Deliverable D2.1
STEP 0 report - Contextual assessment of agroecology in 5 European territories

TAPE Line
Transitioning to Agroecology

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Deliverable Factsheet

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Abstract:	Contextual assessment of the Walloon Region case study as part of the cross-territorial TAPE assessments led in TAPE-line

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1 SHORT PROJECT INTRODUCTION AND SCOPE OF THE DOCUMENT

TAPELINE - *Transitioning to Agroecology through participatory Learning, Implementation of TAPE Tool, strategizing, Networking, and Enrolling* - is an ambitious European Project aimed at transforming territorial agri-food systems through participatory, data-driven agroecological practices.

The project's central objective is to accelerate the adoption of agroecology (AE) at both farm and landscape levels by operationalizing the FAO's Tool for Agroecology Performance Evaluation (TAPE) across five European countries: Belgium, Germany, Switzerland, Italy and Cyprus. TAPELINE addresses the persistent gap between agroecological research and practical, systemic application by anchoring its activities in local contexts through Living Labs, stakeholder-driven co-learning, and strategic governance.

The current document is intended to provide TAPELINE partners & stakeholders involved in the project with a shared picture of the context around agroecology in the territories studied in the project, i.e. the Walloon region in Belgium, Lander Saxony-Anhalt in Germany, Canton of Valais in Switzerland, Lazio region in Italy and Troodos in Cyprus.

The structure of this document reflects the main components of the STEP 0 of the TAPE tool, taking into account existing guidelines prepared by the FAO in relation to the TAPE tool [305], [306].

In this framework, STEP 0 aims to:

- prepare and frame the AE assessment of the selected territories by specifying the objectives of the assessment (for each territory), as well as the sampling methodology and strategy
- understand the context through a detailed description and systemic diagnosis, identifying conditions, dynamics, constraints, and potential levers for agroecological transitions within the assessed territories. This lays the groundwork for informed stakeholder engagement, self-assessment, and performance evaluation.
- gather information needed for step 1 and 2.

The remainder of the document is organized as follows:

- Section 2 provides visual executive summaries of the agroecological context in each of the five territories studied.
- Sections 3 to 7 present detailed territory-level assessments for Wallonia (Belgium), Saxony-Anhalt (Germany), Valais (Switzerland), Lazio (Italy) and Troodos (Cyprus), each covering the study context, contextual assessment, agricultural systems, policies and institutional environment, markets and value chains, and cross-cutting enabling/disabling factors. These country-level reports were prepared by each partner, mainly through desk research, then partially refined and validated with the members of the Multi-Actor Platform (MAP) in each territory.
- Section 8 synthesizes contextual factors shared across, and contrasting between, territories.
- Section 9 identifies shared and territory-specific barriers and enablers to agroecological transition, and

- Section 10 presents the methodological workflows developed to derive farming system typologies across the five territories, which serve as the sampling backbone for TAPE Steps 1 to 3.
- Section 11 inventory the specific research questions raised by each territory's MAP, so as to align the assessment's operational focus with territorial expectations.

2 EXECUTIVE SUMMARIES OF AGROECOLOGICAL CONTEXTS IN EU TERRITORIES STUDIED

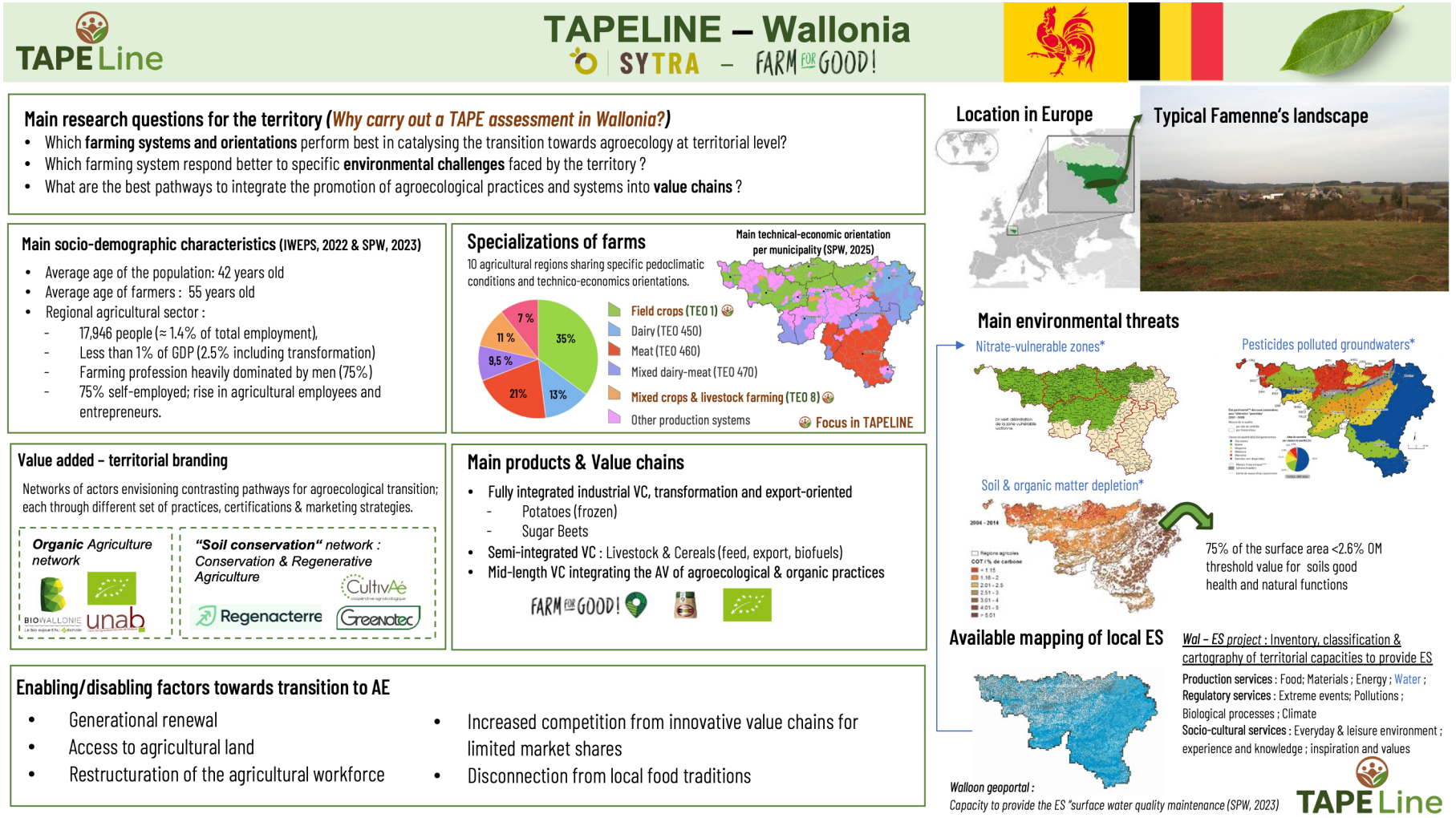


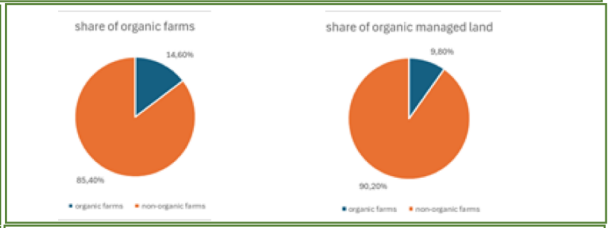
Figure 1 - Executive summary of agroecology in Wallonia & territorial context assessment (as part of TAPE - STEP 0)

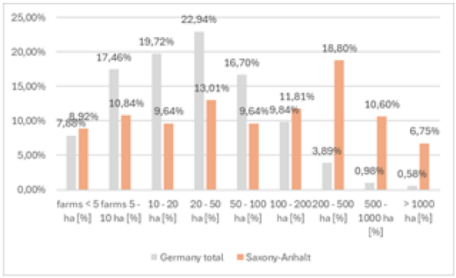
TAPELINE – Saxony-Anhalt

Martin-Luther University (MLU - PP5)

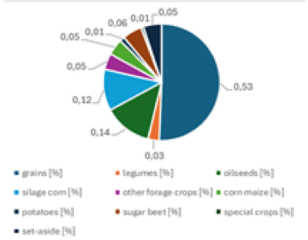
RESEARCH FOCI:
- Potential integration of agroforestry into current management system (structural barriers; economic opportunities/financial support);
- Through Ecosystem Services and Socio-Ecological system approach analysis of ecological and socio-economic impact (e.g. contribution to supplies of energy and raw materials, market opportunities, ongoing structural change)

2.180.448 people live here
47.9 years is the **average age**
50.9 % of the population are **women**
53 % of the population live **in rural areas**
8 % has a **migrant background**
2.27 % share of **agriculture** on the **GDP**
2.62 % working population **in agriculture**





Categories	hectares
Arable land	974.700
Grassland	171.400
Vineyards	748
Orchards	1.081



0.989 animal units per hectare (lower than other German states)

Highlights:
Good soils (driving force for intensive agriculture)
Highly developed agricultural system (technology, high education level farmers , precision agriculture, high food safety
Company farms vs family-run farms
Former coal mining region: from a highly polluted industrial hub into a lakeland area (potential nature-based tourism)
Nearly no direct selling
Geographical indications (e.g. wine from Saale-Unstrut area (PDO-registered); hops from Elbe-Saale (PGI registered)
High prices for land (tenure)
Multifunctionality (e.g. agri-tourism vs alternative energy production)
Impact of climate change and extreme weather events (e.g. increasing drought stress; flood events)
Initiatives concerning water and wetlands


Fig 1 Innovation for sustainable agriculture


Fig 2: New pest: „Schilf-Glasflügelzikade“


Fig 3 Drought stress


Fig 4 Flood events (intensity and frequency)


Fig 5 Former coal mining region


Fig 6 Weinstraße



Fig 7 Wetlands areas in Saxony-Anhalt


Fig 8 Sampling strategy for German territories

Figure 2 - Executive summary of agroecology in Lander Saxony-Anhalt & territorial context assessment (as part of TAPE - STEP 0)

TAPELINE – VALAIS (CH)

UNIL

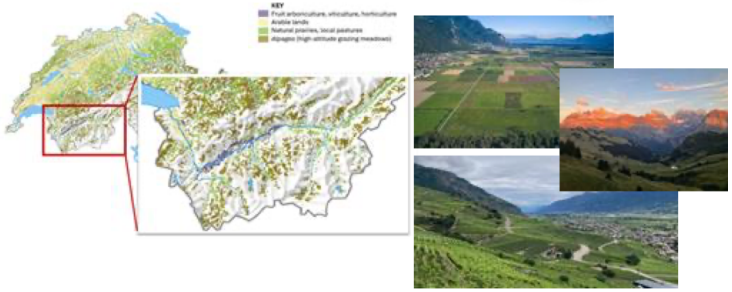
MAIN RESEARCH QUESTION FOR THE TERRITORY

Agroecology in Valais: How can its development be supported?

MAIN SOCIO-DEMOGRAPHIC CHARACT.

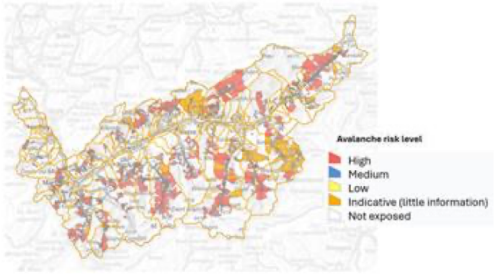
371,288 population
4% of the Swiss population
88.3% of European origin
2 linguistic areas (French/German)
50% share of population in rural areas
1.66% agr. employment as a % of total

Cattle and small ruminant farming (nb. farms)	1482
Equine breeding/holding	89
Poultry farming	4
Winegrowing	633
Tree and/or vegetable farms	132
Crop farming	20
Diversified farms & others	131

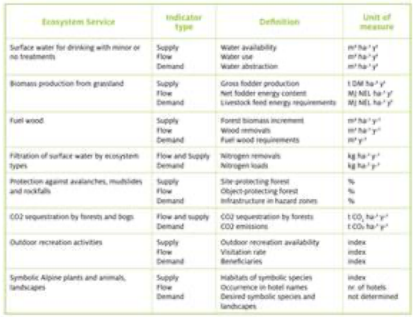


PRESSURES ON NATURAL CONTEXT

Pollutants :
- **Pesticides**
- **Nitrates**



Natural disaster risk :
- **Avalanches**
- **Landslides**
- **Floods in plain**
- **Forest firest**



VALUE ADDED TO PRODUCT

- Local products, with regional public brand
- PDO-PGI, with federal co-funding
- Organic farming is promoted in many sense
- Strong support to Agriculture Knowledge and Innovation
- Federal and Cantonal strong research and innovation
- Local open air markets
- Strong linkages: public canteens, Gastronomie & tourism
- Logistic on-line platform: e-commerce for gastronomie

MAIN PRODUCTS

Wine (all PDO) & Spirits (2 PDO)
Fruits and Vegetables (in the plain)
Cow Cheese (Raclette PDO), milk, various dairy products
Cow Meat (Viande séchée PDO and Jambon PGI)
Sheep and goats meat
Cereals (Pain de Seigle PDO)
Others
Medical and Aromatic Plants
undner Safran PDO, various local specialities

Enabling factors

Attractive context for tourism (strong image for local food)
Cantonal authorities supportive and open to innovative initiatives
Strong research networks and cantonal support to private sector

Disabling factors

Economic vulnerabilities critical for farm and artisans
Low capital and small-size of enterprises
inertia effect linked to the isolation of certain villages
2 differents languages and cultural background

TAPELine

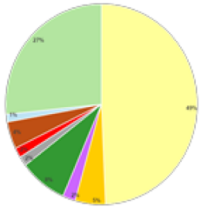
Figure 3 - Executive summary of agroecology in the Canton of Valais & territorial context assessment (as part of TAPE - STEP 0)

TAPELINE – Lazio Region

Tuscia University (UNITUS) – Agricoltura è Vita

How can agroecology be monitored within **land governance processes**, linking biophysical indicators with 10 elements of agroecology?

Agroecosystem	Area (km²)	Population	Population Density (ab/km²)
Comino Valley	583	24.000	42
Sabina Hills	1.132	287.000	254
Castelli Romani	1.167	659.000	564
Kiwi Area	1.526	717.000	469
Dairy Cattle Area	2.542	3.280.000	1.289
Agro Romano	374	161.000	432
Maremma Laziale	930	108.000	117



Crops	Area (ha)	% Area
Arable Lands	301473.16	49.3%
Horticultural crops	31303.81	5.1%
Vineyards	13165.96	2.2%
Olive Trees	48872.33	8.0%
Other Orchards	9617.69	1.6%
Kiwi	9793.95	1.6%
Hazelnuts	26853.29	4.4%
Other Crops	7644.44	1.3%
Meadows and pastures	162457.92	26.6%

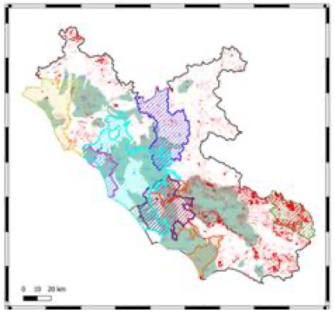
The Italian legal framework — Art. 2135 of the Civil Code and Law 228/2001, complemented by Regional Law 14/2006 and Regional Regulation 1/2018 in Lazio — defines and broadens the scope of **agricultural multifunctionality and multi-entrepreneurship**, encompassing productive, social, environmental, and cultural activities.
At the systemic level, multifunctionality fosters on-farm synergies, while multi-entrepreneurship extends them to the territorial scale, connecting farms with other economic and social actors.
In the Lazio Region, this approach translates into **integrated rural systems, innovation and social inclusion,** and **the collective governance of common goods** and **ecosystem services,** thereby supporting **the regional agroecological transition**.

Agroecosystem	Value Chains
Kiwifruit area	PGI area; strong logistics infrastructure
Castelli Romani Vineyards	PDO wines
Comino Valley	Traditional livestock chees PDO
Agro Romano	Strong logistic infrastructure, proximity to Rome
Sabina Hills	PDO olive oil; Historically rooted
Maremma Laziale	Extensive cropping, multifunctional farms
Diary Cattle Area	High dairy productuion

- *Institutional* – Regional-level planning; interest from the Regional Authority;
- *Economic* – CAP eco-schemes and CSR mechanisms; AKIS networks at national and regional level.
- *Social & Territorial* – Active participatory initiatives;
- *Institutional* – Fragmented governance; limited use of AE indicators.
- *Economic* – Farmers' risk aversion toward long-term investment;.
- *Social & Territorial* – Lack of knowledge and advisory capacity; ecc.



PRESSURES ON NATURAL CONTEXT



- Nitrates (ZVN)
- Other soil pollutants (intensive production)
- Saline water infiltration
- Land abandonment
- Landslide risk
- Methane/ZVN
- Soil erosion

TAPE Line

Figure 4 - Executive summary of agroecology in Lazio region & territorial context assessment (as part of TAPE - STEP 0)

TAPELINE – Troodos [Cyprus]
MOUNTMED

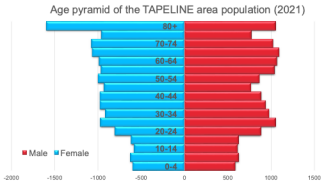
MAIN RESEARCH QUESTIONS FOR THE TERRITORY

Agroecology in Troodos: How can a **participatory territorial approach** foster local understanding and collective action to face complex agri-environmental challenges?

✓ *Engage local actors (residents, farmers, local authorities and researchers) to co-create solutions*
✓ *Strengthen the link between agriculture, food systems, landscapes and social cohesion*

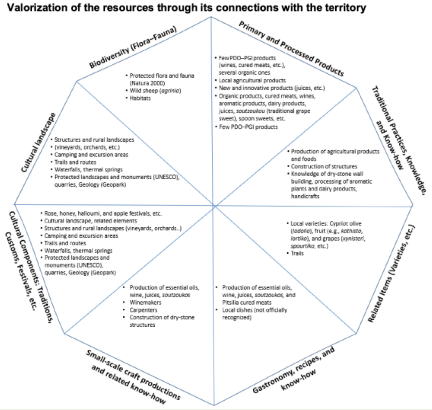
MAIN SOCIO-DEMOGRAPHIC CHARACTERISTICS

- Total area: **245.382** ha
- Number of communities: **126**
- Population: **30.511 (2021)**
- **3,3%** of the Cyprus population
- Full-time farmers: **6%**
- Multi-active farmers: **18%**.
- Younger farmers' farm surface: **>2,1ha** or **<0,6 ha**
- Aging farm population: **48% >65, 20%>75, 6.5% <40**



VALUE ADDED TO PRODUCT / TERRITORIAL BRANDING

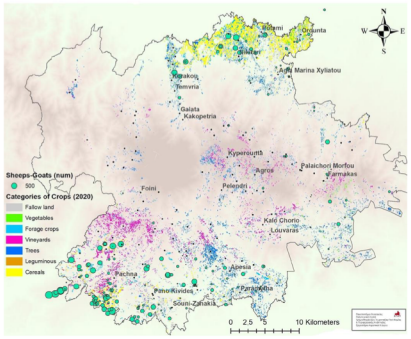
Valorization of the resources through its connections with the territory



AGRICULTURAL SECTORS

- Cultivated land:**14.174,5** ha (~23% irrigated)
- Farm holdings: **8.167**

Farming Systems



Evolution of cultivated land (1985-2021)

year	1985	2004	2017	2021
cultivated land (Ha)	31000	18000	15500	14200

MAIN PRODUCTS (Value chains)

- Wines from indigenous varieties
- *Commandaria* PDO - sweet wine and distilled spirits e.g. *zivania*
- Olive oil, almond trees, peach trees, apple trees, herbs
- Smoked meat products (e.g. *hiromeri*, *lountza*)
- Local cheese products: *Haloumi*, *Anari/anthotyro/ricotta*
- Homemade spoon sweets and traditional fruit preserves (wild rose, soutzoukou)
- Vegetables
- Honey

ENABLING FACTORS

- Mixed land use (agriculture + tourism)
- Place-based branding and terroirs (PDO/PGI)
- Cultural heritage landscapes
- Extended terraced cultivation (vineyards, orchards etc.), and dry-stone structures with high ecological value and rich biodiversity (flora, fauna, indigenous varieties)
- Trees and vineyards, traditional mountain culture systems (carbon sequestration, soil retention)
- Regeneration of cooperatives and producer groups
- Small-scale artisanal production

DISABLING FACTORS

- Land abandonment => Degradation of terraces, loss of agro-biodiversity, higher wildfire and erosion risks
- Demographic loss
- Low value products
- Limited distribution channels
- Strict environmental protection policy has limited consensus on mixed-use land management
- Agricultural land management problems standards in protected areas (e.g. Natura 2000)
- Lack of local stakeholder participation in spatial and agri-environmental management

MAP LOCATION TERRITORY



TYPICAL LANDSCAPES



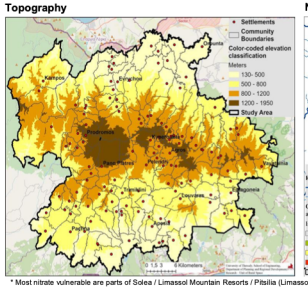
- Mountainous area with a diverse landscape of valleys, terraces, and steep slopes, rich in natural resources (forests, rivers, streams..)
- Cultural assets (monuments of rural and religious heritage, UNESCO-listed sites)



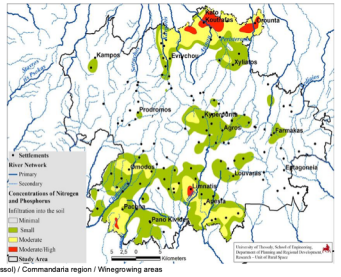
PRESSURES ON NATURAL CONTEXT

- **Pressures:** wildfires, land abandonment, defficient water use, soil erosion, ecological imbalance
- **Climate trends:** declining rainfall, water scarcity, rising temperatures, stronger heat stress forest ecosystems, directly impacting biodiversity, increase of extreme weather events
- **Risks:** desertification, landscape degradation (scattered construction, abandonment of agricultural activities and land), water scarcity and groundwater quality issues (over-abstraction, nitrate pollution from agriculture & livestock, arsenic levels above limit, over-pumping for irrigation)
- **Vulnerable areas to deserticifation:** Marathasa & Limassol mountain resorts (sensitive), winegrowing villages (critical zones)

Topography

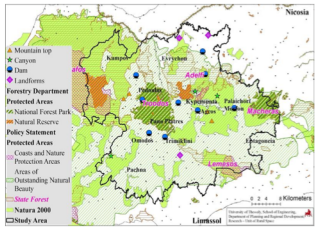


Nitrate Vulnerable* Zones

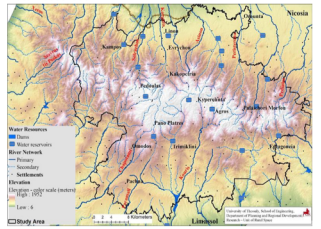


* Most nitrate vulnerable are parts of Solea / Limassol Mountain Resorts / Ptisilia (Limassol) / Commandaria region / Winegrowing areas

Natural resources and protected areas



Water resources



TAPELine

Figure 5 - Executive summary of agroecology in Troodos & territorial context assessment (as part of TAPE - STEP 0)

3 AGROECOLOGY IN WALLONIA (BELGIUM)

3.1 TAPELINE in the territory and the study context

3.1.1 Background and rationale for applying TAPE

This section brings together lessons learned and key insights from previous research and field expertise at the University of Louvain - SYTRA and Farm for Good in relation to the general context of agroecology development in Wallonia. It does not claim to be exhaustive or based on statistical data at this stage.

Trans-disciplinary research approaches have proven relevant when applied in the Walloon context for highlighting the enabling factors and most suitable transition pathways to support the development of agroecological farming systems at landscape level [23]. It is especially useful for identifying the approaches that are most effective in delivering socio-environmental services needed to address current challenges. In that context, TAPELINE's multi-actor approach is considered highly relevant for addressing these challenges by fostering collaboration among researchers, agricultural actors, value chain actors, and public authorities, while supporting the co-definition of agroecological transition pathways.

In the region, different evaluation systems are being developed and used by closely connected, and sometimes competing, economic stakeholders aiming for different visions of agroecology; each targeting a subset of agri-environmental indicators to assess the social benefits provided by specific farming systems. There is, therefore, a strong need for a harmonized evaluation tool, adapted to the regional context and applicable at territorial level, to benchmark co-existing farming systems according to their potential to achieve agri-environmental and agroecological objectives.

At farm level, previous assessments have confirmed that farmers are working on a continuum of environmental performance (between high-intensive farming models and low-input/ organic farming), but no exhaustive and systemic assessment of agroecological performance is available to compare existing production models and proposed transition pathways. The main certification currently used to attest to a higher level of agri-environmental performance (in terms of inputs) is organic farming, representing 11% of Wallonia's *Utilized Agricultural Areas* (UAA). Among other production systems, environmental performances (both positive and negative) vary according to agricultural sectors and regions. The persistence of a large majority of agricultural land devoted to animal feed and export still forces most farmers to adopt highly productive models that maximize the production potential of the soil, while remaining quite distant from agroecological approaches.

The main contribution from UCLouvain – SYTRA in the project is to provide a harmonized evaluation tool, derived from the FAO TAPE tool, for scientifically and holistically assessing the agroecological potential of existing farming systems, while supporting the participative use of this evaluation tool to stimulate and monitor the development of innovative value chains focusing on local food production and agroecological value.

At farm level, previous assessments have confirmed that farmers are working on a continuum of environmental performance (between high-intensive farming models and low-input/ organic farming), but no exhaustive and systemic assessment of agroecological performance is available to compare existing production models and proposed transition pathways. The main certification currently used to attest to a higher level of agri-environmental performance (in terms of inputs) is organic farming, representing 11% of Wallonia's *Utilized Agricultural Areas* (UAA). Among other production systems, environmental performances (both positive and negative) vary according to agricultural sectors and regions. The persistence of a large majority of agricultural land devoted to animal feed and export still forces most farmers to adopt highly productive models that maximize the production potential of the soil, while remaining quite distant from agroecological approaches.

At the value chain level, different *niche* market initiatives and networks are being developed at regional level, trying to include some level of agroecological perspectives, but without a clear vision about the comparative effectiveness of associated farming systems to achieve environmental results and induce significant agroecological transition. There is also an issue of upscaling those niche initiatives to induce significant change at landscape level. For instance, the lack of clarity regarding the validity of the various labels and self-certification initiatives undermines confidence in the message sent to consumers and agri-food manufacturers. The failure to integrate social, market and governance dimensions into the assessment of agri-environmental performance is perceived as a major shortcoming. Such shortcomings can be addressed through strategic support by research institutions and public authorities, including by leading multidimensional farming system assessment like pursued through the TAPE method.

Various emerging initiatives aiming to upscale the agroecological model and induce a food-system transition at territorial level are supported by regional public funds and agencies (e.g., *Manger Demain* and *Farm for good* value chain network). The ultimate goal is to make these agroecological *food-producing* networks self-sufficient and prosperous in the regional market. EU & Regional public policies should enable these new value chains to become self-sufficient by providing a harmonized regulatory and certification framework that promotes the economic sustainability & competitiveness of local value chains for sustainable and healthy food.

Another crucial area where support is needed is the lack of financial security during the transition period, which discourages many farmers from changing their production model. This is particularly true for the transition towards organic farming and other sustainable farming system, which are often economically competitive in the long term but require a transition period associated with uncertainties in yields and farm income [5, 13].

3.1.2 Specific research and evaluative questions

The research approach adopted in Wallonia aims to emphasize specific interactions between:

1) Farm structural & socio-economic factors, including Specializations (e.g., technical & economic orientation), Certification (e.g., organic), Farmer's Network membership, Farm Size, and Agricultural workforce structure.
2) Levels of agroecological practices implementation, both agronomic and socio-economic practices (TAPE STEP 1 – Characterization of agroecological transition - CAET)
3) Levels of agroecological performances, including
4) standardized semi-qualitative indicators (Qualitative economic index, Secure Land Tenure score, Generational Renewal Indicator, Pesticides management score), and
5) quantitative assessment of pesticides risk (Harmonized Pesticide Load Index, HPLI) and of economic performances (gross margins of productions, advanced economic efficiency indicators)

The focus of this case study is to analyze the heterogeneity across and within each of those farming systems, aiming to understand how specific productions and production modes show better social, economic, and environmental performances.
Specific research questions have been further detailed with the Walloon partner (Farm for good) in order to be discussed within the MAP:

- *Which of the emerging agricultural models in Wallonia (organic farming, conservation agriculture, regenerative agriculture, regenerative organic farming, etc.) is the most suitable in terms of agri-environmental aspects and, more broadly, in terms of their implementation, compared to all aspects of agroecology?*
- *What technical (agricultural practices) and governance (dynamics in value chains and networks) factors enable the effective achievement of sustainable agroecological performance levels over time?*
- *What are the concrete results achieved by farmers who are most advanced in agroecology and organic and conservation agriculture (OandCA)?*

- *Are mixed systems (including animals) more efficient from a socio-economic and/or environmental perspective? Do farms that combine crop and livestock production achieve better environmental and economic results than others, and on what specific criteria?*
- *Are agroecology and OandCA suited to certain types of farmers?*
- *Does membership of a movement or network (OA, CA, OandCA, FFG, trade union, other) make a difference in terms of socio-economic and/or environmental performance?*
- *What are the top three agroecological best practices?*
- *Why do some farmers fare better than others?*
- *Does our territorial dynamic in Wallonia (stakeholders, rules, cooperation) help (or hinder) the agroecological transition?*
- *Are farmers who understand ecosystem services more likely to adopt more sustainable practices?*
- *Which production systems are the most environmentally efficient in our region?*
- *What agroecological practices can be easily and profitably integrated into marketing and processing chains?*
- *What does the field say about the drivers of agroecological transition in Wallonia?*

In addition, the project offers a unique opportunity to assess synergies and compare results between the TAPE method (FAO methodology recognized worldwide) and Open Compass (OC)[1] tool, used by Farm for Good and a few other local stakeholders in Wallonia, to streamline agroecological practices in local food value chains. To do so, the project will investigate the following questions:

- *How can the OC tool be used to collect TAPE data?*
- *How and to what extent can this local tool meet the objectives of the TAPE method?*
- *Does the OC tool align with the characterization of agroecological practices as defined by the TAPE method?*
- *OC and TAPE methods to meet agri-food companies' reporting requirements: how can sustainable agronomic practices be linked to companies' environmental commitments?*

In addition, the project offers a unique opportunity to assess synergies and compare results between the TAPE method (FAO methodology recognized worldwide) and Open Compass (OC) tool, used by Farm for Good and a few other local stakeholders in Wallonia, to streamline agroecological practices in local food value chains. To do so, the project will investigate the following questions:

Additional questions and issues raised from the MAP stakeholders' perspective

A wide variety of public and private tools and methods are already available to assess the performance of farms and agricultural production with respect to specific environmental dimension (e.g., GHG balance, LCA, Pesticide risk indicators…).

Existing certification schemes controlled by external assessors, such as organic farming or fair trade, already offer clear guarantees associated with precise and transparent specifications, yet they do not always incorporate a full set of governance & socio-economic sustainability dimensions.

Initial discussions with value chain stakeholders revealed a particular interest and need of retailers for greater clarity and transparency in the critical assessment of agroecological dimensions. This is essential to better identify and target products with the best agroecological outcomes, based on a harmonized evaluation framework that integrates all key aspects of the sustainability.

To better define the research focus, Farm for Good, the territorial partner for Wallonia, conducted preliminary consultations with key stakeholders within its value chain ecosystem.

A central topic of these exchanges was the potential adaptation of the "Eco-meal vouchers" model to promote organic food purchases, aligning with broader corporate sustainability objectives. Retailers and distributors emphasized their Environmental, Social, and Governance (ESG) commitments under the Corporate Sustainability Reporting Directive (CSRD), particularly regarding carbon reduction,

[1] https://www.opencompass.org/en/

water resource protection, ethical sourcing, and sustainable fisheries. However, these actors acknowledged difficulties in translating such macro-level corporate goals into measurable agricultural practices. The diversity of certification schemes, ranging from organic to regenerative agriculture, creates confusion, leaving them unable to distinguish between effective and superficial sustainability claims. as a result, their assessments currently remain largely confined to economic profitability, neglecting the environmental and social impacts within the supply chains they support. This disconnect underscores the need for robust impact measurement frameworks that could incentivize retailers to not only endorse but actively prioritize genuinely sustainable agricultural models.

The consultations also identified several questions that are of direct relevance to TAPELINE: how to position organic farming in relation to regenerative agriculture; how to communicate the value of organic farming to the supply chains; how to overcome farmers' psychological barriers to adopting conservation organic farming practices; and how to encourage large numbers of consumers to progressively adopt more sustainable purchasing habits.

Some retailers also communicated a lack of understanding of the differences in agricultural practices, as well as confusion regarding the challenge of reducing the carbon footprint of agricultural production (i.e., how agricultural practices can achieve this, and not just through carbon farming). A final challenge highlighted by these stakeholders is empowering consumers in their choices, with a priority on carbon-related issues.

Bridging these knowledge gaps will require targeted efforts to align corporate sustainability strategies with tangible agricultural practices and to communicate these linkages effectively to end consumers.

In this regard, the application of the TAPE tool is considered a promising approach to harmonize the assessment and communication of the agroecological performance of agricultural models and associated products in the value chain.

3.2 Contextual assessment

The following sections provide a comprehensive overview of the agroecological context and the main factors towards the agroecological transition in the study area.

3.2.1 Country profile and territory boundaries

1. Name of the territory/country: Wallonia (Belgium)
2. Geographical administrative division: Regional level (Walloon Region)
3. NUTS (Nomenclature of Territorial Units for Statistics) level of the assessed territory: Level 1 (BE3)
4. Map of the territory:

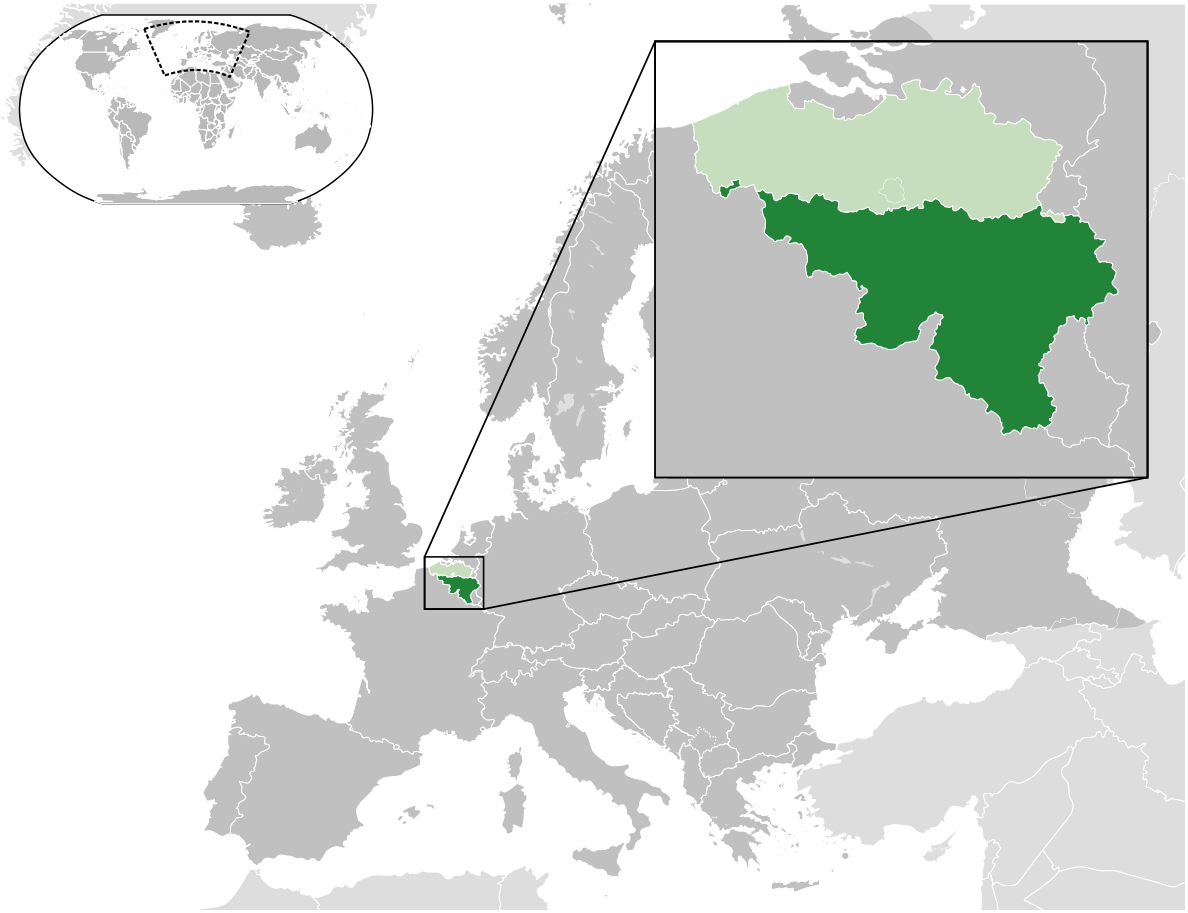


Figure 6 - Location of the Walloon Region (dark green) in Belgium & Europe [11] - Wikipedia commons.

5. Total area: 16,901 km^2

3.2.2 Socio-economic characteristics

The average age in the Walloon population is 42 years [7].
The gender distribution is balanced, except in the higher age groups, where women predominate (Figure 7). Among the farmer population, the distribution differs, however, greatly from the overall population: 9 farmers out of 10 are men.

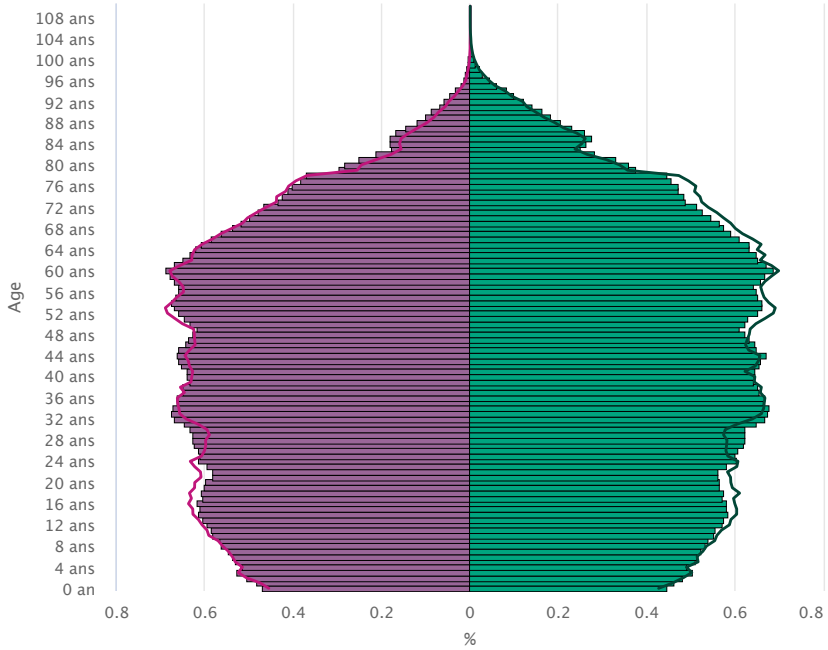


Figure 7 - Pyramid of Ages of Belgian (shaded areas) and Walloon (lines) populations evaluated in 2025 for men (pink) and women (green). [8]

The distribution of the Walloon population between rural and urban areas is balanced: 49% in urban areas, for 51% in rural areas [7]. In Wallonia, 17,946 (1.4%) of domestic employment is within the sector of Agriculture, forestry and fishing. The vast majority (75%) of workers in this sector are self-employed [7], though this share is decreasing, with fewer self-employed workers and a bit more of employees.

Different trends have been observed over recent decades in farm structures and agricultural workforce distributions. Since 1990, the number of farms and the overall agricultural workforce have declined sharply, while the average area per farm has increased considerably (Figure 8).

The agricultural sector only accounted for 0.6% of the regional GDP in 2020 (0.8% at national level in 2023). When including the food transformation industry, this percentage climbs up to 2.6% at regional level [18]. Those numbers reflect the fact that the Belgian and Walloon economy have, for a long time, been strongly oriented towards secondary and tertiary sectors.
The region is characterized by a positive commercial balance around agri-food products (1.1 billion € in 2023), mainly through transformed and animal products (butter, milk powder). When looking at the specific plant products market distributions, Wallonia is also a strong exporter of (frozen or transformed) potatoes and industrial vegetables. On the other side, the Walloon population is also strongly dependent on imports for diversified vegetables and fruits, as well as dairy products (cheese).

The agricultural sector only accounted for 0.6% of the regional GDP in 2020 (0.8% at national level in 2023). When including the food transformation industry, this percentage climbs up to 2.6% at regional level [18]. Those numbers reflect the fact that the Belgian and Walloon economy have, for a long time, been strongly oriented towards secondary and tertiary sectors.

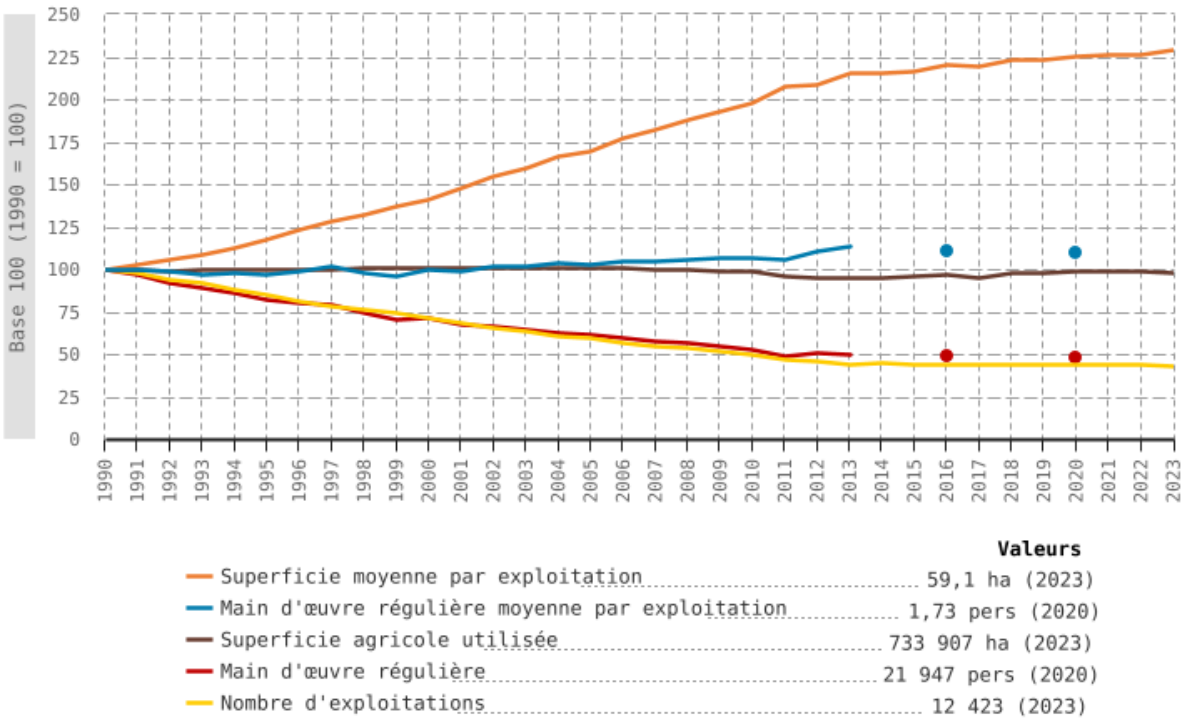


Figure 8 - Means of production in the agricultural sector in Wallonia [19] *- Average area per holding (Orange) ; Average regular labor force per holding (blue); UAA (brown); Regular labor force (red); Number of holdings (yellow)*

3.2.3 Natural context and ecosystemic services

All sub-regions of Wallonia are characterized by a common temperate climate, with minor differences in rain and temperature distributions associated with differences in altitude. The heights of the Ardennes massif, in the south-east of Wallonia, are characterized by a colder and wetter climate than the rest of the region (Figure 9).

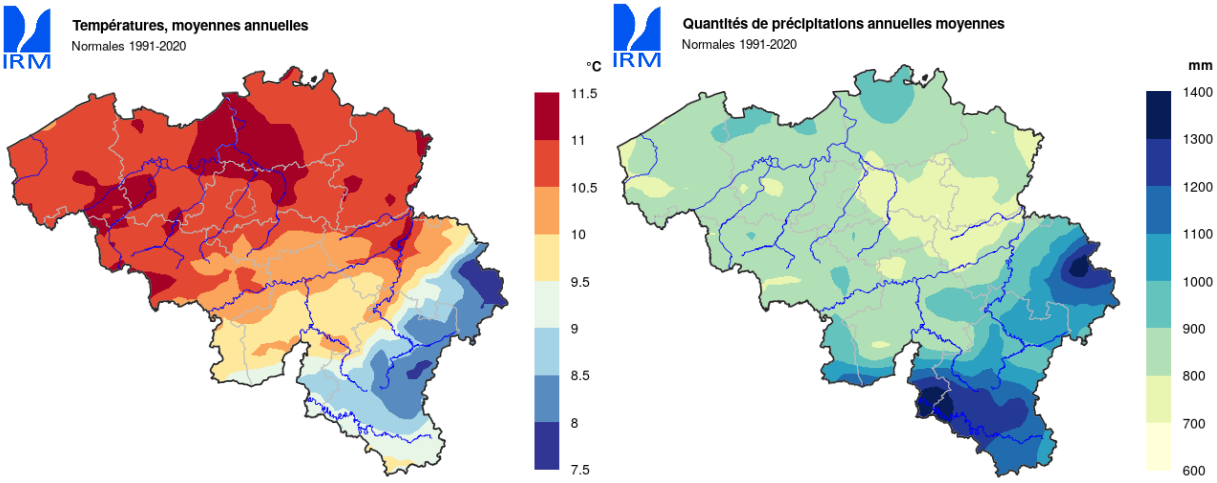


Figure 9 - Geographical distribution of annual average temperatures (left) and precipitation (right) - (IRM, 2025)

The main difference relevant from an agricultural point of view is related to the distribution of geological and pedological characteristics (see section 3.3.2).

Protected areas:
The region is part of and includes

- Natura 2000 network (including some part included in farm management)
- Local contracts for land management (Agri-environmental and climate measures, AECM)
- 13 *Regional Natural parks*, each supported by a specific local network of stakeholders and gathered under a common regional federation

- .

Agricultural landscapes in Wallonia provide a broad range of ecosystem services (ES) that go beyond the sole primary productive function of farming.

The following decomposition of ES has been made for the agricultural land of the territory:[2]

- ***Provision* services:** Food**,** Materials**,** Energy**,** Water
- ***Regulatory* services:** Extreme events**,** Pollutions**,** Biological processes (e.g., Pollination)**,** Climate
- ***Socio-cultural* services:** Everyday environment**,** Leisure environment**,** Sources of experience and knowledge**,** Sources of inspiration and values

This classification system is integrated into the European system and further used in the regional geoportal to map the differentiated capacities to provide each ES at local level. For instance, the crop and animal *food provision* service is mapped in Figure 10, whereas Figure 11 maps another productive service: the bioenergetic potential of wooden areas

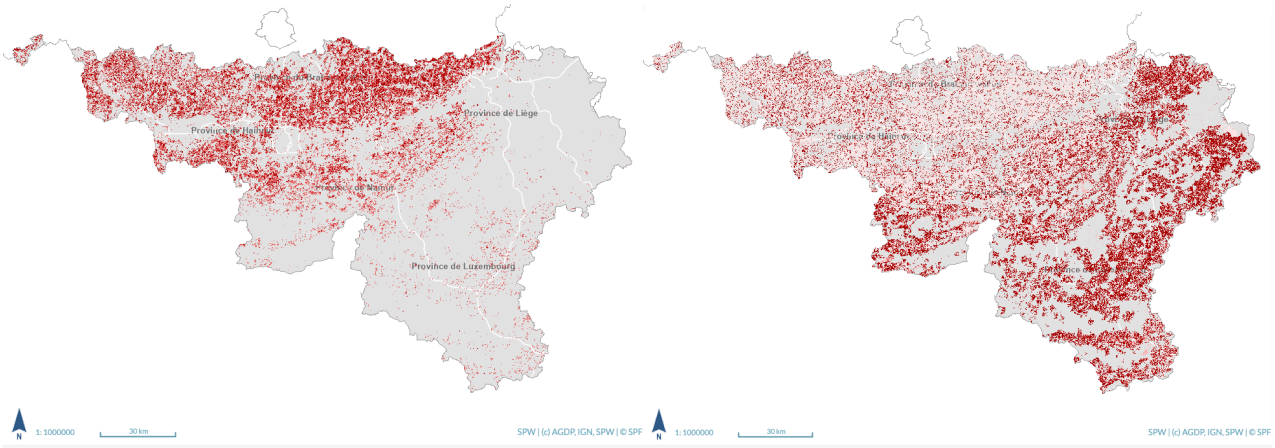


Figure 10 - Productive Ecosystemic Services - Food-oriented[3] crops (left) and Food-oriented livestock (right).

Irrelevant or very low capacity to provide the service Low capacity to provide the service Intermediate capacity to provide the service High capacity to provide the service Very High capacity to provide the service

[2] **Wal-ES platform : https://biodiversite.wallonie.be/home/evaluation-biologique/services-ecosystemiques/plateforme-wal-es-1.html**

[3] The real fraction of large-scale crop productions oriented towards food production remains often unkown at local level

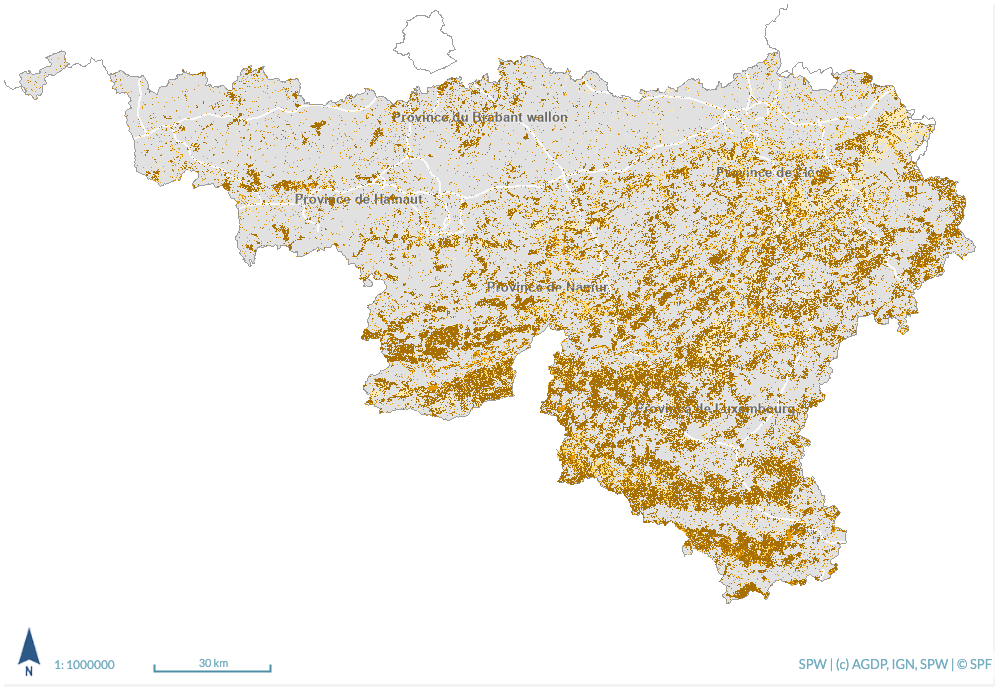


Figure 11 - Productive Ecosystemic Service - Bioenergy production potential from trees and ligneous residues

☐ Irrelevant or very low capacity to provide the service ☐ Low capacity to provide the service ☐ Intermediate capacity to provide the service ☐ High capacity to provide the service ☐ Very high capacity to provide the service

A first look at agri-environmental proxies and *regulating* ecosystemic services capacities informs on the impact of agricultural activities and specializations across different part of the territory studied.

In particular, the mapping of the surface water quality regulation potential (Figure 12) show high contrast, following the occupation gradient of intensive agricultural land use in the northern parts of Wallonia (pesticides & nitrates residues).

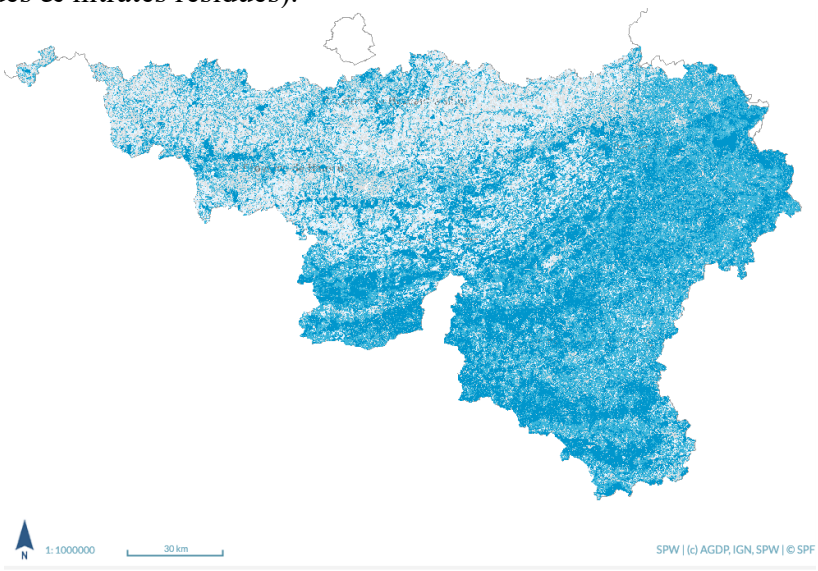


Figure 12 - Regulating Ecosystemic Service - Maintaining surface water quality

☐ Irrelevant or very low capacity to provide the service ☐ Low capacity to provide the service ☐ Intermediate capacity to provide the service ☐ High capacity to provide the service ☐ Very high capacity to provide the service

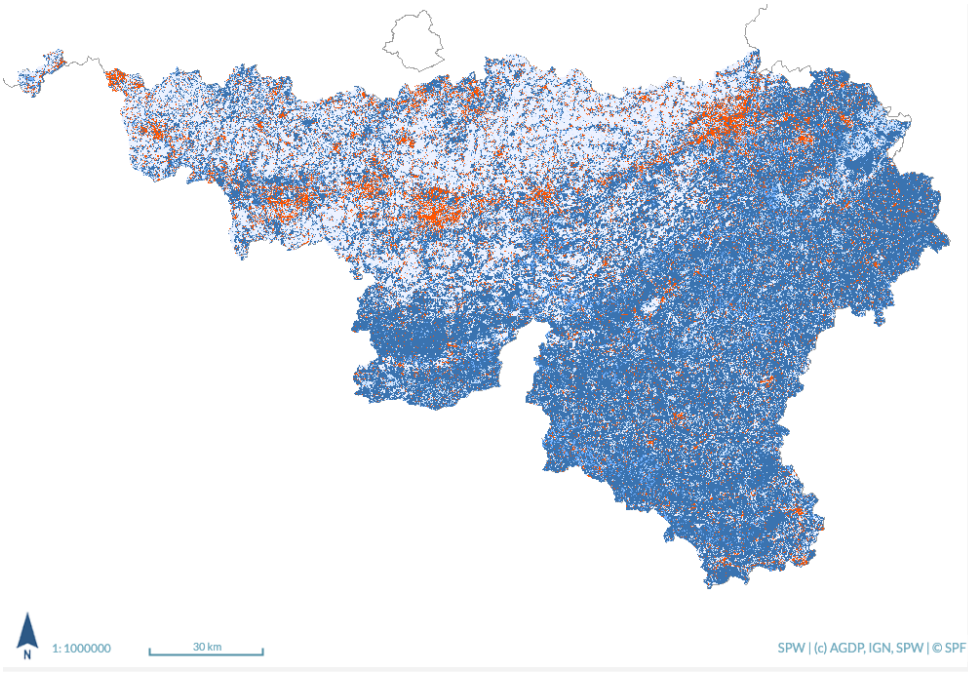


Figure 13 - Regulating Ecosystemic Service - Extreme events Flood protection

Sealed soils. Low capacity to provide the service Intermediate capacity to provide the service High capacity to provide the service Very high capacity to provide the service

The potential of soils from preventing floods is strongly correlated with the position of arable land ; and within the share of arable land ; by the level soil conservation practices in places, influencing run-off and water erosion.

Grasslands regions (Ardennes region in the South) are well-known for hosting the highest level of natural and cultivated biodiversity in the region, and constitute a refuge for a long list of species compared to the intensive-farming regions (silty and sandy-loam regions in the North)

3.3 Agricultural systems in the studied territory

3.3.1 Overview of farms technical-economic orientation in Wallonia

The targeted farm population is centered around the following technical-economic orientations (TEO) :

- *Crop farming systems* - Field crops [**TEO 1**], representing 35% of farms and 36% of UAA in 2024.
- *Mixed (integrated) crop and livestock farming systems* [**TEO 8**], representing 11% of farms and 13% of UAA in 2024.

Those two targeted farming systems are predominant is specific parts of the territory (in green and orange). Their intrinsic characteristics are further described below.

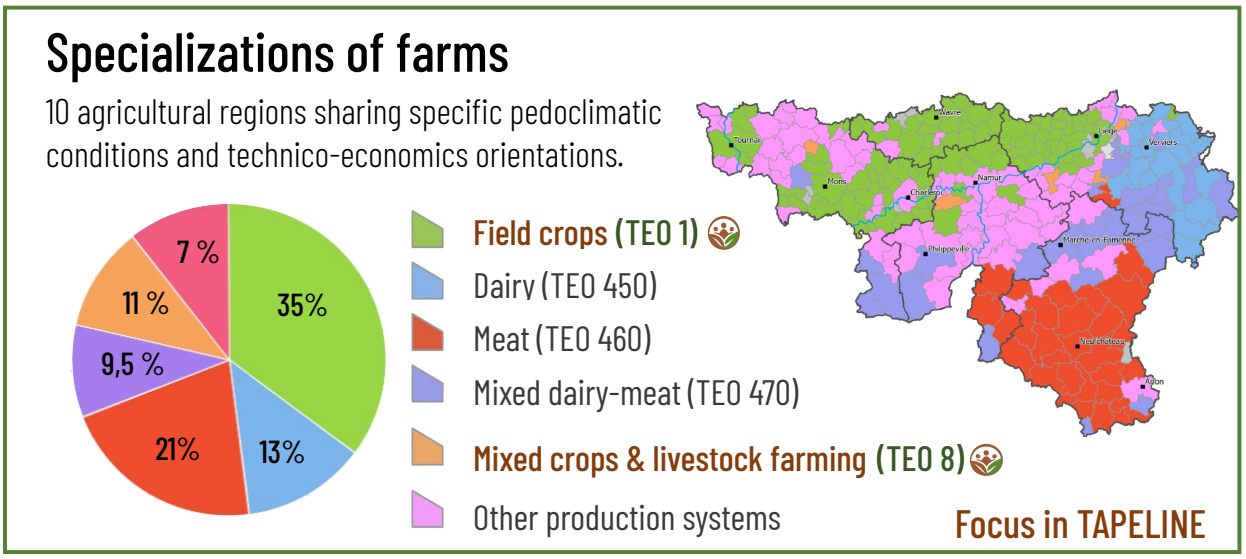


Figure 14 - Distribution of the main techno-economic orientations in each municipality of the Walloon *territory in 2024*

Each of those farming production system is characterized by its own set and distribution of production factors, agricultural practices, and environmental performances.

Figure 15 shows the number of farms grouped in each technical-economic orientation categories and aggregated mean size in 2024.

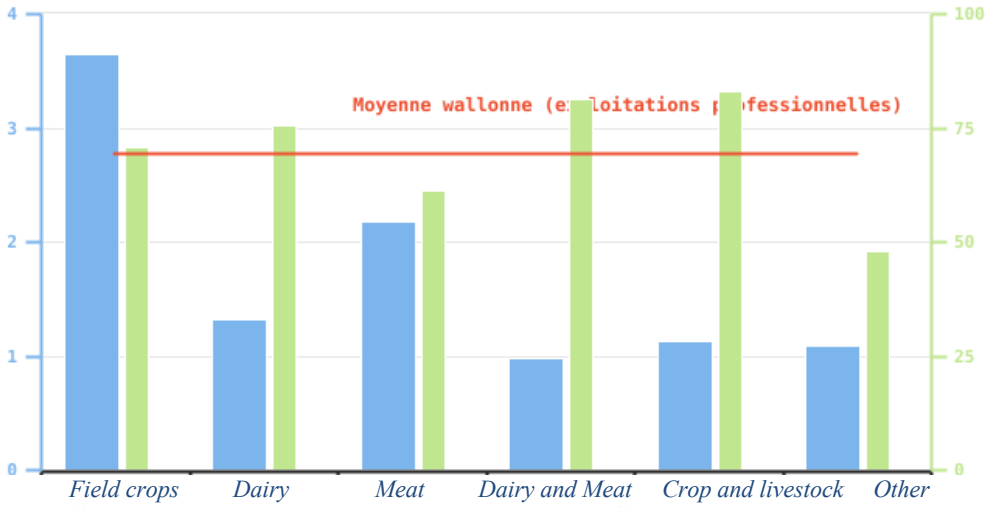


Figure 15 - Number of farms (thousands, in blue) and mean size (mean hectares/farm, in green) across technical-economic orientations (TEO's). The red line represents the mean across all active farms within the territory.

Each of those farming production system is characterized by its own set and distribution of production factors, agricultural practices, and environmental performances. The following paragraphs provide

a descriptive summary of the two Technical-Economic orientations targeted by this campaign (TEO 1, TEO 8)[4]. A more detailed classification of farms is also provided in **Section 9.2,** for the specific aim of the TAPELINE project.

Crop farming system (TEO 1) - 35% of Walloon farms [14]

Specialized arable crop farming systems are predominantly located in the silty and sandy-silty regions of Wallonia (58% and 9% of farms, respectively), where deep, fertile soils with high water-holding capacity are well suited to arable crop productions. A significant share of farms in this TEO is also found in the Condroz region (18%). The average farm size of this system reached 70.6 ha in 2024, close to the regional mean. It has reduced by 11% since 2010, partly due to the arrival in this category of smaller farms that gradually ceased livestock production.

Over the past three decades, the relative share of land dedicated to cereals in this farming system has declined, while forage crops and grasslands have expanded. The share of industry-oriented crops, such as potatoes and sugar beets, has remained relatively stable. Cropping patterns are still dominated by cereals (39% of UAA, primarily winter wheat), followed by forage crops (21%) and industrial crops (19%).

In 2024, livestock production in this system remained negligible: 91% of farms in TEO 1 hold no cattle, and those that do averaged approximately 61 head. On average, farm specialized in crop farming activities mobilize 0.95 working units (W.U), one W.U. managing 75 ha (against 67 ha in 2010). Labor productivity has thus increased and is proportional to the size of land cultivated, ranging from 32 ha managed per W.U. in farms smaller than 25 ha to 185 ha managed per W.U. in farms larger than 200 ha. The workforce is still mainly family-based, with an average operator age of 56.5 years, slightly above the regional mean (55 years).

These TEO 1 farms are deeply integrated into international commodity chains oriented toward animal feed and export markets. Their main environmental vulnerabilities relate to soil structural degradation, including crusting, compaction, and erosion, associated with intensive tillage on silty soils. These risks are expected to be exacerbated by the projected intensification of rainfall events under climate change.

Mixed cropping and livestock farming system (TEO 8) - 11% of Walloon farms [14]

Mixed crop-livestock farms represent a structurally declining category, having lost a quarter of their numbers since 2010, with 1,125 professional farms (11%) remaining in 2024. They account for 14% of Walloon cattle production and occupy 13% of regional UAA, managing 18% of cereal areas, 14% of forage areas, and 8% of permanent grasslands.

These farms are also primarily located in the northern silty region (which hosts 61% of the TEO 8 - *crop & livestock combined* population), and their average farm size climbs at 83 ha (59.1 ha farm size on average in Wallonia). Mean labor requirements per farm exceed those of crop farming systems due to the higher labor intensity associated with livestock management (1.3 W.U./farm). Crop distribution centers on cereals, forage crops, and temporary or permanent grasslands, with industrial crops playing a more limited role.

An inherent agronomic feature of this system is the local integration of feed production and sourcing of soil nutrients through manure application, partially substituting for mineral nitrogen inputs.

Beyond these two systems, livestock-oriented systems such as Dairy Bovine herd (TEO 450 - 13% of farms), Suckler herds for beef production (TEO 460 - 21% of farms) and Mixed Systems combining beef and milk production (TEO 470 - 9.5% of farms) account for the majority of remaining

[4] Those sub-sections are directly derived from the regional reporting set by the administration for the 2024 season (États de l'Agriculture Wallonne).

farming units in the southern part of the region, as illustrated by the geographical distribution of TEOs in Figure 14.

3.3.2 Agricultural zones

The sub-territorial unit of analysis commonly used to describe the diversity of agricultural contexts is the **agricultural region**, as defined by the Walloon regional administration.

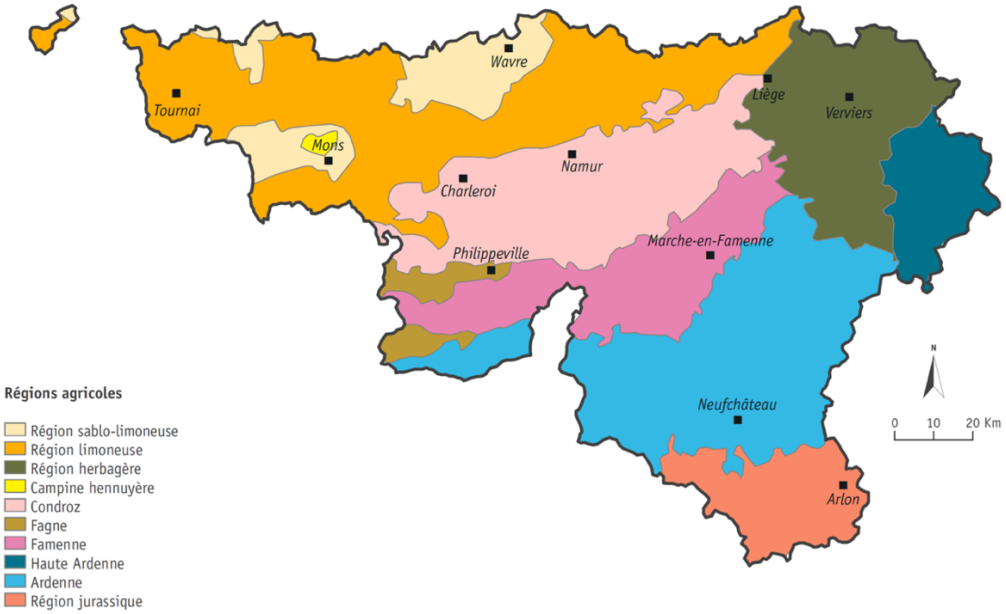


Figure 16 - Agricultural regions of Wallonia defined based on the distribution of pedoclimatic conditions [12]

Those regions are also often regrouped as four macro-regions (*regrouped agricultural regions*, RAR), by looking at the similarities in pedoclimatic and technical-economic orientations of farms across regions. Those regrouped agricultural regions (RAR) are also used to map pesticide use behaviors, which are correlated with crop distributions [4].



Figure 17 - Geographical aggregation of agricultural regions into four regrouped agricultural regions (RARs), based on similarities in pedoclimatic conditions and technical-economic orientations of farms [4]

These regrouped agricultural regions will be used as spatial reference for the territorial analysis conducted in the TAPE diagnosis.

Each of these regions is characterized by its own production structure (crop distribution), and data are available at this subregional level to characterize farming practices (e.g., input use) for each production.

A cartography published by the regional administration in the Walloon State of the Environment shows the distribution of land between utilized agricultural areas (UAA) and other surfaces; and the specific distribution of crops on agricultural land (Figure 18). This provides an overview of the different types of agroecosystems across the territory.

Previous reports and research projects have highlighted that regions with the highest production potential, located in the Northern part of Wallonia (sandy loam soils), are mainly covered by rotations based on cash crops with a high environmental impact, both in terms of soil cultivation and the use of inputs. By contrast, the southern and eastern regions of Wallonia are characterized by more extensive grassland cover and diversified crop rotations; and higher interest in agri-environmental schemes because of more limited opportunity costs and income forgone for maintaining extensive agroecosystems (SYTRA, 2025 – *Insights from the EU Horizon Enfasys project*). However, there is yet a substantial diversity within each agricultural regions, in terms of level of diversification, agronomic quality of crop rotations, and intensity of practices and input use.

Despite higher urbanization and artificialization, the relative share of UAA is higher in northern sub-regions, while forests account for a higher share in the Ardennes regions (southern region).

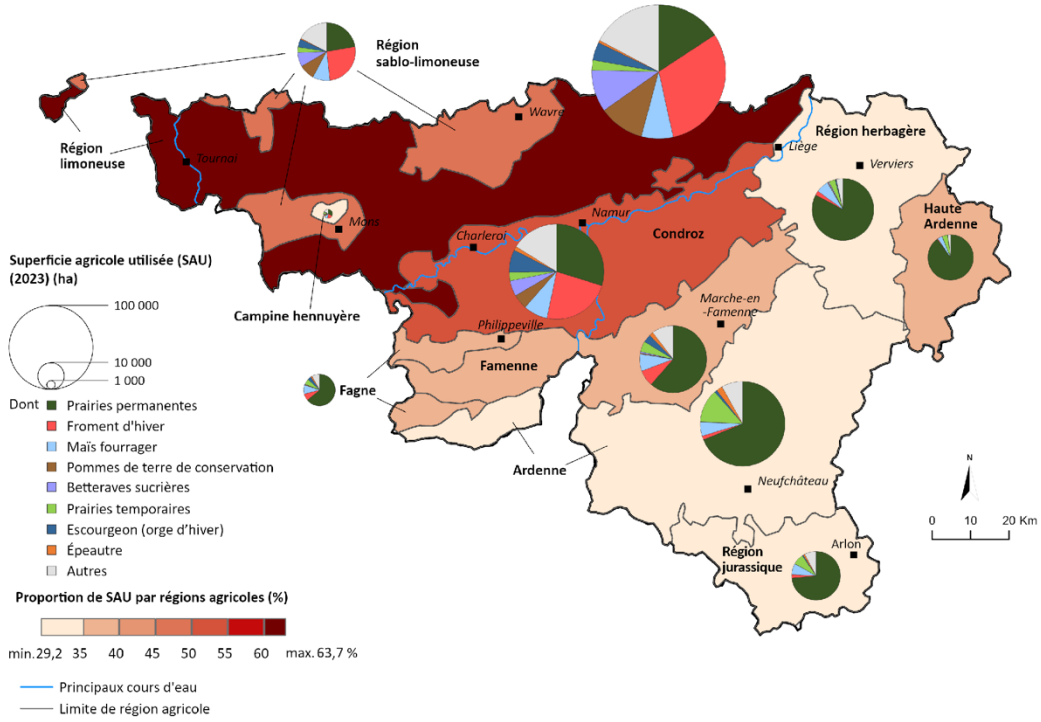


Figure 18 - Agricultural area used by agricultural regions in Wallonia in 2023 [19]. Pie charts - dark green: permanent pastures ; red: winter wheat ; light blue: forage maize ; brown: potatoes ; pink: sugar beets ; light green: temporary pastures ; dark blue: winter barley ; orange spelt ; grey: others.

3.3.3 Analysis of the use of agricultural land

In 2024, the Walloon UAA accounted for 731,984 hectares, representing 43% of total surfaces [17]. Over the 2015-2022 reference period ; temporary and permanent grasslands account together for 48% of UAA (Figure 19). Cereals account for a quarter of agricultural land, while the remaining part was occupied by forage crops (9%), including fodder maize, and industrial crops like potatoes and sugar beets, which accounted together for 10% of UAA.

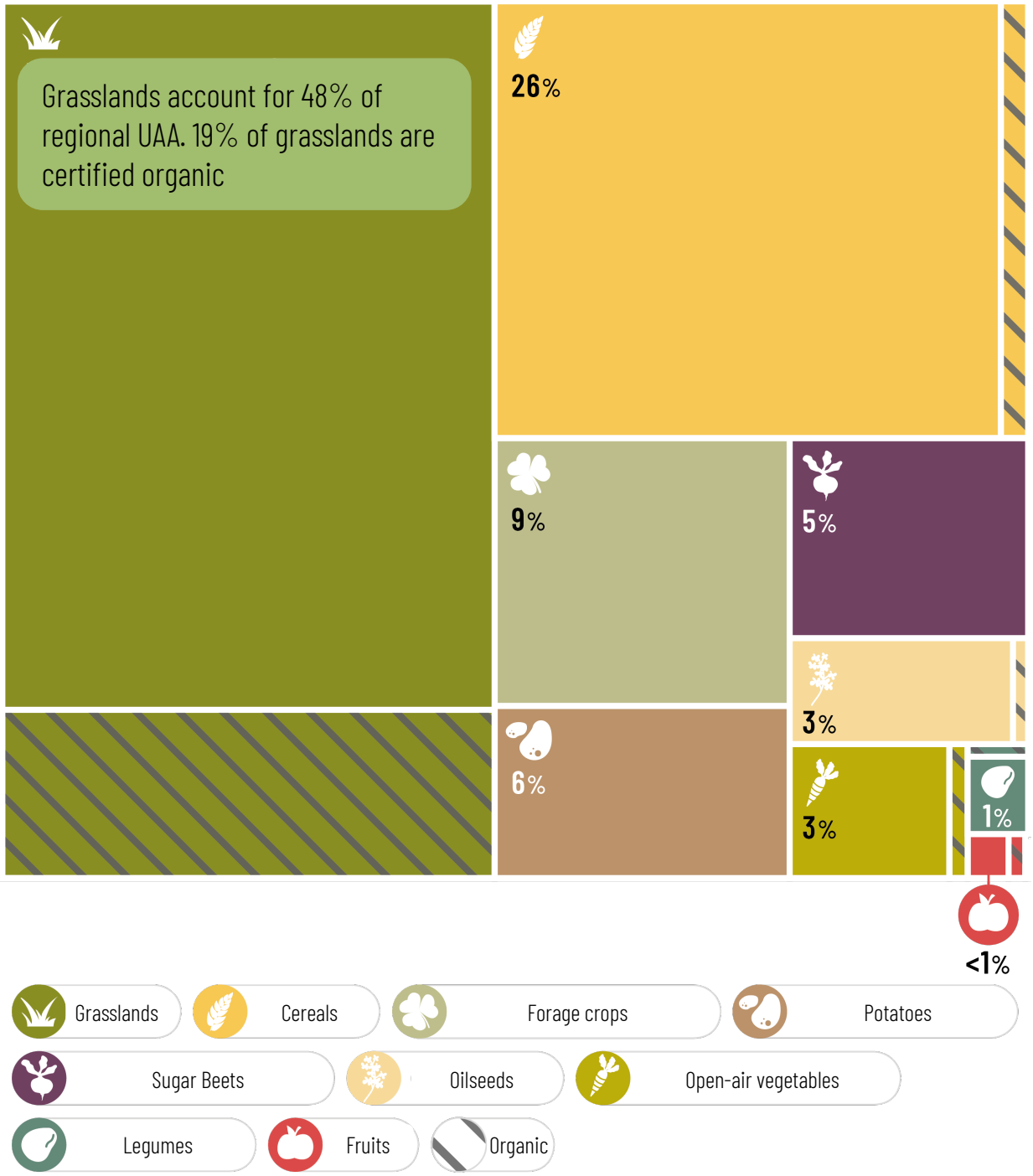


Figure 19 - Distribution of UAA per sector in Wallonia (colors) and shares of sectors certified in organic farming (dashed areas); Reference timeframe 2015-2022 [21]

Crop sectors and grasslands are unevenly distributed across agricultural regions of Wallonia, as illustrated in Figure 20.

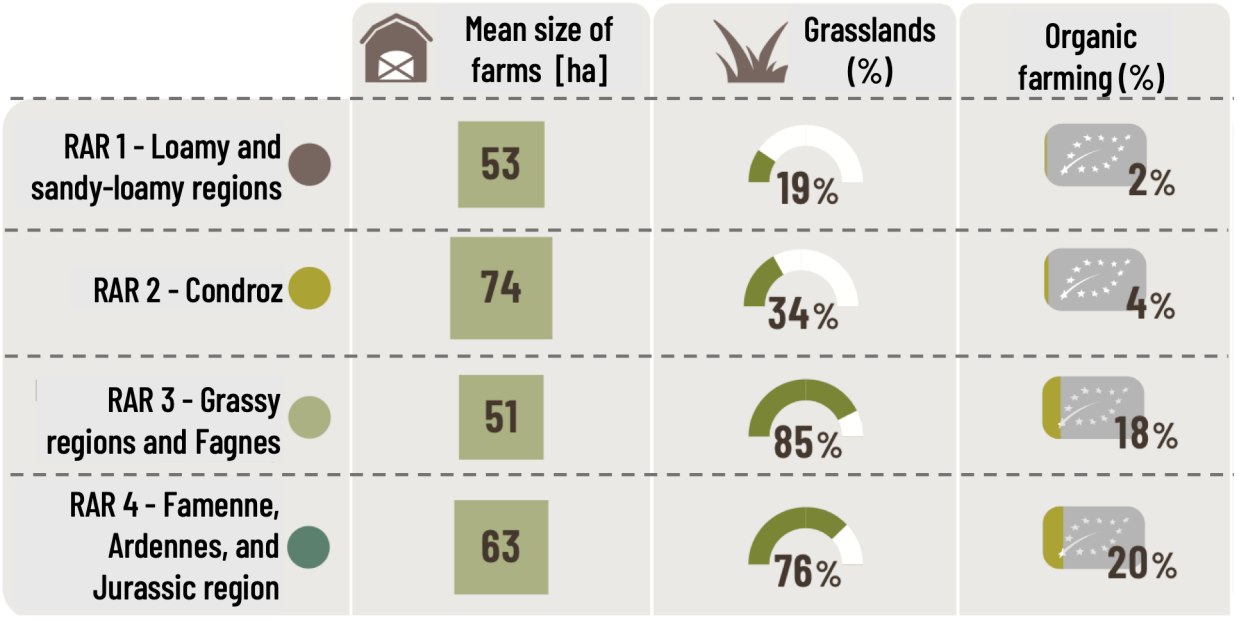


Figure 20 - Distribution and characterization of UAA in Regrouped Agricultural Regions of Wallonia (RAR) - (SYTRA, 2025)

Although plot-by-plot traceability of the final destination of agricultural production remains complex, an estimate was derived from stakeholders in the supply chains (Figure 21). These destinations can be classified according to their main use: (i) local animal feed (livestock), (ii) local human consumption, (iii) gross exports outside the territory, (iv) bioenergy production (biogas, biofuels), and (v) other uses (textiles, biomaterials, etc.). The share of production directly intended for human consumption and food processing varies depending on the farming sector but remains very small. This is particularly true for grains and potatoes, for which only one tenth of production is destined for the local food market.

Overall, in Wallonia, around 71% of the UAA is dedicated to animal feeding ; 13% to exports, 7% for bioenergetic uses, 2% for other uses (materials…) and only 7% for local human food consumption (Sytra, 2026 - Figure 21).

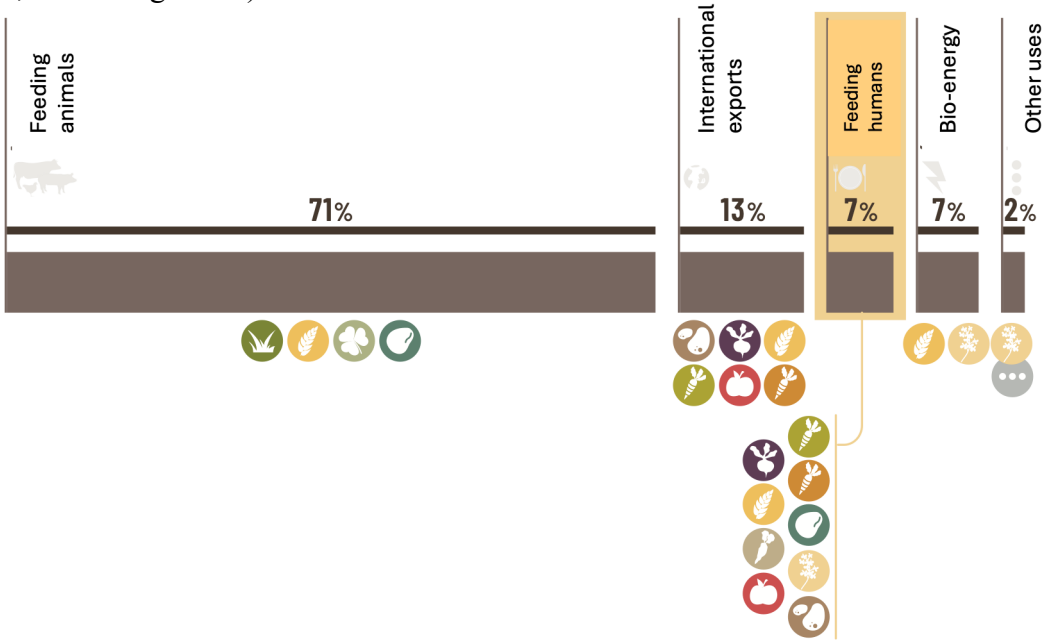


Figure 21 - End uses of agricultural productions in the Walloon Region (aggregated estimates by SYTRA, 2026)

3.3.4 Importance of organic farming

In 2020, the total area devoted to organic farming in Wallonia peaked at 12% of the UAA, before a period of decline marked by a lack of market opportunities for local organic production sectors (Figure 22). Overall, grasslands account for the largest share (75%) of the 90,000 hectares devoted to organic farming in the region (SYTRA, 2026).

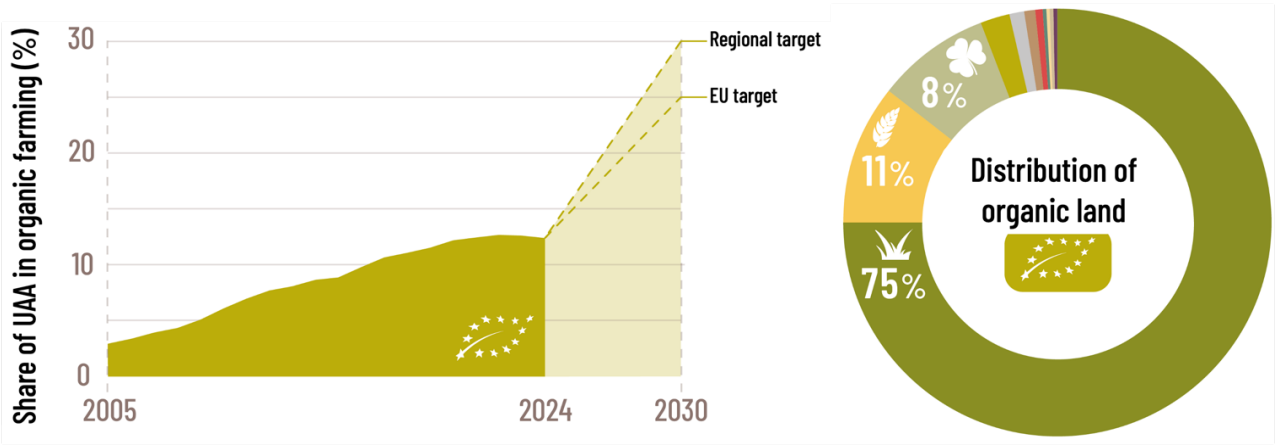


Figure 22 - Historical trend and distribution of organic land across farming sectors in Wallonia (SYTRA, 2026)

In terms of crops, the share of organically managed land and its rate of change vary across the fruit, legume, vegetable, oilseed and cereal sectors, while it remains marginal (~ 1%) in industrial crop sectors such as potatoes and sugar beet (Table 1).

Table 1 - Share of organic farming across agricultural sectors in Wallonia (Sytra, 2025)

Sector	Land area (ha)	% of Regional UAA	% Organic land (2017-2022)	% of total organic land
Greenhouse vegetables	98	0%	26%	0%
Fruits	2 032	0%	26%	1%
Grasslands	344 493	47%	19%	75%
Others	6 623	1%	13%	1%
Forage crops	63 053	9%	12%	8%
Open-air vegetables	19 023	3%	11%	2%
Legumes	4 337	1%	7%	0%
Cereals	186 013	25%	5%	11%
Chicory	6 717	1%	3%	0%
Potatoes	40 576	6%	2%	1%
Oilseeds	20 194	3%	1%	0%
Sugar beets	38 046	5%	0%	0%
Total UAA	**731 205**	**100%**	**12%**	**100%**

3.4 Policies and Institutional Environment

Impacts and challenges of the agricultural policy in the territory

Several policy instruments, developed in response to European Union directives, have been implemented in Wallonia to mitigate the environmental pressures of agriculture. The most significant ones include:

1 The Sustainable Nitrogen Management Programme (Programme de Gestion Durable de l'Azote en agriculture, **PGDA**, in French), derived from the *Nitrates directive*[5] and aimed at regulating nitrogen fertilizer use and protecting water quality;
2 The Walloon Pesticide Reduction Programme (Programme Wallon de Réduction des Pesticides, **PWRP**, in French), which seeks to lower the risks associated with plant protection products (SPW, 2025a).

At the European level, the Common Agricultural Policy (CAP) 2023-2027 was designed with heightened environmental ambitions, articulated through the so-called *green architecture*. This framework combines reinforced conditionality standards, eco-schemes, agri-environment-climate measures (AECMs), and specific support for organic farming. Importantly, the reform grants Member States substantial flexibility in transposing these instruments into their national or regional strategic plans (SPW, 2025a).

In practice, however, the European Court of Auditors noted that the strategic plans adopted by Member States, including Wallonia, fail to reflect a significant increase in ecological ambition compared with the previous CAP programming. Furthermore, relaxation of certain conditionality requirements in 2024, following widespread farmer protests, is expected to weaken the potential environmental effectiveness of the CAP's green architecture in Wallonia and across the EU (SPW, 2025a).

The CAP co-financed subsidies have a strong but heterogenous influence on the profitability of regional sectors. Livestock sectors (especially the bovine meat production) have become highly reliant on direct and coupled payment from the CAP's first pillar, while still facing unstable income and decreasing attractiveness. The second pillar is mainly oriented around practice-oriented AECMs, which have shown some level of effectiveness in maintaining grasslands areas.

Land use and land tenure policies

Land use trade-offs are increasingly debated at regional level, both in relation to competition between agricultural and non-agricultural uses (e.g., Forestry, Housing in rural areas, Leisure activities, Renewable energy production) and to competition among the different destinations of agricultural productions (food, feed, exports, (bio-)energy, other uses), as outlined in Section 3.3.3.

Land tenure has become a predominant issue for a significant share of farmers, especially small farmers seeking to expand their land and new farmers trying to acquire land. Land prices have steadily increased over the past ten years: between 2017 and 2024, the average sale price per hectare of agricultural property rose by 51%, from €27,205/ha to €41,128/ha, corresponding to an average annual increase of 6.1% (Figure 23). This annual increase partly reflects inflation, which account for a significant part of this increase.

In 2024, arable land in Wallonia was sold at an average price twice as high (€50,363/ha) as pastures (€25,735/ha) [6]. This difference explains the spatial gradient, with higher land prices observed in the northern regions (Figure 24).

[5] Council Directive 91/676/EEC of 12 December 1991: http://data.europa.eu/eli/dir/1991/676/oj

To this date, no specific measure, initiative or program have been taken by the regional authorities to mitigate this increase in agricultural land prices.

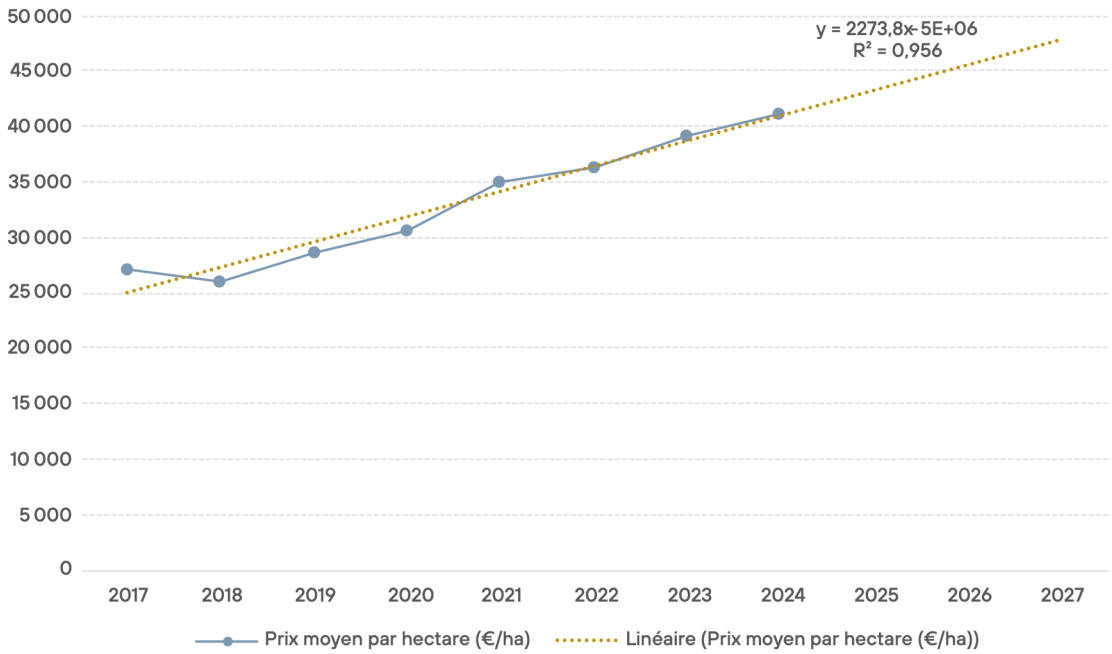


Figure 23 - Changes in the average price (€/ha) of sales of undeveloped agricultural real estate located entirely within agricultural zones (2017-2024). (infography by SPW - DAFoR, 2024)

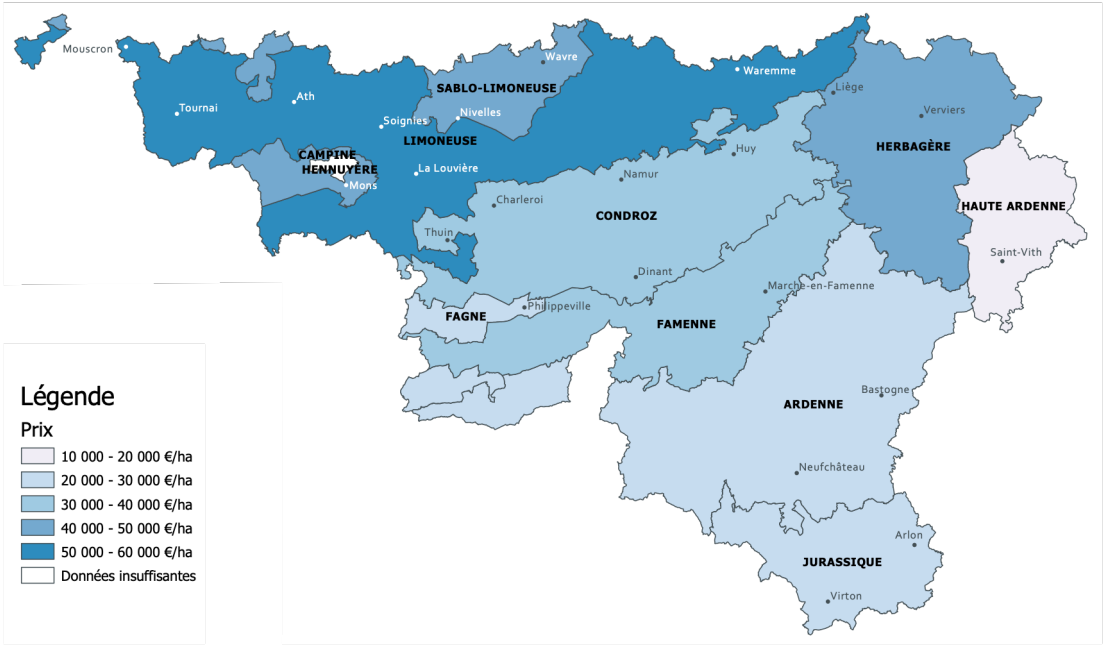


Figure 24 - Sale prices of land declared as arable cropland by agricultural regions of Wallonia (infography by SPW - DAFoR, 2024)

At the same time, rental price for agricultural land under long-term leases averaged 195€/ha in 2024, with significant variation, ranging from 100€/ha to 300€/ha, depending on the agricultural region, following the same spatial gradient as land prices. These renting rates are, however, more strictly regulated through annual coefficients determined based on consumer price inflation and agricultural labor income per hectare.

Research and Innovation strategies

The regional agricultural research center (CRA-W) is involved in different programs aimed at diversifying animal breeds and crop varieties to increase farming system resilience in evolving environmental and climatic conditions (e.g., bread-oriented wheat cultivars, potato varieties resistant to late blight…).

A high share of public and private investments in innovation remains oriented towards genetic engineering technologies (and more recently digital innovation) rather than agroecological system (re-)designs. A study estimated that, between 2019 and 2024, only 10% of public expenditures allocated to food and agriculture was effectively oriented towards agroecological frameworks [1].

Sustainability and climate resilience measures

Walloon agriculture is characterized by a comprehensive framework of public support schemes promoting environmental and climate measures (as reflected in the regional implementation of the CAP's green architecture in Figure 25).

Beyond direct CAP payments supporting environmental and climate objectives (including eco-schemes and agri-environmental-climate measures), Wallonia has invested over the past years in the development of its participative agricultural knowledge infrastructure (e.g. WALAKIS platform and project[6]).

Additionally, pilot programs on agroecology have been launched, including the Terraé project (2022-2026), which supported a pilot agroecological transition with a selection of volunteer farms, and the Blue Deal (2026-2030), which focuses on helping farmers address water quality issues. These programs have brought together research and actions partnerships, initially involving technical advisors and, more recently, integrating interdisciplinary facilitators with knowledge on behavioral and transition mechanisms.

Private farmer's networks and technical organizations are also increasingly promoting agroecology-related practices, such as crop diversification, integrated protection measures, agroforestry, cover cropping, reduced tillage and other soil conservation/regenerative measures.

Input subsidies - CAP implementation

No public subsidies are available or specifically dedicated to input purchases.

The vast majority of funding sources available for supporting farming activities and agri-environmental transition is currently provided under the CAP framework and the regional CAP strategic plan (CAP SP). This includes direct payment provided under the European Agricultural Guarantee Fund (EAGF - €1.32 billions) and the regional rural development program (PwDR), funded through the European Agricultural Fund for Rural Development (EAFRD - €534 millions), with 63% co-financing by the Walloon Region.

For the first pillar, basic income support and redistributive support account together for 50% of direct payments. Coupled payments accounts for 21% of the budget and is driven mainly by beef-cattle support, which alone absorbs about 81.6% of the coupled envelope (Figure 25).

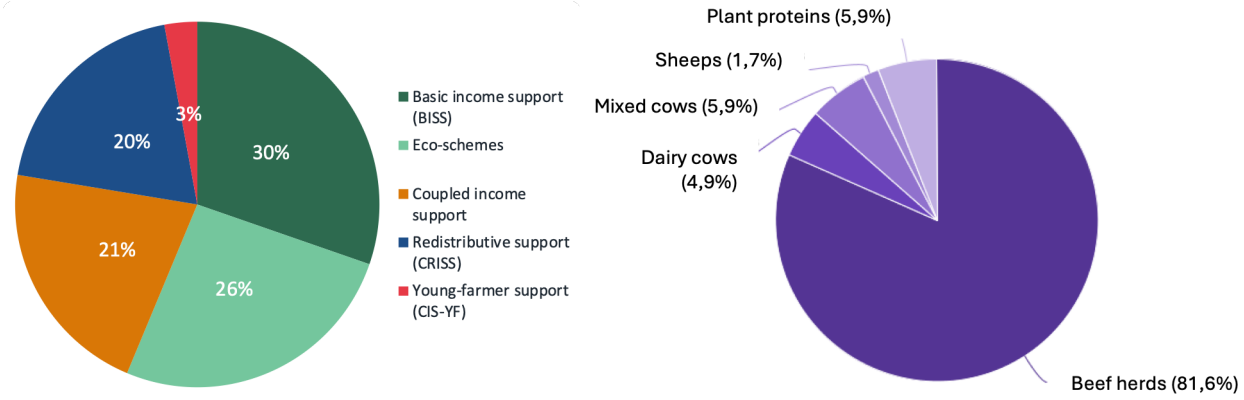


Figure 25 - Breakdown of the 2023-2027 EAGF budget architecture in Wallonia (€1,328 billions financed by the EU Commission) ; latest data retrieved from the annual state of Walloon agriculture [16]

[6] https://walakis.be/en

Regarding the second pillar, support for organic farming practices, the Natura 2000 network, and agri-environmental-climate measures (AECMs) together accounts for about half of EAFRD co-financing, supplemented by support for investments and the establishment of young farmers (Figure 26).

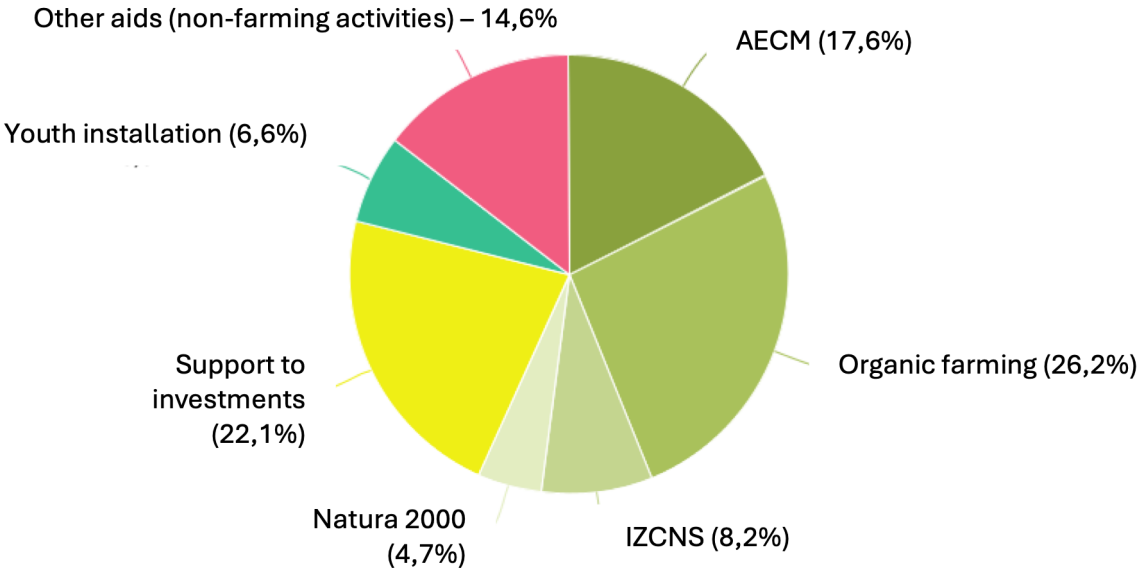


Figure 26 - Breakdown of the 2021-2027 EAFRD budget implementation in Wallonia - €534 millions [13]

The specific subset of subsidies oriented towards *green* farming practices available to Walloon farmers under the current 2023 - 2027 CAP, is listed in Table 2.The agri-environmental programs (under EAFRD[7] funding) are co-financed by the EU Commission (EC) and the Walloon Region, while 1st pillar aid packages (i.e., EAGF[8] funding) are funded by the EC alone.

Overall, strong and consistent support is provided for the conversion to and maintenance of organic farming activities through the second pillar. Combining these schemes with agri-environmental-climate measures can improve the economic sustainability of farms investing in the agroecological transition. Two types of agri-environmental-climate measures are also supported under the local implementation of the ENVCLIM[9] budget package:

- *Basic measures* (MB), open to all farmers and involving voluntary commitments over 5 years for specific practices.
- *Targeted measures* (MC), which target specific environmental issues and are available only to a subset of farmers who meet the eligibility criteria following a mandatory initial assessment and follow-up with the local agri-environmental organization.

As for most of EU countries, Wallonia mainly use ENVCLIM interventions to support the adoption or the maintenance of organic farming and grassland management ; while transformative measures on arable land cultivation remain limited.

[7] European agricultural fund for rural development - i.e. Second pillar of the CAP funding
[8] European agricultural guarantee fund - i.e. First pillar of the CAP funding
[9] Environmental, climate-related and other management commitments – AECC. Ring-fenced financial allocation within the CAP's Rural Development fund (Pillar II) designed to incentivize sustainable land management, organic farming, animal welfare, and biodiversity preservation (IEEP).

Table 2 - CAP interventions supporting environmental and climate practices in Wallonia (derived from the EU catalogue of CAP intervention, in 2025).

Title	Funding bodies	(Co-)funding by the Walloon region[10] (%)	Description	Budget in CAP cycle 2023-2027 (€)		Payments € (min-max)
CAP SP (EAGF) - Ecoscheme 141 - L*ong soil cover*	European Commission (EC)	0%	Encouraging soil cover between harvests over winter to protect soil & water, improve biodiversity	€ 99,609,825	€345,000,000	15-45 €/ha depending on threshold
CAP SP (EAGF) - Ecoscheme 142 - *Environment-friendly / low-input crops*	EC	0%	Promoting cultivation of low-input / species-diverse crops to improve soil & biodiversity	€ 30,547,440		380-440 €/ha depending on variant
CAP SP (EAGF) - Ecoscheme 143 - *Ecological mesh size*	EC	0%	Enhancing ecological networks via environmental elements (hedges, ponds, margins, etc.)	€ 58,305,310		450 €/ha base rate; final payment depends on element type & location
CAP SP (EAGF) - Ecoscheme 144 - *Reduction of inputs*	EC	0%	Reducing use of certain PPPs or use mechanical weed control; reducing environmental/health risks	€ 30,680,000		16-150 €/ha depending on intensity / molecule list; ~80 €/ha as mid-target
CAP SP (EAGF) - Ecoscheme 145 - *Permanent grassland subject to livestock density*	EC	0%	Maintaining permanent grasslands with stocking density conditions to preserve biodiversity & reduce emissions	€ 126,172,384		Base rate: min 36€/ha - max 80€/ha
CAP SP RDP (Rural Development Plan) (EAFRD) - ENVCLIM (AECM) - MB11 *Keeping endangered local breeds of animals*	EC + Region	63%	[offsetting the costs of] contributing to the preservation of the rich genetic and cultural heritage represented by endangered local breeds of horses, cattle, sheep, and pigs. This is achieved by ensuring, on the one hand, a sufficient population for an effective	€ 4,223,480	€ 94,000,000	

[10] Member State (Walloon Region, in this case)

			presence in the Walloon region and, on the other hand, the preservation of a sufficiently large genetic base to prevent any problems of inbreeding and degeneration.			
CAP SP RDP (EAFRD) - ENVCLIM (AECM) - MC7 *Landscaped plots*	EC + Region	63%	[offsetting the costs of] Managing or creating plots for biodiversity / habitat / water retention / ecological features	€ 27,412,000		
CAP SP RDP (EAFRD) - ENVCLIM (AECM) - MC4 *Grasslands with high biological value*	EC + Region	63%	[offsetting the costs of] Conserving/improving high-nature value grasslands; stricter biodiversity/habitat practices	€ 17,776,800		
CAP SP RDP (EAFRD) - ENVCLIM (AECM) - MB2 *Natural grassland*	EC + Region	63%	[offsetting the costs of] Maintaining natural prairies with low intensity management	€ 9,692,320		
CAP SP RDP (EAFRD) - ENVCLIM (AECM) - MB5 *Grassed headlands*	EC + Region	63%	[offsetting the costs of] transforming field margins into narrow strips (10 to 20 meters) of grassland cover (grasses and legumes), farmed in a low-intensity manner, without inputs, with late summer mowing and the presence of an un-mowed refuge area.	€ 18,173,000		
CAP SP RDP (EAFRD) - ENVCLIM (AECM) - MB12 *Standing Cereals*	EC + Region	63%	[offsetting the costs of] leaving plots of cereals on the stalk in rotation until the end of February in order to promote biodiversity by providing food in winter, the most crucial period for their survival, to the most endangered species of wintering and migratory birds. This AECM thus addresses the issue of the decline of small wildlife in the plains.	€ 9,288,000		
CAP SP RDP (EAFRD) - ENVCLIM (AECM) -	EC + Region	63%	[offsetting the costs of] reducing livestock numbers and maintaining permanent grassland.	€ 17,400,000		€30-60/ha depending on stock density

MB13 *Forage Autonomy*						class; min €100 per engagement
CAP SP RDP (EAFRD) - ENVCLIM (AECM) - MC10 *Agri-Environmental Action Plan*	EC + Region	63%	addressing the farm as a whole and, following an assessment of the challenges facing the region and the strengths and weaknesses of the farm, a short-, medium- and long-term action plan is drawn up by the advisor and the farmer.	€ 1,900,000		20€/ha ; max 1000€
CAP SP RDP (EAFRD) - ENVCLIM (AECM) - MR14 *Soil*	Region	100%	[offsetting the costs of] improving and maintaining the organic carbon content in the farm's soils at a level that reflects a favorable situation in terms of soil quality (structural stability, organic status, biological activity, etc.). First (& only) result-based AECM in Wallonia.	€ 9,200,000		
CAP SP RDP (EAFRD) - ENVCLIM - *Support to Organic farming*	Region	100%	encouraging farmers to engage in organic production and to apply the European specifications defined by Regulation (EU) No 2018/848 on organic production and labelling of organic products.	€ 117,404,400	€ 117,404,400	
CAP SP RDP (EAFRD) - ASD 341 - *Natura 2000 payments in agricultural areas*	EC + Region	63%	Compensation to farmers whose land is subject to restrictions following its inclusion in the Natura 2000 network. The amount of this compensation is determined based on the level of restrictions and in line with the specifications of the Natura 2000 management units (MUs). SO1, SO4, SO5, SO6, SO8	€ 25,250,000	€ 25,250,000	€460/ha for high-constraint grasslands, €1,200/ha for extensive riparian strips

Access to credit

In Belgium, men and women have – legally – equal rights and access to credit. In practice, however, this does not prevent certain forms of informal gender discrimination in access to loans, as well as imbalances within households regarding access to credit and personal financial resources. One of the main constraints identified is the conditions imposed by certain banks for access to credit, which limits the scope of investment opportunities (e.g. establishment of large-scale poultry or laying hen facilities) and makes it more difficult for farmers to transition to new agricultural systems.

This is why in the regional adaptation of the TAPE questionnaire ; criteria Q10.1.3 (*Access to financial resources and ability to self-finance*) was formulated as:

Investment opportunities

Within the CAP co-financing, and more specifically under the EAFRD, different types of agricultural investment supports are available (Table 3).

Table 3 - Public investment aid in Wallonia potentially available to farmers (Walloon Agricultural Portal, 2025)

Title	FUNDING BODIES	*Co-funding (%)*	*Support rate (%)*	*Budget (€)*
CAP SP RDP (EAFRD) - INVEST 351 - Aid for productive investments[11] in agricultural holdings	EC + Region	63%	[10% - 40%[12]]	€ 115,800,000
CAP SP RDP (EAFRD) - INVEST 352- Aid for non-productive investments in agricultural holdings	EC + Region	63%	100% of eligible costs, max. €30,000/farmer	€ 900,000
CAP SP RDP (EAFRD) - INVEST 354[13] - Investments in the processing/marketing of agricultural products and non-agricultural diversification	EC + Region	63%	[20% - 40%] for farmers and cooperatives	€ 10,400,000
CAP SP RDP (EAFRD) - INVEST 355 - Aid for non-productive investments in rural areas (SEP site restoration and restoration of ecosystem services)	EC + Region	63%	100% for ES restoring/maintenance	€ 11,250,091
CAP SP RDP (EAFRD) - INVEST 357 - Aid for investments in forestry infrastructure related to climate change	EC + Region	63%	100%	€ 1,000,000
CAP SP RDP (EAFRD) - INVEST 361 - Support for young farmer's installation	EC + Region	63%	Forfeit: € 70,000/farmer	/

[11] Examples of productive investments strongly supported are CUMA (Common Agricultural Machinery Use Cooperatives), with a basic intervention rate of 20%.
[12] Stronger rates are also applied for young farmers, farmers located in area of natural or specific constraints (ZCNS), grassland-oriented systems, small farms (< 60ha), organic farming, Polyculture (≥ 5 crop groups) or diversified market gardening, higher animal welfare guarantees…
[13] INVEST 354 are also available to a limited number of stakeholders located at the beginning of value chains, such as collection and processing cooperatives.

3.5 Markets and value chains

An overview of Walloon stakeholders involved in local, regional and international food and agriculture markets and value chains is illustrated in Figure 27.

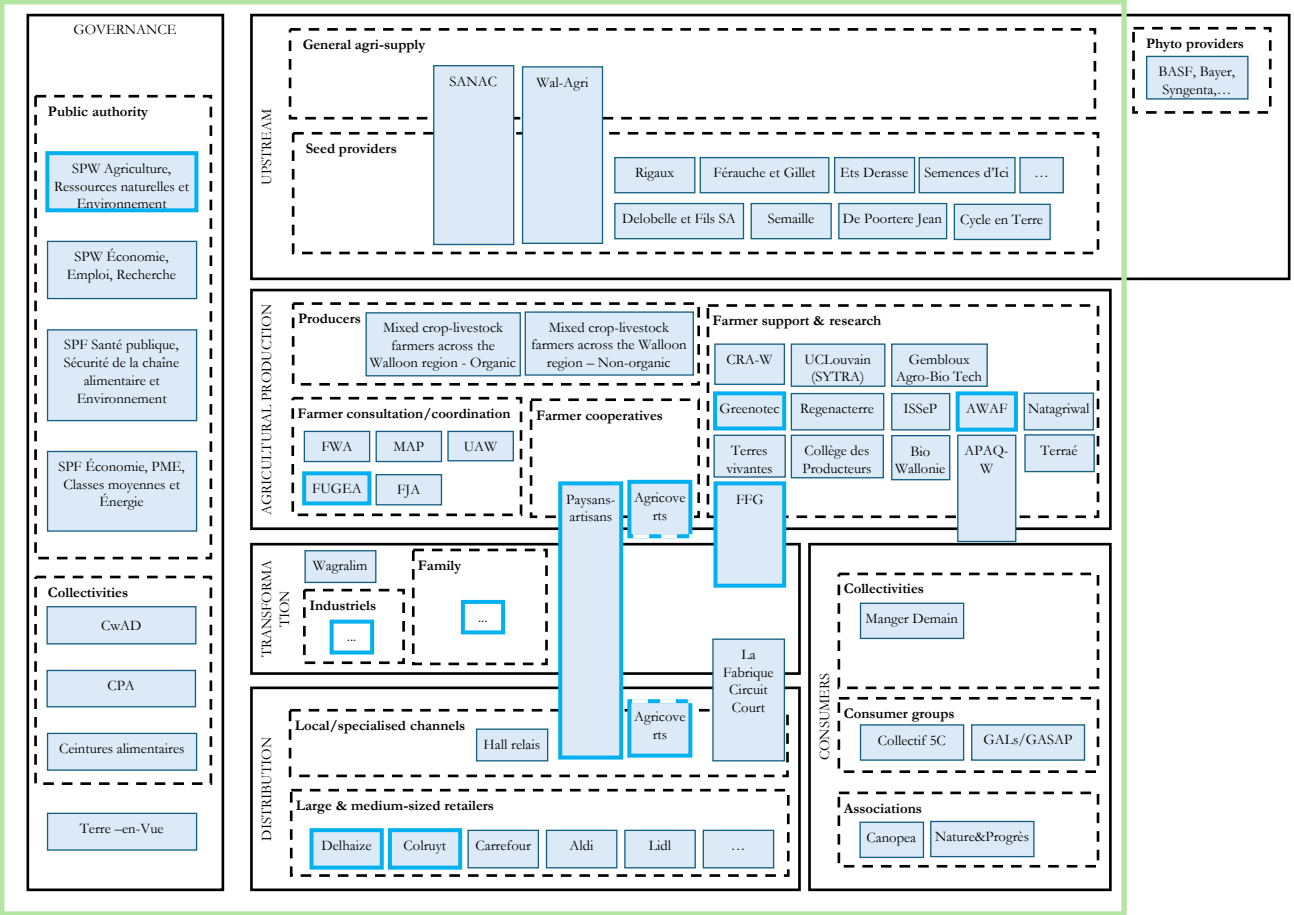


Figure 27 - Actor's map representing the ecosystem of actors in Wallonia (Wiaux, 2025). The green frame represents the limits of the system considered ; and the boxes highlighted in blue are targeted for MAP constitution.

The elements below details further market features of specific farm structures in the perspective of the agroecological transition:

- Livestock sectors are highly reliant on CAP first pillar subsidy ; unstable income security and decreasing attractiveness
- Field crops are integrated into international value chains and global market through cooperatives.
- Second pillar: Maintenance-oriented AECM (management of grassland areas and key ecological infrastructures).
- Market gardening (vegetables): industrial sector and fresh produce sector; partly export-oriented
- Fruit sector: highly industrialized and export-oriented
- Niche local networks (**vegetables and dairy**) :
    - Consumers networks (trust-based): *AMAP, GASAP*
    - Producer cooperatives (Paysans Artisans, Agricovert)
- Emerging medium-length local value chains ; ensuring fair prices to producers in agroecological transition (New mid-chain actors enhancing added value transfer: FFG, Cultivaé…).

Across the territory, various networks of actors promoting contrasting pathways for agroecological transition coexist, each based on different set of practices, certifications and marketing strategies (Figure 28). These networks involve a diversity of actors, including farmers, advisors, retailers, etc.



Figure 28 - Main transition models and associated networks observed in Wallonia in 2026 (author's knowledge).

Figure 29 introduces the typical organization of the Beef supply chain in Wallonia, while Figure 30 shows the contrasts between two central crop sectors organization. Potatoes cultivation follows a strongly integrated model with processing companies.

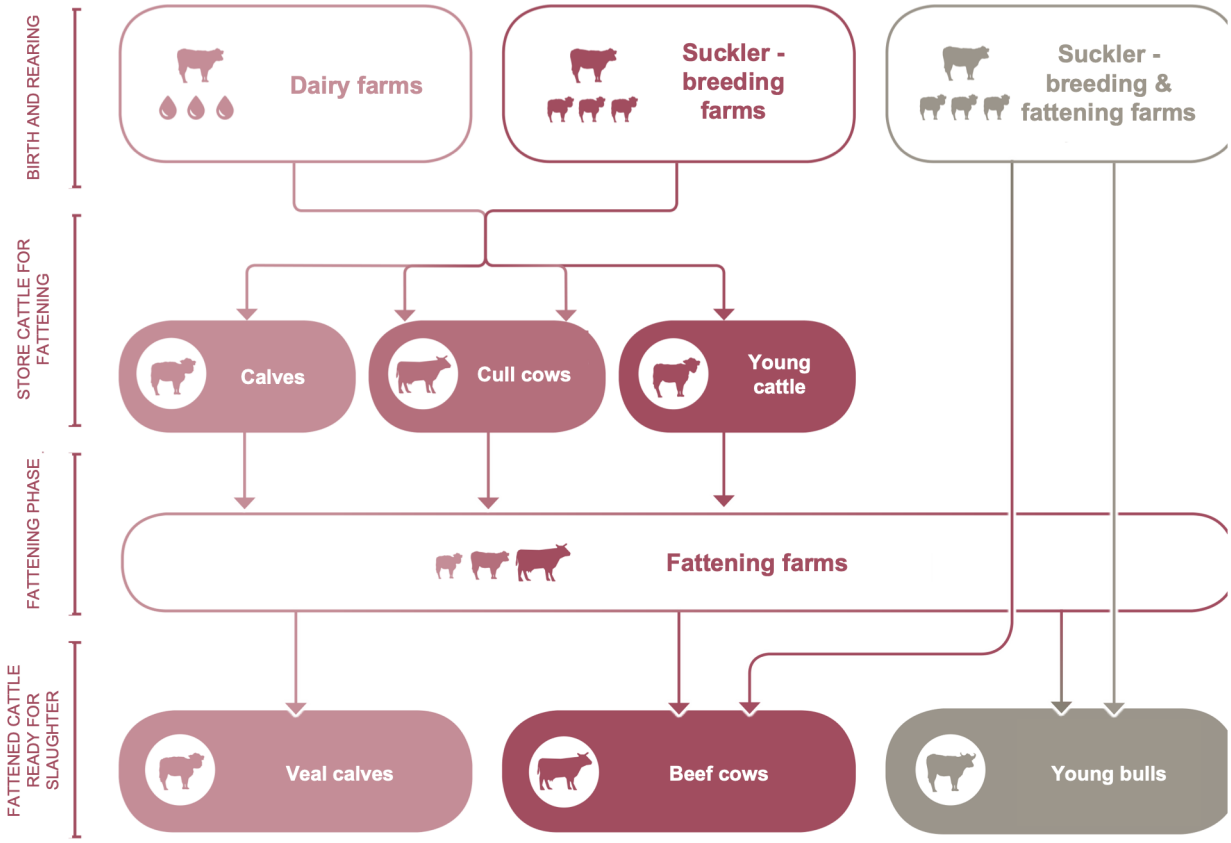


Figure 29 - Organization of the Walloon beef supply chain. Note : some part of fattening is integrated with Flanders [10]

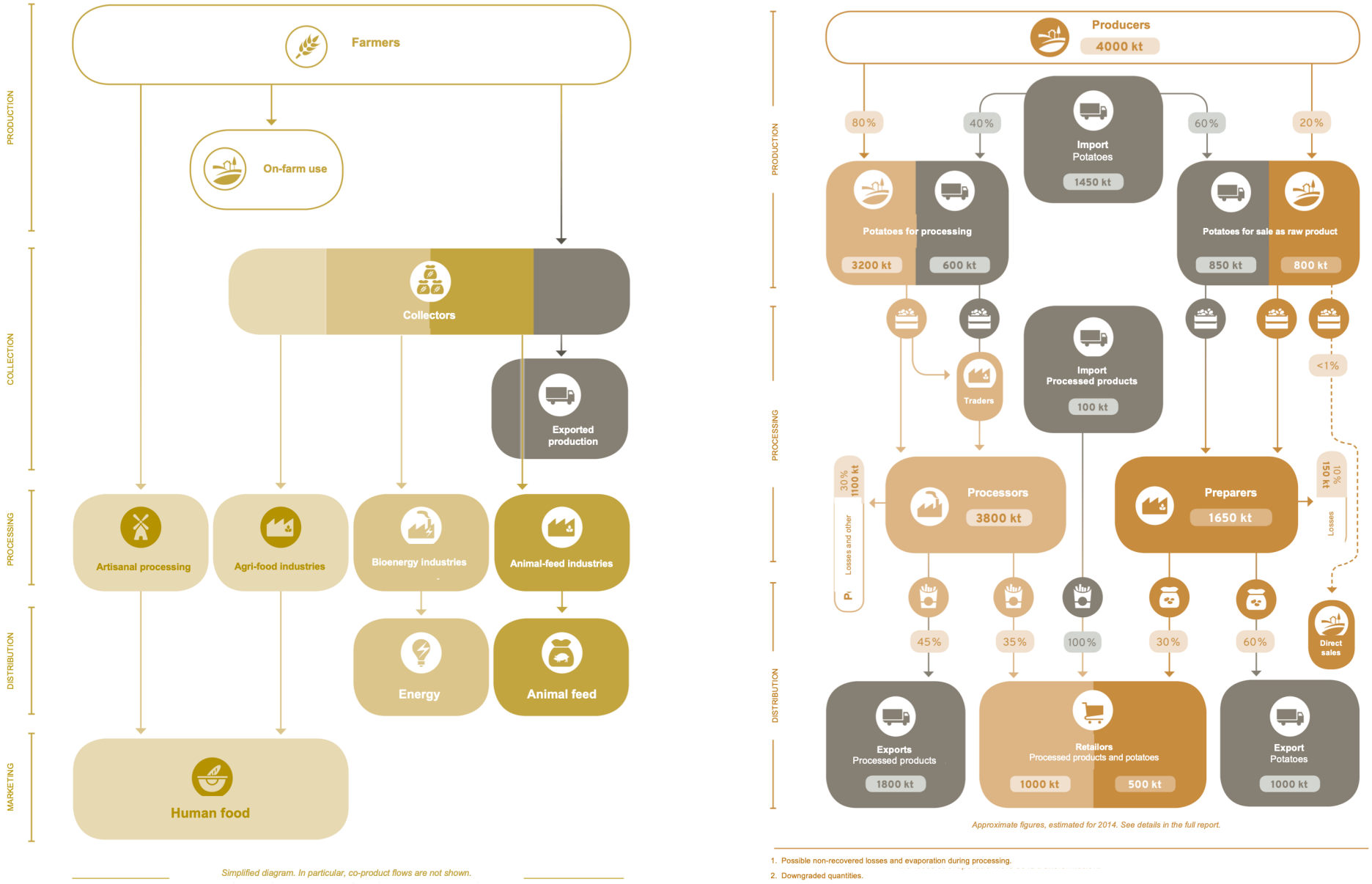


Figure 30 - Stakeholders & fluxes from production of cereals (left) & potatoes (right) crop sectors in Wallonia to their end-consumption. [2], [3]

3.6 Cross-cutting themes - enabling and disabling factors

This section provides additional insights into existing conditions that either facilitate or constrain the agroecological transitions in Wallonia.

3.6.1 Environmental challenges

Agricultural cropping systems in Wallonia exhibit variable environmental impacts depending on crop type and associated management practices. The main areas of concern for farmers, local inhabitants and decisionmakers are (1) erosion and flood risk, (2) nitrate leaching potential, and (3) pesticide use intensity and associated risks for the environment and human health.

Soil erosion (runoff and water erosion) and the emergence of soil conservation practices: Permanent grasslands provide the most effective soil cover, displaying erosion risks more than ten times lower than those of arable lands. Temporary grasslands also significantly limit soil losses, although to a lesser extent than permanent pastures. Among arable crops, maize and potatoes show the highest erosion risk, due to row structure, late canopy closure, and soil exposure during critical rainfall periods. Sugar beet and cereals present lower risks, though they remain considerably higher than grasslands.

Vegetative cover is the primary driver of erosion risk, with continuous or dense cover mitigating erosion. For this reason, independent advisory organizations and associations promoting Conservation Agriculture (CA) have worked over the last decades to raise awareness among Walloon farmers about the agronomic and multidimensional benefits of winter cover crops and other soil conservation practices, including crop diversification and limited tillage.

Nitrate leaching - A threat for drinkable water quality: Nitrate leaching to groundwaters if commonly measured and controlled through Autumnal Potentially Leachable Nitrogen (PLN), ensuring compliance with legal thresholds defined under the nitrates directive. Permanent grasslands (in the South-East of the territory) exhibit the lowest PLN values, reflecting their capacity to capture and recycle nitrogen (Figure 31). They are followed, in increasing order of leaching risk, by sugar beet (low residual N in autumn), cereals (intermediate levels)**,** maize and potatoes (highest residual nitrogen, thus greatest risk for groundwater contamination). Crop rotations, through both their sequence and diversity of crops, can amplify or mitigate leaching risks. Winter Catch crops (CIPAN) significantly reduce residual nitrogen and potential losses.



Figure 31 - Nitrates vulnerable zone (PROTECT'eau, 2025)

Pesticide use and associated risks - An unequal distribution of contributions to pesticide-related risk across sectors

In terms of active substances use per hectare, grassland has the lowest pesticide input intensity (~0.05 kg of active substance /ha), representing a minimal source of pesticide-related risk. Cereals (e.g., winter wheat) show for moderate levels (~2 kg a.s./ha), while sugar beet relies on higher inputs (~5 kg a.s./ha), and potatoes the highest (~16 kg a.s./ha), making it the most pesticide-intensive crop in Wallonia.

However, the average volumes of active substances used per hectare of crop are not sufficient to characterize the overall contribution of each sector to pesticide-related risks. The combination with the relative share of each sector in the territory (Figure 19), as well as the joint assessments of the risks to human health, environmental ecotoxicity (terrestrial and aquatic), and persistence in the environment of the different active substances provide a more complete and accurate picture of the risk associated with each sector (Figure 32).

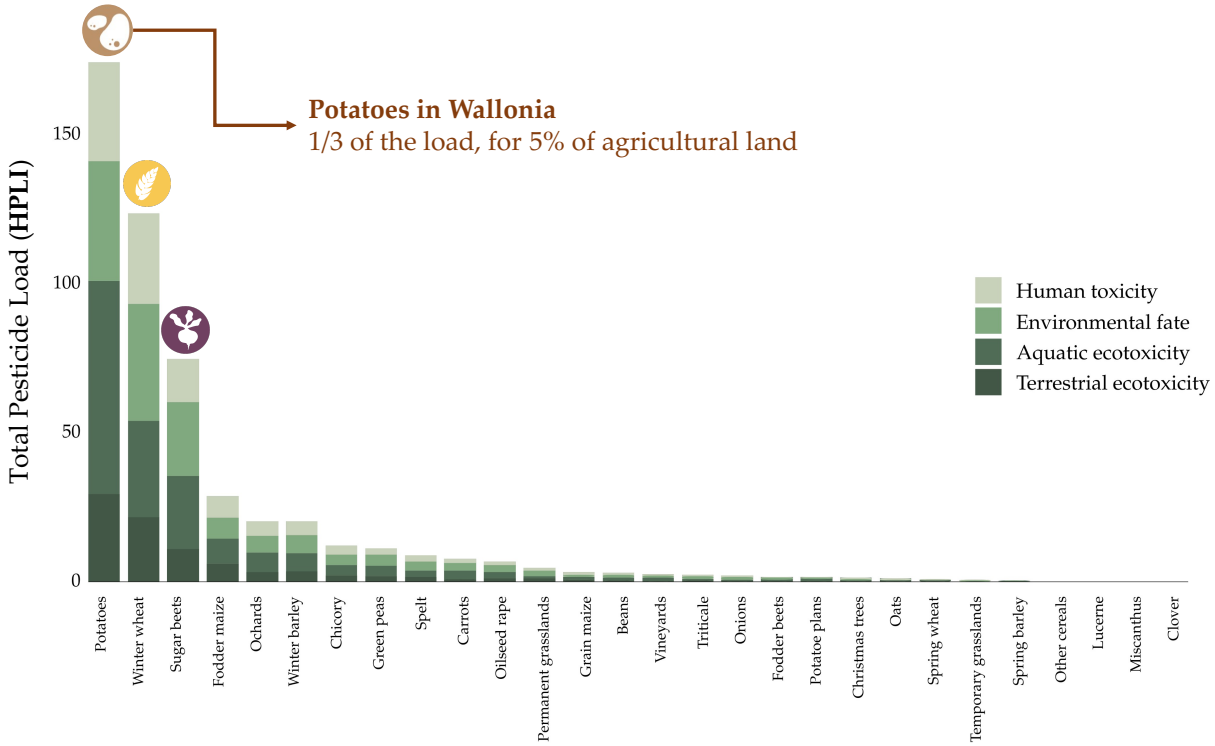


Figure 32 - Aggregated Pesticide Load at territorial level in Wallonia across farming sectors [20]

One of the main consequence and concern at stake is the observed decrease in qualities of water bodies (Figure 33). Latest scientific assessments highlighted the degradation of water resources around pumping stations, particularly due to specific chemical contaminants such as pesticides residues (metabolites) and PFAS contamination. These issues are now at the center of scientific, mediatic and political attention. The Walloon Region has, in response, implemented a plan to address

pesticide-related issues, but it has, so far, failed to induce a significant reduction in use and environmental risks (SYTRA, 2025).

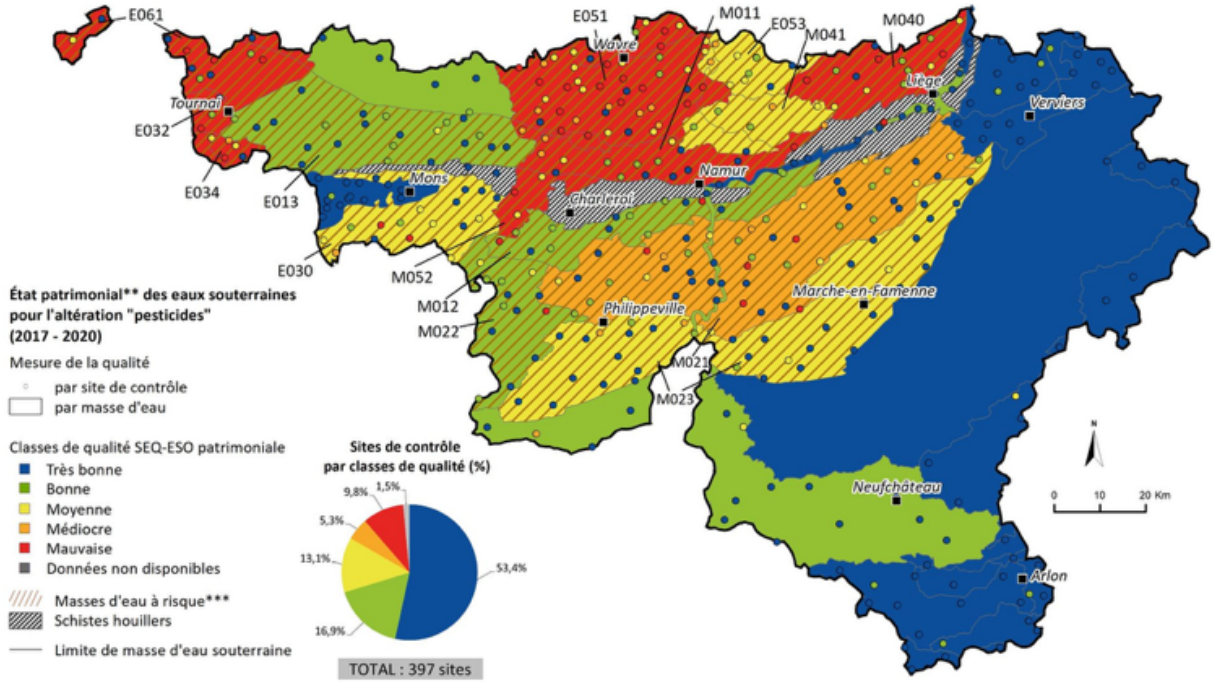


Figure 33 - Impact of pesticides on groundwaters quality (SPW, 2022)

The issue of climate change mitigation and adaptation in the agricultural sector is also being discussed by the national and regional public authorities. The main sources of agricultural GHG emissions (mainly in the form of methane and nitrous oxide) are soil management, nitrogen fertilization and cattle farming.

The spatial disparity of environmental challenges and degradations faced across the territory is strongly correlated with the disparity in production systems mentioned above (see *Natural Context* and *Agricultural systems / Farm structural characteristics)*. The presence of intensive and industrial agricultural production and production systems in the northern and western regions of Wallonia has a more pronounced impact on agri-environmental indicators (for example, the quality of surface water and groundwater is negatively affected by pesticides and nitrates). Erosion and degradation of organic matter stocks is also stronger in these regions with high agronomic potential.

Furthermore, the spatial scales relevant to the various issues differ and call for consideration of different courses of action. While some pressures might partly be addressed through localized individual actions, such as reducing the use of pesticides and synthetic nitrogen fertilizers in crop rotation systems, other challenges, such as effective water resource management, combating water erosion and flooding, and maintaining the complex ecological network, require collective action at the watershed or agricultural landscape scale. Addressing these challenges requires, therefore, systemic and coordinated action at the level of regional and federal administrative entities.

3.6.2 Other key issues

Several additional socio-economic constraints condition the agroecological transition in Wallonia. Generational renewal constitutes a structural bottleneck, as demographic ageing of the farming population threatens farm continuity and the uptake of innovative practices. Land tenure insecurity further limits long-term investment capacity, with access to agricultural land remaining highly volatile due to fragmented ownership and speculative pressures.

The restructuring of the agricultural workforce, including increased reliance on external labor and evolving recognition of gender roles in farm management, introduces additional socio-organizational complexity. Regarding knowledge transfer, two distinct advisory systems coexist: commercially oriented extension services delivered by input suppliers[14], and independent advisory services provided by public institutions, small and medium cooperatives and other farmer organizations[15]. This institutional duality generates a heterogeneous information environment in which farmers navigate through potentially divergent recommendations, raising questions about the governance of agricultural knowledge dissemination.

Most of the independent advisory networks that have emerged over the past thirty years in the region have envisioned approaches focused on agri-environmental, organic, conservation and regenerative practices (and/or agroecology as a whole) as fundamental motivations for bringing farmers together around a common set of practices aimed at reducing environmental impacts and adapting to changing conditions such as climate.

[14] E.g. : SCAM, Walagri cooperatives
[15] E.g.: Natagriwal, Greenotec, Terres Vivantes, Regenacterre, Farm for Good, Sectoral pilot centers

4 AGROECOLOGY IN SAXONY-ANHALT (GERMANY)

4.1 TAPELINE in the territory and the study context

4.1.1 Background and rationale for applying TAPE

The territory of Saxony-Anhalt is a region under multiple transition pressures and several structural challenges mainly related to:

- Economic restructuring (decline of mining, industrial jobs)
- Demographic change (outmigration, ageing)
- Environmental pressures: soil degradation; drought and climate stress.

In this context of great transformation, agroecology represents a strategic response, enabling resilience, ecosystem services supply and circular bioeconomy, thanks to specific actions towards:

- Climate mitigation & adaptation
- Biodiversity restoration
- Economic diversification

The analysis conducted for the Step 0 within TAPELINE project, helped us to identify some of the most crucial characteristics of the local economy and the need for a systemic transformation. These elements make the implementation of the TAPELINE project very crucial for the territory of Saxony-Anhalt.

In fact, the territory demonstrates a clear interest in agroecology (AE), particularly agroforestry (AF). Several model enterprises are already active in this field, alongside others that are both willing and increasingly compelled to advance in this direction. This indicates a growing level of awareness and openness to change. These conditions provide a strong foundation and starting point for further analysis and dialogue, as such enterprises, and ideally many more, require supportive and appropriate framework conditions to enable their transition.

The existence of several players already actively engaged in agroforestry initiatives, make the implementation of the TAPELINE project particularly relevant also for the state of Saxony-Anhalt. In fact, the project represents a great opportunity to provide all main actors and players, in particular agricultural enterprises, with the support they need to achieve positive expected impacts on the territory.

More specifically, the implementation of the TAPELINE project in Saxony-Anhalt can help demonstrate the extent to which AF can serve as a source of renewable energy. This is particularly relevant as municipalities are required to submit their municipal heat plans by 2026 (for cities with more than 100,000 inhabitants) and by 2028 for smaller towns.

In addition, the project is expected to identify potential economic opportunities for farmers, including those related to the production of fruits and nuts.

It is then possible to conclude that agroecology offers a promising pathway to address the intertwined environmental, economic, and social challenges of post-socialist and post-mining regions, but its success depends on scaling up from pilot initiatives to systemic transformation.

4.1.2 Specific research and evaluative questions

Within the identified boundaries for the territory of Saxony-Anhalt, the analysis of the contextual features, allowed to identify some specific research questions that help to make the implementation of the project more focused on the specific needs of the territory.

Among the main project objectives, the most relevant ones for the territory of Saxony-Anhalt are:

- to improve the framework conditions mainly related to market economy conditions,
- to reduce the short-term, high-investment costs barriers through financial incentives or risk mitigation mechanisms during the initial transition period (e.g. with public-private-producer partnerships enabling cost-sharing and allowing farmers to co-finance their initial investments; intercropping to provide extra income)
- to design agroforestry systems for greater economic viability and resilience
- to gain more knowledge from socio-economic perspective, besides the biophysical one
- to make AF a viable approach viable both for small- and large-scale farming systems

- provide farmers with evidence-based knowledge about the positive impacts of AE and AF on soil quality
- provide data about positive impacts on biodiversity
- to prove relevance of AF for transitional economic systems, going through systemic changes, like the one in Saxony-Anhalt
- to analyze changes in consumer demand and new sustainable systems which could bring about new business opportunities, for example in the plant protein sector or the bioeconomy
- to investigate any opportunity for developing a circular and healthy food systems

These are the main general research axes:

1. Potential integration of AF into current management system → Main structural barriers (including land tenure system);
2. The AE to enhance the value of and to promote the territory: economic opportunities/financial support for the implementation of AE. To which extent AE/AF can contribute to local economy → Specific contribution to post-mining areas
3. Main ecological and socio-economic impact of AE/AF → Potential contribution to supplies of energy and raw materials, new market opportunities

Specific aspects the project TAPELINE could contribute to analyze in the territory of Saxony-Anhalt, about the impact of AE/AF from a wider perspective and possible synergies with regional economic development. In fact, designing a local strategy to enhance agroecological transition needs a strong connection with other initiatives that are aiming at supporting the economic transition, especially in this part of Germany.

Thus, these are some of the specific research questions that the project should help to investigate:

1. *What are the main characteristics in the farming system in Saxony-Anhalt which can enable the implementation of agroecology and in particular agroforestry?*
2. *Could Agroforestry (AF) support the current needs about energy supply in Saxony-Anhalt, through local heat networks?*
3. *What is the main biodiversity/environmental matters that could be better addressed by AE?*
4. *What are the pros and cons of simpler AF systems like short rotational plantations (KUPs), e.g. erosion and biodiversity aspects*
5. *In case of specific tree crops: establishment of a local / regional food chain, e.g. self-sufficiency in walnuts*
6. *Which role could nature parks play in supporting the establishment of AF systems?*
7. *To which extent can AE/AF can support the development of bioeconomy (agroecological farming, multi-purpose forestry and sustainable fishing embedded in healthy and robust ecosystems) in Saxony-Anhalt?*
8. *To which extent is the TAPE tool working as a decision support tool for farmers and local authorities? Can TAPE tools help identify major opportunities and challenges related to agroecological transition?*

4.2 Contextual assessment

4.2.1 Country profile and territory boundaries

Saxony-Anhalt (NUTS code DEE at level 1) is located in central Germany, in a region historically known as "East Germany," which formed part of the former German Democratic Republic (GDR; German: Deutsche Demokratische Republik, DDR). It has a total area of 20,467 km^2 and in the north-east it borders Brandenburg, in the south-east it borders Saxony, in the south it borders Thuringia and, in the west, it borders Lower-Saxony.

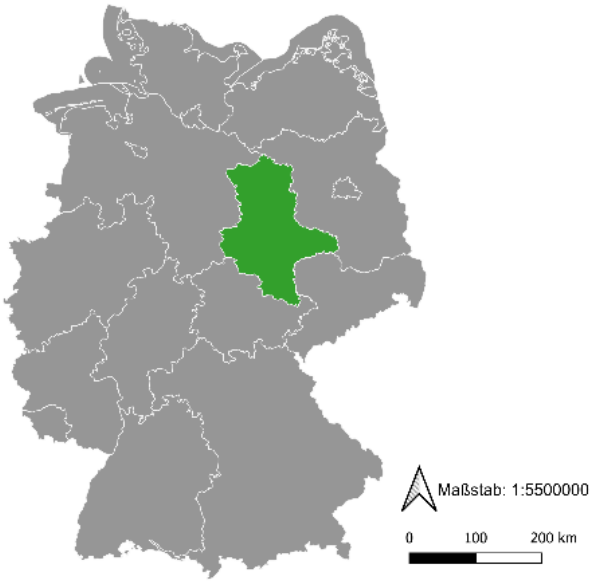


Figure 51 - Location of Saxony-Anhalt in Germany[1]

Land use in Saxony-Anhalt is strongly dominated by vegetated areas, which cover 86.2% of the regional territory. Within these vegetated areas, agriculture accounts for 60.0% and forests for 22.6%. Built-up areas (7.7%), transport infrastructure (3.9%) and water bodies (2.2%) complete the regional land-use balance (Table 4) [24].

Table 4 - Share of Land Use-Types in Saxony-Anhalt [24]

Type	Share
Settlements	7.7%
Traffic	3.9%
Vegetation - Agriculture - Forests	86.2% (60.0%) (22.6%)
Water Bodies	2.2%

4.2.2 Socio-demographic characteristics

In Saxony-Anhalt the population size is 2,180,448, and 50.9 % of it are women with an average age of 47.9 years.

Even though there is no consistent definition of rural area, according to the Ministry of Economy (Ministerium für Wirtschaft, Tourismus, Landwirtschaft und Forsten) 80 % of population in Saxony-Anhalt live in rural areas.

Concerning the relevance of agriculture in the local economy, its share, including forestry and fishery, on the GDP in Saxony-Anhalt is 2.27 %. While 2.62 % of the population works in the agriculture and forestry. About major agricultural exports and imports there are no data available. 8 % of the population has migrant background.

4.2.3 Natural context and ecosystemic services

According to the Köppen-Geiger-Classification Humid subtropical climate (Cfa), Warm-summer humid continental climate (Dfb), Hot semi-arid climate (Bsk) and Subarctic climate (Dfc) are the present climate zones. In Saxony-Anhalt 16 % of the area is under a type of nature conservation. Wolves are present with 32 packs, 4 couples and one territorial wolf. In the Harz region some Lynxes are also present but with a low density. Most present are loess and sandy loess areas with the soil types Chernozem, luvisols, gleysols, podzoluvisols and regosols. In the northern regions of Saxony-Anhalt older glacial drift areas play the dominant part with the soil types Cambisols, podzols, gleysols, luvisols and histosols. In the river landscape of the Elbe major fluvial plains are present with the soil types fluvisols, gleysols, luvisols, cambisols and regosols. In the Harz region mountains and hills predominantly of igneous and metamorphic rocks with the soil types cambisols, podzols and gleysols are present. As well as mountains and hills predominantly of non-metamorphic sandstone, claystone and marlstone with the soil types cambisols, podzols, luvisols and gleysols. And some mountains and hills on non-metamorphic sedimentary rocks partly covered by loess with the dominant soil types luvisols, leptosols, cambisols and gleysols. Some regions of Saxony-Anhalt are especially dry. As an example, Bad Lauchstädt where the mean precipitation per year (2001 - 2024) was 484mm.[16]



Figure 34 - Topography of Saxony-Anhalt.

The two official agroecological zones are Temperate, cool; dry and Temperate, cool; wet[17].

Regional Agroecology Zones

[16] https://lau.sachsen-anhalt.de/fileadmin/Bibliothek/Politik_und_Verwaltung/MLU/LAU/UMWELTINFORMATIONEN/Klimafolgen-Indikatoren/A3_Niederschlag/A3_Niederschlag_250217_f%C3%BCr_2024.pdf

[17] Data Viewer | GAEZ v4 Data Portal

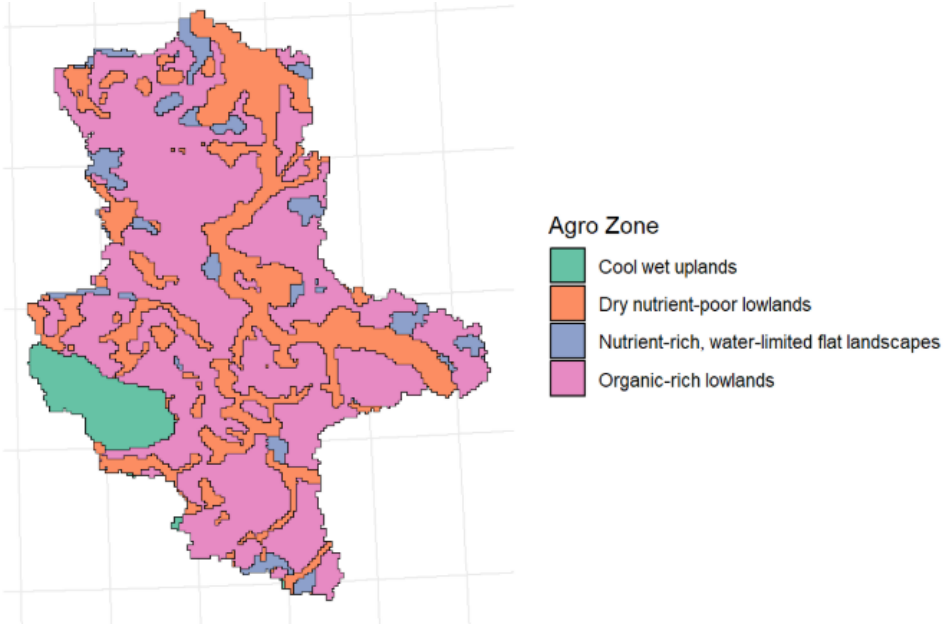


Figure 35 - Agroecology Zones of Saxony-Anhalt.

Based on pedoclimatic and IACS-data we clustered Saxony-Anhalt into Agroecology Zones. Input data was mean temperature in 2025 [25], precipitation in 2025 [26], 30-year average of the annual climatic water balance [27], available water capacity, bulk density, volume of stones, share of organic carbon, cation exchange capacity, base saturation, slope, altitude [28], share of arable land and share of grassland[18]. Within the Agroecology Zones it can be assumed that the agricultural conditions are comparable. Based on the values within the Zones of the input parameters we classified the Zones as Cool wet uplands, Dry nutrient-poor lowlands, Nutrient-rich, water-limited flat landscapes and Organic-rich lowlands.

An alternative discrete spatial framework called *Boden-Klima-Räume* (Soil-Climate Zones) – introduced in Appendix **12.3.2** - was also bring along further steps of the TAPE evaluation process to compare the relevance of the predefined *Agrozones* to the official mapping (5 *BKR)*, based on official climate & soil statistics.

4.3 Agricultural systems in the studied territory

4.3.1 Overview of agriculture in the country

Saxony-Anhalt is one of Germany's most agriculturally oriented federal states. Approximately half of the state's land area is used for agriculture, with arable cropping dominating land use. The region's agricultural landscape is strongly influenced by soil fertility gradients. Areas such as the Magdeburger Börde contain highly productive loess soils that support intensive cereal production, while northern regions like the Altmark are characterized by lighter sandy soils that favor mixed or lower-intensity systems.

Agriculture in Saxony-Anhalt is characterized by an unusually large average farm size compared with Western Europe. Following the restructuring of socialist collective farms after reunification, many large agricultural enterprises continued operating in modified corporate forms. As a result, average farm sizes often exceed 250 ha, considerably larger than the German national average [35]. This structural pattern has significant implications for farming system organization.

The economic model of the last sixty years in Europe was based on the principle of economies of scale. Thus, in several socio-economic contexts, modern agricultural development has been driven by specialization, intensification, and scale enlargement, i.e., classic economies of scale [55]. According to this economic model economies of scale were for a long time a central assumption in conventional agriculture, especially for productivity gains and this lead to the assumption that large

[18] IACS data of Saxony-Anhalt from 2025

farms benefit from economies of scale and advanced mechanization, due to the fact that high level of specialization allows farmers to be technically efficient [55]. However, what is the actual impact of farm size on production, profitability, and environmental challenges is largely discussed [30]. Recent research highlights both the strengths and challenges of these systems. Large farms can achieve high productivity and adopt advanced technologies, but they also face environmental challenges related to biodiversity loss, soil degradation, and climate vulnerability as other farming systems also driven by specialization and intensification
Addressing these challenges requires integrated approaches that combine agronomic innovation, environmental management, and supportive policy frameworks. Farming system analysis provides a valuable framework for understanding these complex interactions and guiding the transition toward more sustainable agricultural systems in Saxony-Anhalt.

Historical Transformation of Farming Systems after German Reunification

Farming systems in Saxony-Anhalt represent a distinctive agricultural model shaped by historical, structural, and environmental factors. The persistence of large farm structures following German reunification has created highly mechanized, arable-dominated production systems that differ substantially from those found in western Germany.
The present agricultural structure of Saxony-Anhalt cannot be understood without considering the historical transformation that occurred after German reunification in 1990. Prior to reunification, agriculture in the former German Democratic Republic (GDR) was organized through large collective farms known as Landwirtschaftliche Produktionsgenossenschaften (LPGs). These cooperatives often cultivated several thousand hectares of land and relied heavily on centralized planning.

Following reunification, these cooperatives were privatized or restructured into new organizational forms such as agricultural cooperatives, limited liability companies, and private family farms. Although the institutional framework changed dramatically, many of the large production units remained intact due to their operational efficiency and established infrastructure [31].
Consequently, eastern German agriculture retained a dual structure consisting of large corporate farms alongside smaller family farms. This structural dualism has important implications for land markets, rural employment, and agricultural innovation. Research indicates that land prices in eastern Germany have increased substantially since the early 2000s, partly due to investor interest and agricultural policy incentives [32].
These land market dynamics influence farming system decisions, including crop choice, input use, and long-term investments in soil and environmental management.

Dominant Cropping Systems and Agricultural Production
Arable cropping dominates farming systems in Saxony-Anhalt. The most common crops include winter wheat, barley, maize, and oilseed rape, reflecting both agroecological suitability and market demand. Crop rotations in many farms follow relatively simplified patterns dominated by these high-value crops.

However, simplified rotations may have ecological consequences. Research in European agricultural systems suggests that reduced crop diversity can increase vulnerability to pests, reduce soil health, and limit ecosystem services [33]. As a result, agricultural researchers increasingly investigate alternative cropping systems designed to enhance sustainability while maintaining profitability.

Long-term experiments conducted in central Germany provide valuable insights into the effects of crop rotations and management practices. For example, the Etzdorf long-term experiment examines crop rotation effects on soil organic matter and yield performance in sugar beet-based systems [34]. Similarly, the Bad Lauchstädt long-term fertilization experiment: one of the oldest agricultural experiments in Europe: provides extensive data on nutrient management and soil fertility [68].

These experiments demonstrate that crop rotation diversity and balanced fertilization play a crucial role in maintaining soil productivity over time. Nevertheless, economic pressures often discourage farmers from adopting more complex rotations, highlighting the importance of policy incentives for sustainable farming practices.

Soil Management and Agroecosystem Functioning

Soil quality represents a fundamental component of farming system sustainability. Several long-term studies conducted in Saxony-Anhalt investigate how management practices influence soil physical, chemical, and biological properties.

Research by Nelkner et al. (2019) [60] examined soil microbial communities in long-term agricultural experiments at Bernburg-Strenzfeld. Using metagenomic techniques, the study found that fertilization and tillage practices significantly influence soil microbial diversity and ecosystem functioning. These microbial communities play essential roles in nutrient cycling and soil health.
Similarly, Deubel et al. (2011) [61] demonstrated that long-term tillage practices influence nutrient stratification in soils, particularly for phosphorus and potassium. Reduced tillage systems may improve soil structure and reduce erosion but can also lead to nutrient accumulation in surface layers.

The growing body of soil research highlights the importance of integrated soil management strategies, including balanced fertilization, crop rotation diversification, and reduced soil disturbance.

Biodiversity and Ecosystem Services in Agricultural Landscapes

In addition to production objectives, modern farming system research increasingly addresses environmental sustainability. Agricultural landscapes in Saxony-Anhalt are characterized by large field sizes and relatively low landscape heterogeneity, which can negatively affect biodiversity.
Agri-environmental schemes implemented under the European Union's Common Agricultural Policy (CAP) aim to mitigate these impacts by encouraging environmentally friendly practices. Measures such as flower strips, ecological focus areas, and agroforestry systems have been introduced to enhance biodiversity and ecosystem services.
Studies evaluating these measures indicate mixed outcomes. Schmidt et al. (2022) [62], Elias et al. (2025) [63] found that wildflower strips can significantly increase pollinator abundance and plant diversity when properly designed and maintained. However, the effectiveness of these measures often depends on farm management decisions and landscape context.
Recent research also explores the potential of agroforestry systems in eastern Germany. Litschel et al. (2023) [64] analyzed stakeholder perspectives on agroforestry adoption and found that although farmers recognize its ecological benefits, economic and institutional barriers remain significant.
Overall, the literature suggests that integrating biodiversity measures into large-scale farming systems requires both financial incentives, improved knowledge transfer and adjusted legislation.

Digitalization and Technological Innovation in Agriculture

Technological innovation is increasingly shaping farming systems in Saxony-Anhalt. The region's large farm sizes facilitate the adoption of advanced agricultural technologies such as precision farming, satellite monitoring, and digital decision-support systems.
Digital agriculture offers several potential benefits, including improved resource efficiency, reduced environmental impacts, and enhanced farm management capabilities. Paustian and Theuvsen [29] highlight that large, mechanized farms in eastern Germany are particularly well suited for adopting precision technologies due to their scale and capital availability.
Satellite-based monitoring systems are already used by regional authorities to support agricultural policy implementation and compliance monitoring. These systems enable large-scale monitoring of crop patterns and environmental measures, providing valuable data for farming system analysis.
Nevertheless, digitalization also raises challenges related to data governance, farmer training, and technological accessibility.

Sustainability Transitions and Climate Adaptation

Climate change represents a major challenge for agriculture in Saxony-Anhalt. Increasing drought frequency, rising temperatures, and changing precipitation patterns may affect crop productivity and soil conditions.
Researchers therefore emphasize the need for climate-resilient farming systems, including diversified crop rotations, drought-tolerant crops, and improved soil water management. Experimental projects in the region explore alternative crops such as legumes and pseudo-cereals that may enhance system resilience.
In addition, integrated landscape approaches are being developed to improve ecosystem services such as water retention and carbon sequestration. These approaches align with broader European strategies promoting agroecology and sustainable intensification.

Research Gaps and Future Directions
Despite significant research on agricultural systems in Saxony-Anhalt, several gaps remain in the literature.
First, many studies focus on either agronomic or socio-economic aspects of farming systems, while integrated socio-ecological analyses remain relatively limited. Farming system research would benefit from interdisciplinary approaches combining ecological modelling with farm-level decision analysis.
Second, the long-term sustainability of large-scale arable systems in eastern Germany requires further investigation, particularly in the context of climate change and land market dynamics.
Third, landscape-scale approaches to biodiversity conservation and ecosystem services require more empirical research. Given the large field sizes and relatively homogeneous landscapes in Saxony-Anhalt, innovative spatial management strategies may be necessary.
Finally, digital agriculture presents new opportunities for farming system analysis by enabling high-resolution monitoring of agricultural practices. Future research should explore how digital technologies can support data-driven agricultural sustainability transitions.

4.3.2 Overall presentation of the farming sectors

The farms in Saxony-Anhalt are bigger compared to the average farm size in Germany. The mean size in Saxony-Anhalt is 280.78 ha, in Germany the mean size is only 65.04 ha and the distribution is also different to the one in Germany in total, see figure 4 [35].

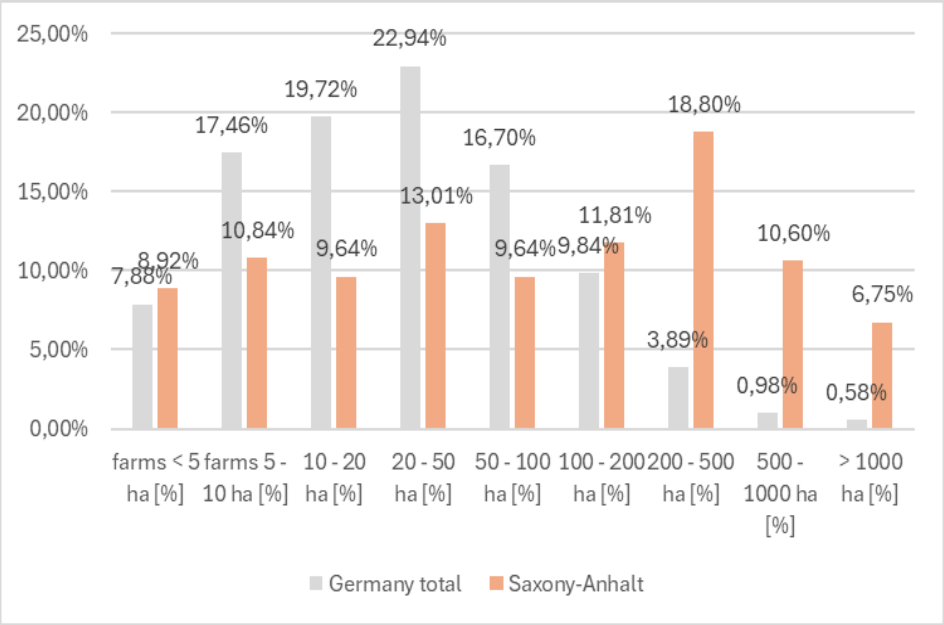


Figure 36 - Distribution of farm sizes in Saxony-Anhalt and Germany in total

In 2023 4,150 farms were present with 628,300 livestock units [LU] in total. Per hectare that means that 0.547 livestock units were present. The distribution of the livestock units can be seen in figure 5. The total agricultural land has a size of 1,148,400 ha and the arable land of 974,700 ha. More than 50 % of the space is used for the cultivation of grains. That and the distribution of the different categories can be seen in figure 6. Within in the grains wheat is the most common grown grain with a share of 29 % of the total arable land. Barley is grown on 12 %, rye on 5 % and other grains on 2 % of the total arable land. The total area of grasslands is 171,400 ha. Perennial crops are grown on 2,300 ha [36].

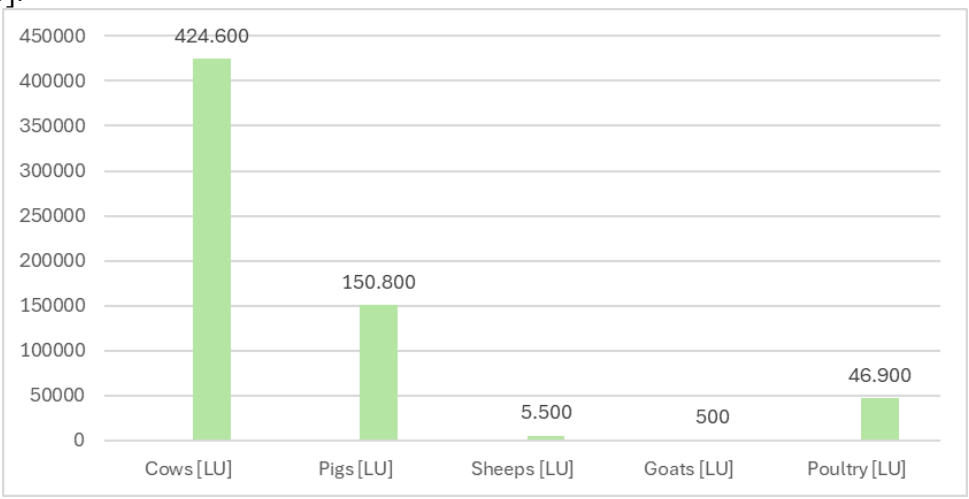


Figure 37 - Livestock units [LU] per category

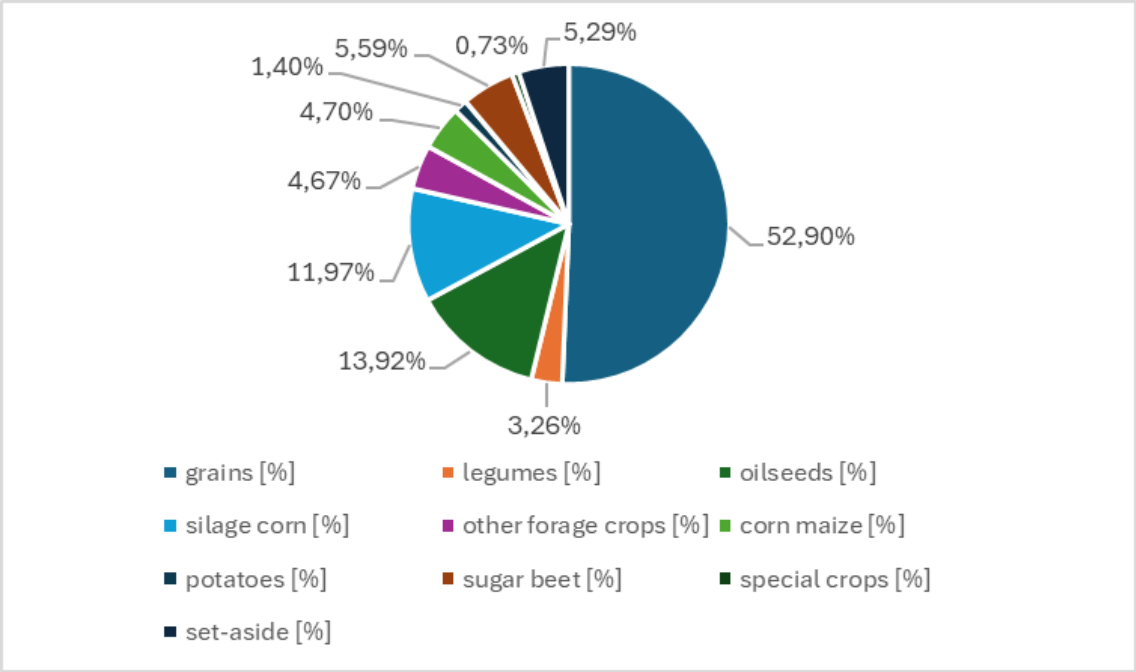


Figure 38 - Distribution of the different crop-categories in Saxony-Anhalt [%]

In Saxony-Anhalt 14.6 % of the farms produce according to organic farming representing 9.8 % of the agricultural land.

Vineyards are present on 748 ha in Saxony-Anhalt. The total size of orchards in Saxony-Anhalt is 1,081 ha. The distribution of the different types of fruits can be seen in Figure 7. Other fruits are Apricots, Peaches, Quinces, Walnuts and further fruit trees.

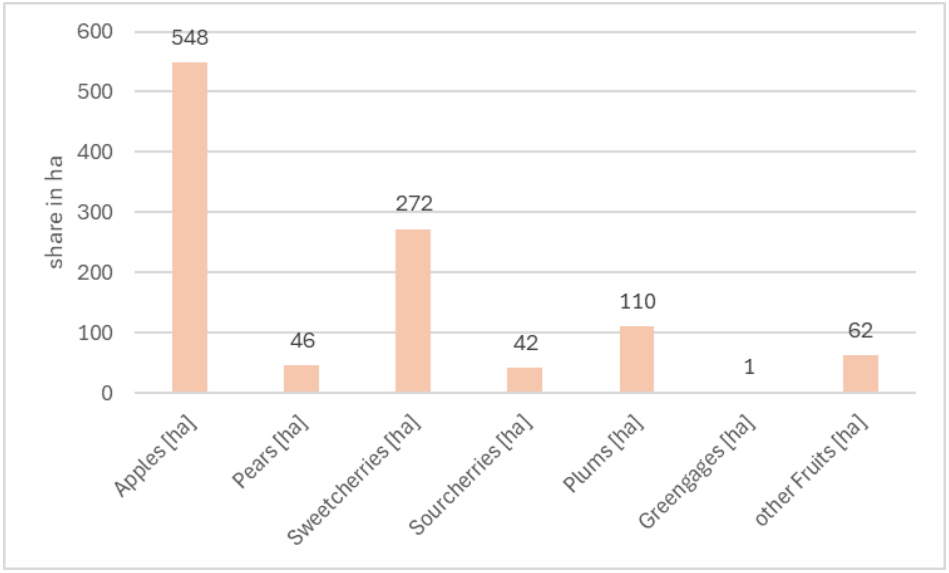


Figure 39 - Share of the different fruit types in Saxony-Anhalt [ha]

Gender Distribution in agriculture

Reliable data about the share of women among persons working in agriculture are available just for Germany in total. The percentage is approximately 33%. The percentage of women managing farming businesses is approximately 11% in Germany. In Saxony-Anhalt the share is between 15.5% among all farms and 11.9% among full-time farms of women managing farms.

Land tenure in Saxony-Anhalt

The share of land tenure in the UAA is approximately 70%. Representing approximately 976,900 ha arable land, 172,800 ha grassland and 2,400 ha perennial crops farmed by approximately 4,040 farms.

The average tenure per hectare was 407 € in 2023 or 6.60 € per "Ackerzahl" (scale from 1-100 measuring the quality of soils) for arable land. And 173 € per hectare or 4.08€ per "Ackerzahl" for grassland in 2023 [37]. The share of land tenure on the UAA in Germany was approximately 60% in 2023 with the highest costs per hectare in North Rhine-Westphalia, Lower Saxony and Schleswig Holstein.

4.3.3 Ecosystem Services (ES) approach and the territory of Saxony-Anhalt

The ecosystem services (ES) framework has become a central concept in environmental management and sustainability science, linking ecological processes to human well-being. Within agricultural systems, farmers play a critical role as both providers and beneficiaries of ecosystem services. However, the effectiveness of the ES approach depends heavily on how farmers perceive, value, and integrate these services into their decision-making.

A consistent finding across the literature is that farmers tend to prioritize provisioning services, particularly food production and income generation, over regulating, supporting, and cultural ecosystem services. For example, recent empirical studies show that farmers often perceive services such as soil fertility, pollination, and pest control as secondary or indirect, even though these are essential for long-term productivity (e.g., Journal of Environmental Management, 2023). This "provisioning bias" reflects the immediate economic pressures faced by farmers and highlights a key limitation in the adoption of ecosystem-based management approaches.

Another important theme is the gap between scientific and farmer perceptions of ecosystem services. Research in Biological Conservation (2021) demonstrates that scientists typically emphasize regulating and supporting services due to their ecological importance, whereas farmers focus on tangible and short-term benefits. This divergence can lead to mismatches in policy design and implementation, particularly in agri-environmental schemes and conservation programmes. As a result, policies based solely on scientific assessments may fail to resonate with farmers' lived experiences and priorities.

Socio-cultural and contextual factors also play a significant role in shaping farmers' perceptions. Studies such as those published in PLOS ONE (2022) show that variables including education level, farming system, geographic location, and cultural values influence how ecosystem services are understood and valued. For instance, farmers in traditional or extensive systems may have a stronger appreciation of cultural and regulating services compared to those in highly intensive systems. This suggests that ecosystem service frameworks must be adapted to local contexts rather than applied uniformly.

Closely linked to perception is the issue of awareness and knowledge. Several studies indicate that limited awareness of ecosystem services: particularly indirect and supporting services: can hinder the adoption of sustainable practices. Farmers may not fully recognize the benefits of biodiversity or ecological processes, which reduces their willingness to engage in conservation measures. At the same time, experiential knowledge and local ecological understanding often complement scientific knowledge, suggesting that co-production of knowledge between farmers and researchers can improve outcomes.

Farmers' perceptions are also strongly connected to behavioral intentions and policy uptake. Research on Payments for Ecosystem Services (PES) schemes [54] shows that farmers who recognize the value of ecosystem services are more likely to participate in such programmes. Conversely, misalignment between perceived benefits and policy incentives can limit participation. This highlights the importance of aligning economic instruments with farmers' value systems and perceptions.

Finally, recent studies have expanded the ES framework by examining perceptions of ecosystem disservices, such as crop damage by wildlife or pest outbreaks. These studies reveal that negative perceptions can undermine support for biodiversity conservation, even when ecosystems provide net benefits. Understanding both services and disservices is therefore essential for designing balanced and acceptable management strategies.

In summary, the literature demonstrates that farmers' perceptions of ecosystem services are shaped by economic priorities, knowledge systems, and socio-cultural contexts. These perceptions, in turn, influence decision-making, behavior, and policy effectiveness. Bridging the gap between scientific frameworks and farmer perspectives remains a key challenge, requiring participatory approaches, improved communication, and context-sensitive policy design [58] [59].

ES in Saxony-Anhalt

Table 5 - Ecosystem Services in Saxony-Anhalt

Ecosystem Services	Source
Food supply, water supply, energy supply	Kroll et al. 2012 [38]
Local climate regulation, recreation potential, biodiversity potential, food supply, above-ground carbon storage	Haase et al. 2012 [39]
Highly relevant: food production, biomass for energy, reduction of harmful substances, protection against floods, spiritual values, recreation, landscape beauty Less important: regulation of global climate, regulation of local climate, biomass for further treatment, erosion control	Gorn et al. 2018 [40]
Crop provision, food provision	Burkhard et al. 2009 [41]
Soil degradation prevention, erosion control, maintenance of biodiversity	Baude & Meyer 2023 [42]
Global climate regulation, local climate regulation, air pollution control, water cycle regulation, food production, nature experience, leisure activities	Arnold et al. 2018 [43]
Pest control, Pollination, Seed dispersal, erosion control, decomposition and fixation processes, Quantity and Quality of yield, heritage and culture, bequest values (Vineyards)	Weinreiter 2025 [44][19]

[19] https://www.life-vineadapt.eu/fileadmin/Dateien/Inhalt_Material/LIFE_VineAdapt_C5_Final_Report_English_de_final.pdf

4.4 Policies and Institutional Environment

4.4.1 Agricultural policy in the territory

The European Union's Common Agricultural Policy (CAP) 2023-2027 provides the principal financial and regulatory framework for the adoption of environmentally sustainable practices in Saxony-Anhalt. In particular, the CAP's green architecture, such as conditionality requirements, eco-schemes under Pillar I, and agri-environment-climate measures (AECMs) under Pillar II, supports key agroecological practices such as agroforestry, crop diversification, and reduced external input use [45] [56].
Support for farmers and rural stakeholders under the Common Agricultural Policy (CAP) in Germany is managed in the 2023-2027 period nationally through their CAP Strategic Plan (CSP), funded under the European Agricultural Fund for Rural Development (EAFRD), European Agricultural Guarantee Fund (EAGF) and national contributions.[20]

The GAK ("*Gemeinschaftsaufgabe Agrarstruktur und Küstenschutz*", "joint task of agricultural structure and coastal protection") is also important for the support or rural areas and the agriculture [46].

Despite the implementation of several regional innovation projects, demonstrating a strong emphasis on knowledge co-creation, landscape diversification, and climate adaptation strategies, particularly in response to increasing drought stress [47], the current policy approach primarily incentivizes the adoption of discrete practices rather than systemic farm redesign, resulting in a partial and uneven transition [48].
Moreover, structural constraints, such as large-scale farm specialization and limited development of agroecological value chains, continue to hinder the upscaling of these practices beyond pilot and demonstration contexts.

Other policies

Bioeconomy
Other relevant policies adopted by the state of Saxony-Anhalt are related to bioeconomy and sustainable management resources. In particular:

1. Strukturentwicklungsprogramm - Mitteldeutsches Revier Sachsen-Anhalt [65][21]
2. Bioökonomie als Treiber für Wertschöpfung und Innovation.[22]

Bioenergy in Saxony-Anhalt
4.2% of the UAA were used to produce bioenergy plants like maize (50,000 ha) and other bioenergy plants (800 ha) in 2022.[23] The share of bioenergy on the total electricity production was 2024 at 12.4%, representing three million megawatt hours. The production of biomethane was 1.9 terawatt hours. 170 of the 482 biogas plants are reaching 20 years of operating time and with that the end of the subsidization by the EEG.[24]
The Saxony-Anhalt State Energy Agency (Landesenergieagentur Sachsen-Anhalt) sees potential for bioenergy from agroforestry in the future.[25]
Agroforestry

[20] Germany | EU CAP Network
[21] https://strukturwandel.sachsen-anhalt.de/fileadmin/Bibliothek/Schulung/Strukturwandel/SEP/Strukturentwicklungsprogramm__Onlinefassung__barrierearm_.pdf
[22] Sachsen-Anhalt | Bioökonomie.de
[23] Bioenergie in Sachsen-Anhalt
[24] Willingmann begrüßt bessere Perspektiven für Bioenergie
[25] Email from Claudia Jahn to author, November 7, 2025

In Saxony-Anhalt there is currently no funding available for the establishment of Agroforestry. For the maintenance of Agroforestry is funding through the Ecoscheme 3 available. The amount of this is in 2025 200 € per hectare wooded area (not system area). In 2026 the amount will rise to 600 € per hectare wooded area.[26]

The requirements for the funding are:[27]

- At least two rows of wooded strips
- The share of the wooded strips has to be between 2 and 40% of field
- Wooded strips must not exceed 25 meters in width along their entire length
- The distance between two wooded strips and between a wooded strip and the edge must not exceed 100 meters along the entire length
- If the field boundary consists of hedges and forest, the strip of trees must maintain a minimum distance of 20 meters.
- The agroforestry system has to be planted in lines
- There is a negative list of tree species that are not allowed to be used (*Acer negundo, Buddleja davidii, Fraxinus pennsylvanica, Paulownia tomentosa, Prunus serotina, Quercus rubra, Rhus typhina, Robinia pseudoacacia, Rosa rugosa, Symphoricarpos albus*)[28]

Biodiversity strategy

The implementation of biodiversity strategy in Saxony-Anhalt demonstrates substantial progress in terms of measure uptake, scientific innovation, and landscape-scale conservation. However, empirical studies reveal a persistent gap between implementation and ecological effectiveness, particularly in agricultural systems, where standardized approaches often fail to achieve target biodiversity states. While flagship initiatives such as the Green Belt highlight the potential of integrated, large-scale conservation, broader implementation remains constrained by governance fragmentation, sectoral policy conflicts, and limited long-term institutionalization.
In fact, the implementation of biodiversity strategy in the state of Saxony-Anhalt shows some weak policy integration, given biodiversity objectives not fully mainstreamed into agriculture, energy, and infrastructure policies and persisting conflicting incentives (e.g. intensive agriculture) [49].

4.5 Markets and value chains

4.5.1 Main characteristics of the agricultural value chains

Following German reunification, Saxony-Anhalt as all other Eastern German regions experienced profound economic restructuring characterized by deindustrialization, privatization, and integration into global markets. Saxony-Anhalt, with its legacy of heavy industry, chemical production, and agriculture, represents a paradigmatic case of post-socialist regional transformation within global value chains (GVCs).

In this paragraph a short presentation to describe the main structural characteristics of value chains in Saxony-Anhalt and its relevance within global and European value chains, including also possible pathways for upgrading and transformation.

Historical transformation
Understanding the current characteristics of value chains, implies first an understanding of the historical transformation of value chains in Eastern Germany. Before reunification, East Germany's economy was characterized by:

- Vertically integrated industrial

[26] Aktuelle Förderlandschaft
[27] Gibt es Förderung für Agroforstwirtschaft?
[28] https://agroforst-info.de/wp-content/uploads/2024/02/Themenblatt_3-2.Auflage-Web.pdf

- Strong sectoral specialization
- Centralized planning

These systems represented closed value chains, often spanning entire production processes within single entities. The transition to a market economy led to:

- Rapid privatization
- Collapse of uncompetitive industries
- Integration into Western and global value chains

This restructuring resulted in:

- Fragmented production systems
- Loss of upstream and downstream linkages
- Dependence on external firms

The literature consistently highlights the emergence of "branch plant economies", where production facilities are controlled by external actors.
Recent studies emphasize persistent core-periphery structures within Germany:

- Western regions dominate high-value functions
- Eastern regions specialize in manufacturing

The role of "anchor firms" is particularly significant in shaping regional development trajectories [50].

Structural Characteristics

In Saxony-Anhalt value chains are mainly characterized by dominance of small and medium enterprises (SME) and Fragmentation, which means that generally speaking the regional economy is characterized by:

- A high proportion of SMEs and micro-enterprises (although dominate land use and production volume → a dual structure)
- Limited vertical integration
- Strong regional orientation

Looking at specific sectors of the local economy, it is observed that:
In bioeconomy sectors such as forestry and construction firms are predominantly small-scale, the market concentration is low, and activities are often locally embedded.

Additional statistics on *businesses orientations* of farm units in Saxony-Anhalt are provided in Appendix12.3.1.

Main sectoral Composition

Currently main sectors in the regional economy, that can play also a relevant role towards agroecological transition, are:

- Chemical Industry

The chemical industry remains a cornerstone of Saxony-Anhalt's economy, particularly in clusters such as Leuna and Bitterfeld-Wolfen. This sector shows a good integration into European industrial value chains and focuses mainly on intermediate goods. Compared to other German regions it is characterized by a lower R&D intensity.

- Agri-Food Systems

The agri-food value chains are central to rural regions in Saxony-Anhalt. It shows strong dependence on policy frameworks (e.g., CAP) but also an increasing importance of sustainability standards. Institutional governance remains complex. Formal regulations and informal practices, i.e. institutional interplay, plays a crucial role in shaping these value chains [57].
The chemical industry plays an important role for the agriculture in Saxony-Anhalt with fertilizer producers like "SKW Piesteritz"[29] or "Domo"[30]. Other relevant structures are Seed producers like

[29] SKW Piesteritz GmbH
[30] DOMO Chemicals

"KWS"[31] or "Strube"[32] and science and gene-bank structures like "IPK Gatersleben"[33] (leading in science with NGT) and Universities like "MLU"[34] or "HS Anhalt"[35].
More than 300 farms do at least some direct selling.[36] Saxony-Anhalt has its own agricultural marketing company support farms with marketing and strategic decisions[37]. The GAK also supports market structure improvements [46]. For direct regional selling some platforms exist to connect farmers with consumers.[38]
Relevant for the agricultural market situation in Saxony-Anhalt is the presence of three sugar factories in Klein Wanzleben, Könnern and Zeitz.[39]

- Bioeconomy

The bioeconomy, focusing on renewable resources and circular economy, is emerging as a key development field with a strong integration of agriculture, biotechnology, and materials science.
A recent relevant scientific project to support plant-based value chains is the DiP Sachsen-Anhalt.[40]
The DiP initiative exemplifies this transformation, aiming to create digitally integrated plant-based value chains and a regional bioeconomy ecosystem [51].
The transition toward a bioeconomy represents a form of inter-sectoral upgrading, combining:

- Agriculture
- Chemical industry
- Energy systems

This reflects broader trends toward hybrid value chains.
Value added to products through geographical indications (GI) and quality schemes:[41]

- Wine from Saale-Unstrut area (PDO-registered)
- Hops from Elbe-Saale area (PGI-registered)
- Salzwedeler Baumkuchen (PGI-registered)

4.6 Cross-cutting themes - enabling or disabling factors

4.6.1 Economic structure in Saxony-Anhalt

The table below provide with the main data about the economic structure in Saxony-Anhalt - gross value added per sector 2022 [66][42]

Table 6 - Economic structure in Saxony-Anhalt

ID	Economic sector	Share [%]
A - T	gross value added of all economic sectors	100
A	Agriculture, Forestry and Fishery	3.2

[31] KWS SAAT
[32] Strube D&S
[33] Leibniz-Institut für Pflanzengenetik und Kulturpflanzenforschung | Leibniz-Institut (IPK)
[34] Institut für Agrar- und Ernährungswissenschaften
[35] Hochschule Anhalt
[36] Landwirtschaft in Sachsen-Anhalt
[37] AMG/Sachsen-Anhalt
[38] hallo altmark + Regionale Produkte aus Sachsen-Anhalt
[39] Südzucker AG - Werk Zeitz
Könnern I unser größter Standort in Deutschland
https://www.nordzucker.com/de/the-sugar-company/standorte/klein-wanzleben/
[40] DiP Sachsen-Anhalt
[41] Geographical indications and quality schemes explained - European Commission
[42] https://statistik.sachsen-anhalt.de/fileadmin/Bibliothek/Landesaemter/StaLa/startseite/Themen/Gesamtrechnung/Berichte/Volkswirtschaftliche_Gesamtrechnung/6P101_2024-A.pdf

B - F	Manufacturing sector	32.9
B - E	Manufacturing sector without constructing sector	26.4
B	Mining and quarrying	0.8
C	Processing sector	19.5
D	Energy supply	4.1
E	Water supply, Disposal and similar matters	2.0
F	Constructing sector	6.5
G - T	Service sector	63.8
G - J	Trade, transport and storage, hospitality, information and communication	17.3
G - I	Trade, transport and storage, hospitality	15.8
G	Trade, maintenance and repair of motor vehicles	9.7
H	Transport and storage	4.6
I	Hospitality	1.5
J	Information and communication	1.5
K - N	Financial, insurance and corporate services; real estate and housing	17.6
K	Financial and insurance services	1.7
L	Real estate and housing	8.2
M - N	Corporate services	7.7
M	Freelance, scientific and technical services	3.3
N	Other corporate services	4.4
O - T	Public and other services, education, health	28.9
O - Q	Public services, education, health	25.5
O	Public administration, defence, social security	8.2
P	Education and teaching	5.6
Q	Health and social services	11.7
R - T	Other services	3.3
R	Art, entertainment and recreation	0.9
S	Other services not mentioned elsewhere	2.3
T	Domestic services	0.1

4.6.2 Environmental challenges

The most important environmental challenges in Saxony-Anhalt are the effects of climate change, such as extreme weather events (droughts, heavy rainfall) and rising temperatures, as well as the associated water shortages and increasing pollution of soil and waterways. The loss of biodiversity and the need to balance economic interests with environmental protection also pose major challenges.[43] Climate change makes water and wind erosion more likely. Both are already issues in Sachsen-Anhalt and a threat for soil health [67]. [44]

The mean temperature has risen by 1.5°C compared to 1881. The highest increase took place in the recent decades. The temperature extremes also increased. In the lowland regions the number of hot days has doubled since 1961. In the past decade the number of tropical nights has increased. The summer became drier and the winter wetter. Soil moisture is declining in most regions. This is particularly true at the beginning of summer. Despite natural fluctuations between years, there has been a significant decrease in the number of days with a snow depth of at least five or 20 centimeters in the Harz Mountains. The growing seasons starts around 10 days earlier, with chances and risks for agriculture. The growing season has lengthened by about 13 days. Falling groundwater levels are to be expected. The risk of forest fires increases. Increasing low water levels are affecting the navigability of the Elbe [52].

The condition of the surface water bodies in Saxony-Anhalt in relation to the water framework directive is not good. 3% of the surface water bodies are in a good ecological condition. 22% in a moderate ecological condition, 38% in an unsatisfactory condition and 33% in bad ecological conditions. 4% of the surface water could not be assessed. 52% of the surface water bodies are in a good chemical condition (without mercury and brominated diphenyl ether). 47% are in a bad chemical condition and 1% of the surface water bodies could not be assessed. With mercury and brominated diphenyl ether all surface water bodies are in a bad chemical condition. The reason for the bad conditions is that water bodies have been altered in structure and course, or their continuity has been interrupted. Besides that, agriculture plays an important role in terms of oxygen, nutrients and salt content. The deficits in the chemical conditions are mainly caused through historical contamination and old mining sites.[45] The groundwater bodies also face challenges. 38% are in no good chemical conditions. 62% are accordingly in good chemical condition. 89% of the groundwater bodies are in good quantitative condition and 11% are accordingly in bad conditions. The bad chemical conditions are mainly related to nitrate, sulfate and ammonia. The bad quantitative condition is mainly related to lignite mining and climatical changes.[46]
Due to climate change and increasing water stress actors call for action to adapt and renature water bodies and increase water retention.[47]
Relevant is the spread of new pests like the Reed Glasswing Cicada, causing especially problems with potatoes and sugar beets.[48]

Because of the bad chemical condition due to nitrate and ammonia “Rote Gebiete” exists where stricter rules of the Düngeverordnung are applied to reduce the negative impact from agriculture. The “Rote Gebiete” can be seen in Figure 8.

[43] Klimafolgen-Indikatoren für Sachsen-Anhalt
Klimaschutz in Sachsen-Anhalt
Bundesland Sachsen-Anhalt | Umweltbundesamt
[44] https://llg.sachsen-anhalt.de/fileadmin/Bibliothek/Politik_und_Verwaltung/MLU/LLFG/Dokumente/04_themen/agraroekologie/schriftenreihe_der_llg/18_erosionsleitfaden_schriftenreihe-llg-2018-1.pdf
[45] Oberflächengewässer
[46] Grundwasser
[47] Weg vom Weiter-So | Heinrich Böll Stiftung Sachsen-Anhalt
[48] BMLEH - Pflanzenschutz - Schilf-Glasflügelzikade als Überträger bakterieller Krankheitserreger

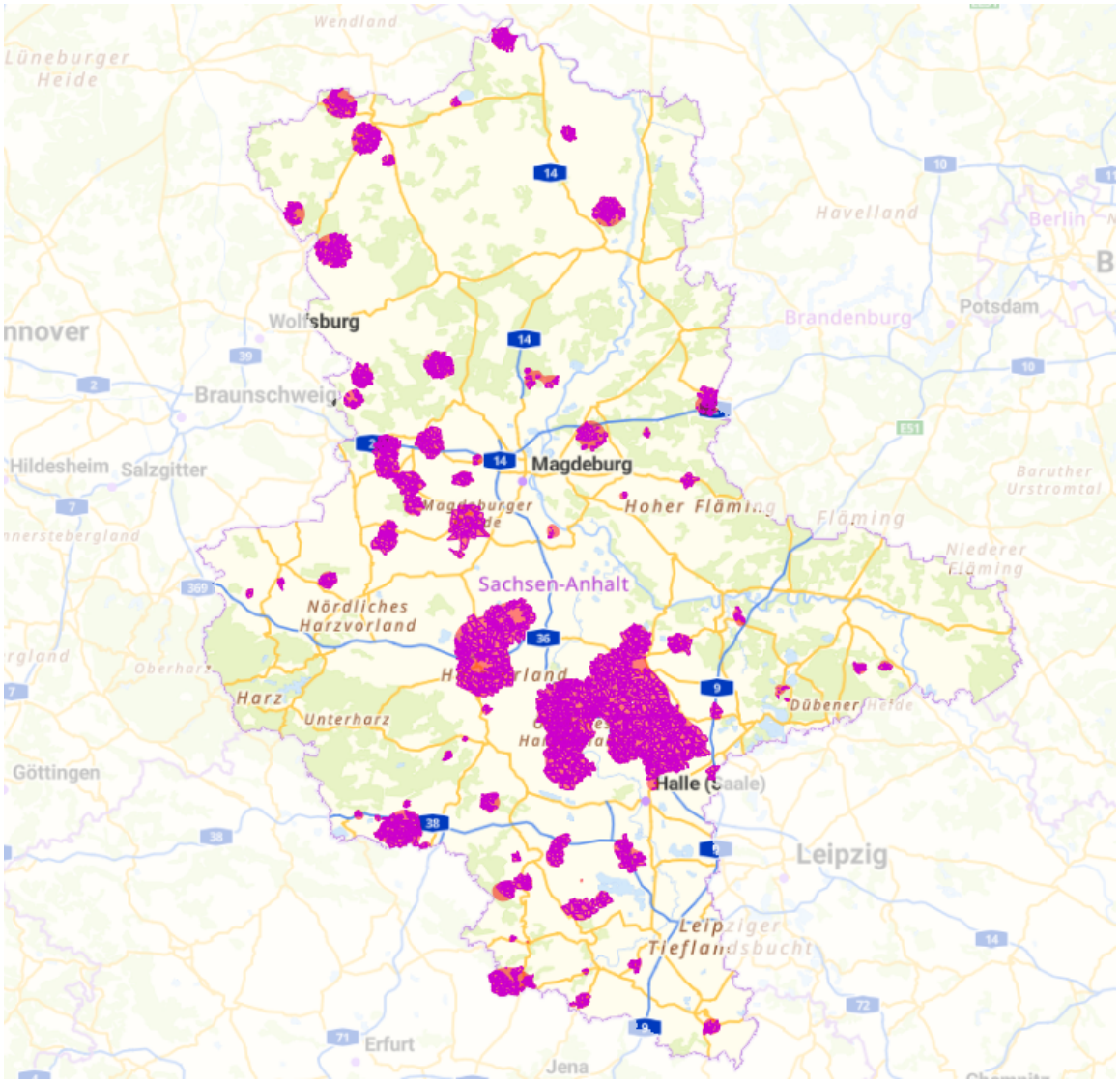


Figure 54 - "Rote Gebiete" in Saxony-Anhalt [49]

Relevant educational/capacity building initiatives related to sustainable resources management and nature protection have been recently launched in the state of Saxony-Anhalt. In particular, the project "BiNaTra", led by the Hoschschule Sachsen-Anhalt.

4.6.3 Other key issues

The territory of Saxony-Anhalt is one of the German regions most intensively studied in terms of socio-demographic change, especially within the broader context of Eastern Germany's post-socialist transformation. As already highlighted, the territory is facing a multi-dimensional structural transformation, driven by:

- Demographic ageing and shrinkage
- Selective out-migration and human capital loss
- Labour market restructuring and skill shortages
- Persistent socioeconomic and spatial inequalities

The territory has one of the oldest populations in Germany, with about 27% aged 65+ already in 2019 and current projections suggest continued population decline and a rising share of elderly (≈31% above working age).

[49] Sachsen-Anhalt-Viewer

5 AGROECOLOGY IN VALAIS (SWITZERLAND)

5.1 TAPELINE in the territory and the study context

5.1.1 Specific research and evaluative questions

- *How and what should be produced in Valais to encourage a transition towards a healthy and sustainable diets?*
- *What promising initiatives contribute to this goal, and how can they be strengthened economically?*
- *How can we mobilise stakeholders to increase the number of initiatives that contribute to this healthy and sustainable diet?*
- *What restructuring efforts, requiring both individual and collective investment, should be implemented to achieve a sustainable transition of this food system?*
- *What factors are preventing or slowing down the development of agroecology in Valais?*

5.2 Contextual assessment

The following sections are meant to provide information for a comprehensive understanding of the agroecological context and the main factors towards the agroecological transitions.

5.2.1 Country profile and territory boundaries

The territory studied in this research is the Valais Canton[50] in Switzerland (CH). The Valais Canton is classified as a NUTS 3 region under the European statistical system. Its NUTS code is CH012 and it forms part of the Lake Geneva region, which is classified as NUTS 2 (code CH01).

Geographically, the Valais Canton is located in the southwestern part of Switzerland, bordering the Cantons of Vaud to the northwest, Bern to the north, Uri to the northeast, and Ticino to the east. It also shares an international border with Italy to the south and France to the west. The region runs mainly along the Rhône Valley from its source in the Alps all the way down to Lake Geneva. As of 2025, the total surface area of the Valais Canton is 5,224 km², making it the third-largest Swiss Canton after Grisons and Berne.



Figure 40 - Map of the Valais Canton alongside neighboring Cantons and countries. Source: Encyclopaedia Universalis [69]

[50] A Canton is a territorial and administrative division that functions similarly to a US state or a German Bundesland, each with its own government, constitution, and laws, within a federal system that (in Switzerland as of August 2025) encompasses 26 Cantons.



Figure 41 - Map of the Valais Canton within Switzerland. Source: Wikipedia Commons [70]

5.2.2 Socio-economic characteristics

The total population of the Valais Canton at the end of 2024 was 371,288, i.e. 4% of Switzerland's population of just over 9 million [71]. The average age in the Valais Canton is 43.6 years [72]. Women and men are just about equal in number.[51]

The vast majority of residents in the Valais Canton are of European origin (88.3%); the largest population of foreigners are Portuguese (7.7% of total population); French (3.7%); and Italian (3.0%). There are small minorities of citizens from Asia (5.6%), Africa (4.0%), the Americas (1.8%), and Oceania (0.1%).

The Canton is divided into two main linguistic areas, and some valleys have unique regional languages. The relative isolation of the valleys, due to their natural enclosure, has favoured the development of distinct cultural identities and specific traditions, thus influencing agricultural practice. The Canton of Valais is a complex and diverse territory.

The major urban centres in the Valais are found in the Rhône River valley that runs east to west through the Canton. This can be appreciated by looking at a population density map of the Canton, produced by the Canton administration in French and German. The areas in dark pink and purple are high-density areas, while areas in the lightest shades of pink are mountainous areas of which a large part is unfit for human habitation or economic activity (see topographical map below) :

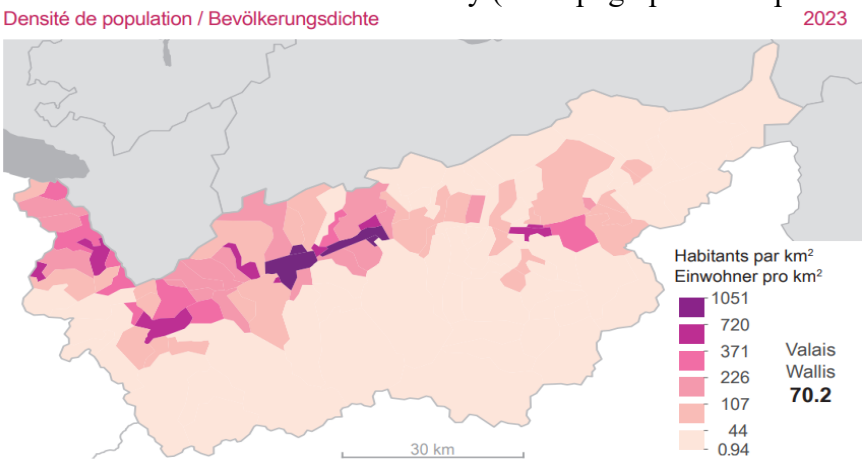


Figure 42 - Population density of the Valais Canton in 2023. Source: État du Valais, 2024 [72]

[51] As of 31 December 2024, there are 185,484 us and 185,804 women. Swiss Federal Statistical Office, "Demographic Balance by Canton."

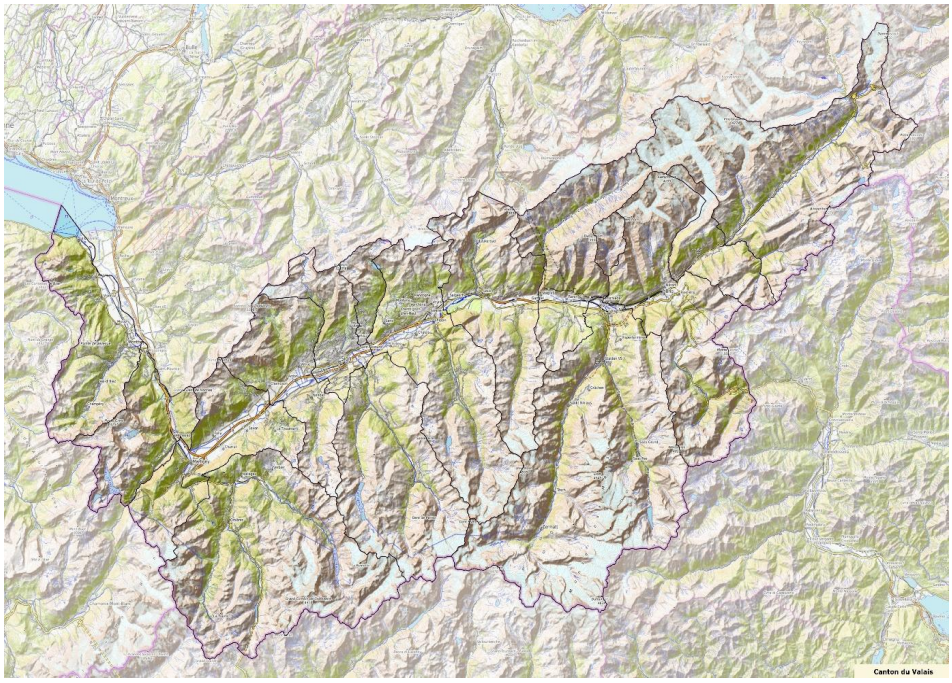


Figure 43 - Topographical map of the Valais Canton showing the Rhône River valley and surrounding mountains. Source: Gifex [73]

While statistics on the percentage of urban vs. rural population could not be found, a national review of this topic found that in the Valais Canton above 50% of the population lives in rural areas [74].

Agricultural employment represents 1.66% of employment in the Valais Canton as of 2021, and this is in line with the Swiss context more generally [75]. Because agricultural employment is often seasonal, persons working in the agricultural sector have a higher-than-average rate of unemployment [75].

We were unable to find statistics on the contribution of agriculture to GDP at the Valais Canton level. However, for Switzerland as a whole, agriculture represents 0.6% of GDP, one of the lowest shares among developed economies [76].

In terms of agricultural exports, the Valais region is known in particular for [77]:

- Dairy products, in particular *raclette* cheese
- Wine grown on terraced land, in particular the white *fendant* associated with *raclette* as a dish, but also spirits
- Stone fruits, notably apricots which developed in the early 20th century thanks to drainage works on the Rhône River [78]
- The ranking of agricultural exports can also be appreciated by looking at the surface areas devoted to each aspect of agriculture in the Valais, where the vast majority (79%) of surfaces are directly or indirectly related to livestock rearing, viticulture constitutes another 11%, and arboriculture represents 5% [79].

Other agricultural exports and regional specialties include [77]:

- Dried meats
- Williams variety pears
- Asparagus
- Saffron
- Chestnuts
- Rye and rye bread

We were unable to find reliable information on agricultural imports into the Valais Canton. Switzerland is a net importer of cereals [80] and likely oilseeds [81], a substantial portion of which

are used to feed animals.[52] In 2022, 16% of animal feed consumed in Switzerland (by weight) was importer as opposed to produced locally [82]. One could hypothesize that the Valais region could follow this importation trend, i.e. importing cereals and oilseeds to feed animals, but this remains a hypothesis and not a conclusion of this research, especially considering the historical importance of natural roughage as feed for livestock in the Valais Canton.

At the national level, other common agricultural imports for which Swiss has a negative commercial balance are coffee, tobacco, and other vegetable extracts; fruits, vegetables and live plants; meat and meat preparations; and, to some extent, dairy products, eggs, and honey [83].

5.2.3 Natural context and ecosystemic services

Climate and topography

The Valais is a large valley enclosed between two relatively high mountain ranges that act as a barrier to Atlantic and Mediterranean weather systems. The Valais therefore enjoys a unique climate characterized by cold winters and hot, dry summers. Precipitation varies greatly depending on location. For example, the Great St Bernard Pass receives more than 2 metres of rain per year, while the Rhône plain between Riddes and Tourtemagne receives 650 mm per year, with rainfall being held back by the mountain walls. Furthermore, precipitation increases with altitude, according to a gradient that varies from one valley to another depending on exposure to the winds. The combination of geographical location, topography, altitude and orientation and great morphological diversity (30 side valleys along the Rhône River) produce a multitude of climatic situations, with Valais enjoying a mosaic of different microclimates.

The dominant climate zone in the Valais Canton is the Dfb climate zone as per the Köppen-Geiger climate classification, meaning that the weather is Continental (D), with no dry season (f), and a warm summer (b). This climate predominates in approximately 80% of the Canton's surface area.[53] Minority climactic regions are subarctic (Dfc), oceanic (Cfb), and tundra (ET). Average annual temperature for lowland riverside cities in the dominant climate zone[54] ranges around 2°C to 3.5°C, with around 1500 mm annual precipitation. By default, higher-altitude rural towns tend to have lower average temperatures as well as higher precipitations, as noted above.

The mountainous terrain of the Valais makes it a place of great contrasts in altitude. The highest point in the Valais Canton is the pointe Dufour: it stands at 4,634 meters in altitude and is also the highest point in Switzerland. Lake Geneva (*Léman* in French, *Genfersee* in German) is the lowest point in the Valais, at 372 meters in altitude, over 4,000 meters below the highest point. The highest village in the Valais, Chandolin, is located at 1,934 meters high on the southern side of the Rhône, while the lowest, Le Bouveret, at 384 meters in altitude, is situated where the Rhône meets Lake Geneva.

Within the Valais Canton, one specificity that results from the topography and river flow is the very high number of hydroelectric dams. The Valais has approximately 50 large hydroelectric stations and 182 smaller hydroelectric stations. It produces 28% of Switzerland's energy production [84].
Because the Valais is situated between two mountain ranges running east to west, each of the mountain ranges represents a barrier to humid air moving north or south. The result of this is that the Valais Canton is one of the driest in all of Switzerland, as can be seen in the map below (Figure 44):

[52] Swiss Granum, *Importations de Céréales* (2024), https://www.swissgranum.ch/fileadmin/user_upload/swiss-granum/dokumente/Marktzahlen/Aussenhandel/2024-10-31_Einfuhr_Getreide.pdf; Swiss Granum, *Importations de Protéagineux à Fins Fourragères et d'oléagineux*.

[53] While the webpage does not explicitly specify what is meant by the « Number » column next to each classification, a look at the methodology suggests that each individual data point corresponds to a square surface area distributed evenly along the entire Canton. ClimateData.org, "Sources de Données," 2025, https://fr.climate-data.org/info/sources/.

[54] Examples of such cities include Brigue, Sierre, Martigny, Sion, and Naters. ClimateData.org, "Climat de Valais: Température, Graphique Climatique, Tableau Climatique Pour Valais," 2025, https://fr.climate-data.org/europe/suisse/valais-1155/.

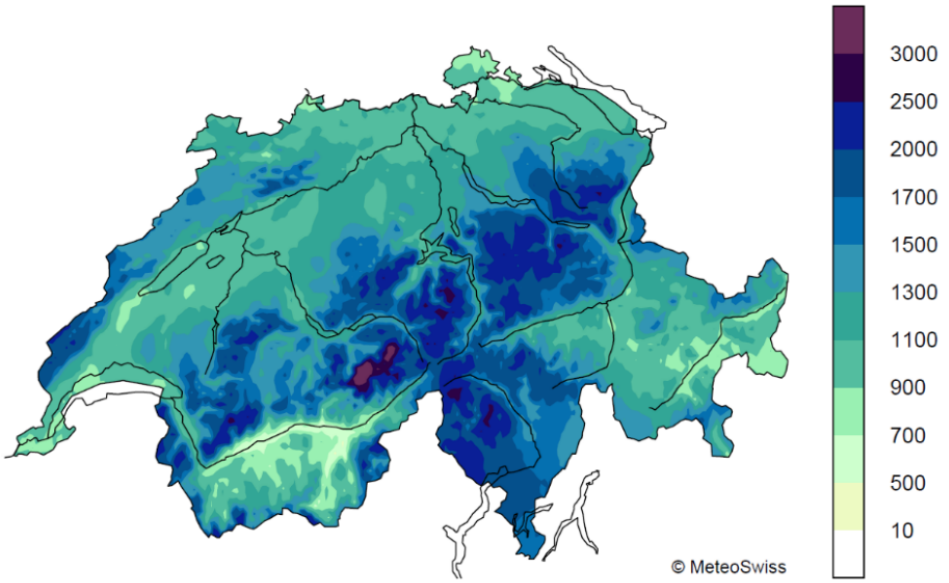


Figure 44 - Average annual precipitation across Switzerland, data series from 1991 to 2020. Source: Météo Suisse [85]

Table 7, produced by the Valais Canton, shows key data points collected from a sample of representative meteorological observatories in the Canton. The Table 7 provides information on average temperature, days with frost, days with rain, and precipitation in 2023. One can immediately note that the recorded precipitations are well under the latest (2024) Swiss average of 1,362 mm [86]. In some areas of the Rhône River valley, average precipitation can range from 550 and 700 mm [85]. However, it should be noted that water availability in much of the Valais Canton is high, thanks to glacier melt and snowmelt [87].

Table 7 - Temperature, frost and rainy days, and precipitation in representative locations of the Valais Canton. Source: État du Valais [72]

Température, pluviométrie / Temperatur, Regenmessung 2023

Station (altitude en m) Station (Höhe in m)	Température de l'air Lufttemperatur (°C) Moyenne / Mittel	Jours avec Tage mit Gel / Frost	 Pluie / Regen [1]	Précipitations Niederschläge mm
Zermatt (1638)	6.0	163	122	772.6
Ulrichen (1346)	5.7	168	149	1 209.0
Visp (639)	11.1	97	115	832.2
Montana (1423)	7.5	132	134	1 071.4
Sion (482)	11.8	85	109	822.1
Col du Grd-St-Bernard (2472)	1.3	216	163	1 458.8

[1] >= 0.3 mm

The Rhône River has played an important role shaping man's relationship to nature and the potential for agriculture over the centuries. In the late 19th century, the first of three "correction" projects was undertaken on the river: the main agricultural consequence was that flooding was contained, while marshes were dried and major forested areas cleared to make arable land available to the population. In the mid-20th century raised dikes enabled the development of industrial and residential areas. A third correction project underway, worth several billion Swiss Francs, will make the river more accessible to the population while undertaking works to reduce flood risk [88].

Compared to the rest of Switzerland (except the southern and easternmost Cantons), the Valais receives a comparatively high number of sunny days, as can be seen in the map below. This feature is particularly useful to viticulture in the Canton.

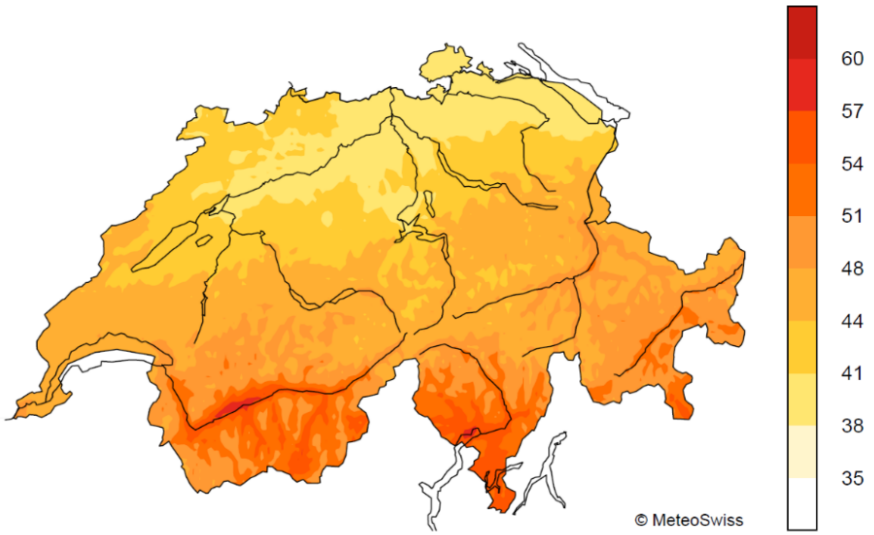


Figure 45 - Average days of sunshine across Switzerland, data series from 1991 to 2020. Source: Météo Suisse [85]

Soils and soil use

The Swiss Federal Office of Agriculture curates a map of Switzerland where the agricultural potential of the soils are presented, based on rock substrate, exposition, steepness, and existing agricultural use. The map below, focusing on the Rhône River valley situated in the Valais, highlights that the main land potential is

- At high altitudes: livestock rearing and fodder production
- In the Rhône plain: cereal and large livestock

Regrettably, the classification focuses only on potential for livestock, fodder, and cereal production. Viticulture, orchards, vegetable and fruit production are not singled out.

However, by cross-referencing the territory categorizations for the Valais region and the soils therein,[55] one finds that the main agriculturally exploited soils to be found in the region are:

- Deep in the Rhône river valley:
  - calcaric Cambisol
  - calcaric Regosol
- On the steep mountainsides to the north of the Rhône:
  - eutric, calcaric, gleyic Cambisol
  - eutric Cambisol
- At higher altitudes north of the Rhône and in the Orsières valley to the southwest:
  - dystric calcaric, eutric Regosol
- At higher altitudes in valleys to the south:
  - eutric Regosol
  - dystric, eutric Regosol
  - calcaric Regosol
  - Podzol
  - Ranker
  - Lithosol
- At the highest altitudes in the mountains to the south:
  - eutric, dystric Regosol
  - calcaric Regosol
  - Podzol

[55] Federal Office for Agriculture (FOAG), *Carte Des Aptitudes Des Sols de La Suisse (Guide Couleurs)* (2011), https://geofiles.be.ch/geoportal/pub/lpi/BEK_LANG_FR.pdf. and Confédération suisse, "Cartes Interactives de La Suisse," 2025, https://tinyurl.com/235bbeut.

- humic, mollic Gleysol (rare)
- eutric Histosol (rare)

Overview of land use

The diversity of landscapes and climatic conditions from the Rhône valley to the mountain peaks is reflected in the stratification of landscapes and agricultural production. This can be seen in the below map of land use, which underlines various types of agricultural activity depending on altitude and microclimates.

One can infer from the map that

- the rich, alluvial plain of the Rhône River is suitable for orchards and vegetable farming, as well as some livestock and cereal production
- areas in intermediate altitudes with steep, terraced land are used for viticulture as well as fruit production
- land above wooded areas consist mainly of Alpine prairies used to pasture livestock in summertime

It is noteworthy that the agricultural land within which vineyards are found (in brown below) is generally north of the Rhône River, so as to be exposed to the south.

The natural conditions of the Valais make it impossible to grow crops on the many excessively steep slopes. As a result, 77% of agricultural land in the Valais is grassland used as pasture (34% of the Valais UAA) or hay meadow (43% of the Valais UAA). These agricultural areas can only be used for cattle or small ruminants.

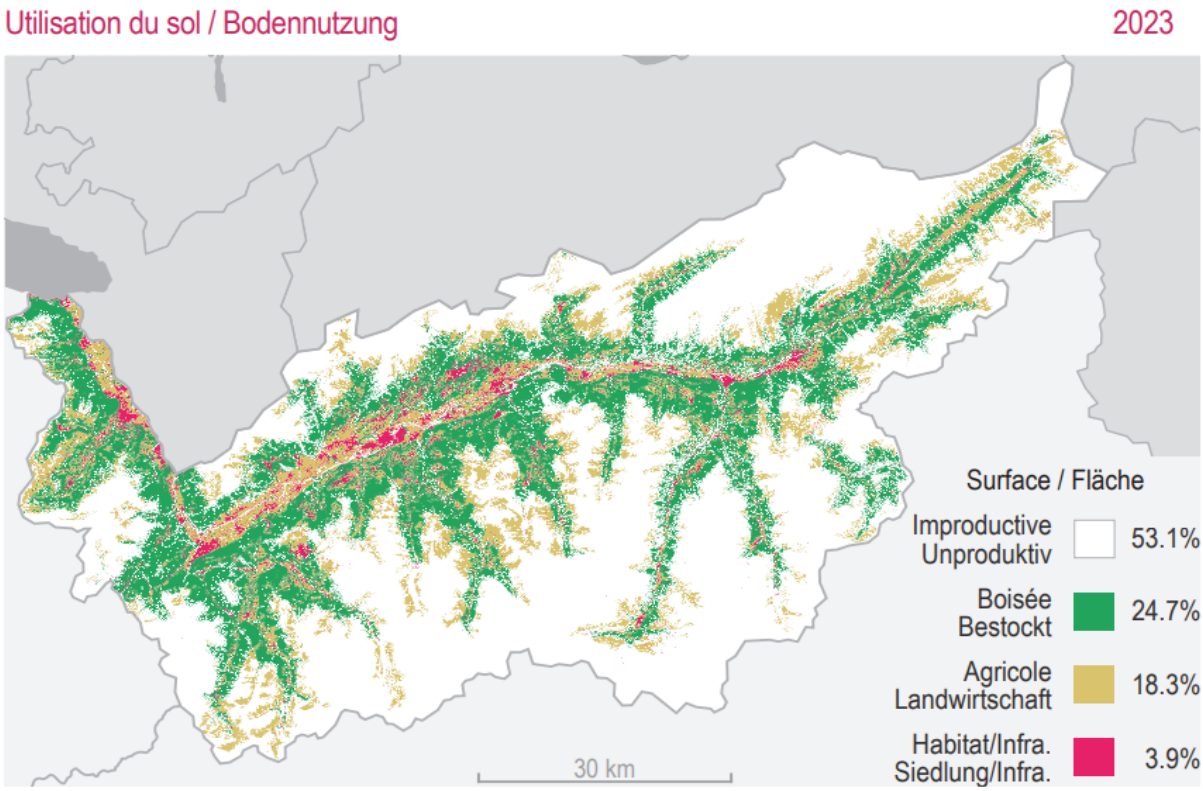


Figure 46 - Land use map of the Valais Canton. Translation: Improductive = Unproductive ; Boisée = Wooded area ; Agricole = Agricultural ; Habitat/Infra. = Towns and infrastructure. Source : État du Valais [72]



Figure 47 – [Left] Picture of the vineyards on the lower slopes of the Valais mountains at Fully. Source: ©Antoinette Bernard

Figure 48 – [Right] Picture of a mountain pasture in the Val d'Illiez, the Lapisa mountain pasture in Champéry. Source: La Cavagne

Loss of agricultural land

According to the Cantonal administration, the Valais is losing agricultural land at a high rate [89]:"On average, around 3,500 hectares of agricultural land are lost each year nationwide. However, in the Valais Canton, this loss is twice as fast, meaning that all agricultural land will disappear within 200 years if this rate continues. In the Rhône valley, the situation is even more critical: residential and infrastructure areas have increased by more than 50% over the last 30 years, and agricultural land is disappearing at a rate more than three times faster than the national average, meaning that the valley will be completely urbanised within a century if the trend continues."
The map below illustrates at what point would disappear the remaining stock of agricultural land if land use change were to continue at the current pace:

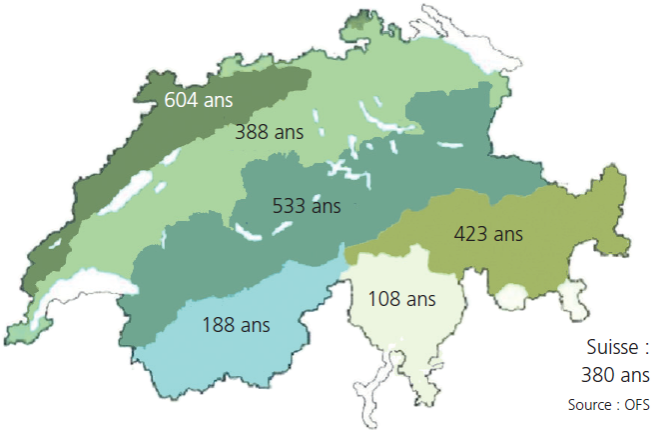


Figure 49 - Number of years before agricultural land disappears completely, if current land use trends continue. Source: Office Fédéral de la Statistique [89]

In the Valais region, if land use change were to continue at the present pace, then agricultural lands would be gone within 188 years.

Protected areas

The Valais Canton contains approximately 60 protected areas decreed by the Canton. They range from high-altitude glaciers to numerous alpine wetlands ("mire landscapes", in the words of legislation) to a few plain wetlands and dry areas, for instance. The vast majority (20) of protected areas are alpine wetlands. The map below presents the main protected areas decreed by the Canton:

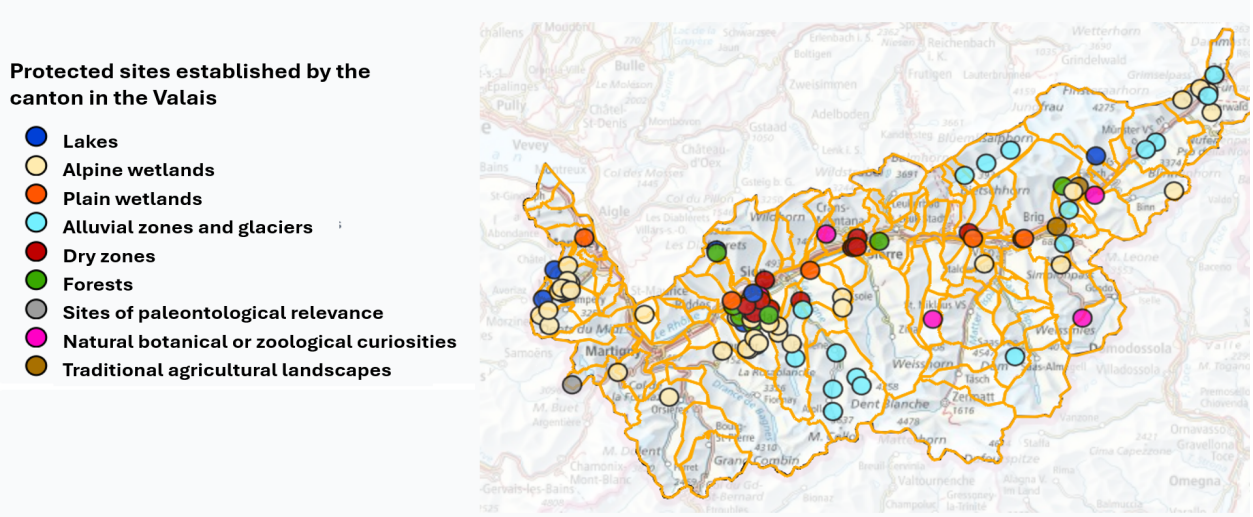


Figure 50 - Protected areas in the Valais Canton established by Cantonal decree. Source: Canton du Valais [90]There are numerous additional protected areas [91]:

- Three vast Regional Natural Parks (*Regional National Parks*) around Martigny, Sierre, and Fiersch ; these are areas notable for their traditional landscapes, whose management and inhabitants have a mission to conserve and highlight natural and cultural landscapes, to support sustainable economies, and promote education and awareness-raising on environmental topics while facilitating research and conservation efforts [92]
- Ten federal hunting districts (*districts francs fédéraux*) - nature preserves managed by the federal state which have as their objective to protect rare and vulnerable mammals and birds while finding a balance with human hunting activities[56]
- A UNESCO natural World Heritage site around the Jungfrau/Alteschhorn mountains
- A number of protected forests
- Dozens of small areas of protected dry prairies and pasturelands
- Alluvial zones (protected zones bordering rivers and lakes) and surrounding vegetation
- A significant number of protected federal landscapes, sites and natural monuments (mainly high peaks and their surrounding mountain landscape)
- About a dozen nature preserves managed by Pro Natura, Switzerland's oldest nature preservation organization [93]

Further, virtually all the Valais Canton surface areas under ~2,200m to 2,400m are part of the REN (Réseau Écologique National/National Ecological Network), which aims to provide corridors for wildlife and plants. Examples of REN sites in the Valais are forests, waterways, agricultural lands, dry prairies, forest borders, and embankments [94]. According to the Federal Office of the Environment (OFEV), Switzerland has the highest rate of vulnerable species amongst developed countries [95].

Ecosystem services

Bibliographic research yielded no specific mapping and assessment of ecosystem services in the Valais Canton. A 2020 review of ecosystem services conducted by the Federal Office for the Environment (OFEV) featuring three Swiss regional case studies did not contain any case studies resembling the Valais Canton [96]. Some insights into ecosystem services delivered in the Valais region can, however, be taken from the results of an intensive, multi-actor research project running from 2016 to 2018, in which ecosystem services in the Alps as a whole were analysed and mapped.

[56] As per the OFEV, "In accordance with the provisions of the Ordinance on Federal Hunting Districts (ODF), hunting districts 'aim to protect and conserve rare and endangered wild mammals and birds, as well as their habitats. They also aim to conserve healthy populations of huntable species that are adapted to local conditions.'" Federal Office for the Environment (FOEN), "Districts francs fédéraux," September 5, 2024, https://www.bafu.admin.ch/bafu/fr/home/themen/thema-biodiversitaet/oekologische-infrastruktur/eidgenoessische-jagdbanngebiete.html.

The authors identified eight main ecosystem services provided by nature in the Alpine region, and the corresponding indicators, as per the table below [87]:

Table 17 - Main ecosystem services and corresponding indicators identified in the Alpine region. Source: Interreg Alpine Space (EU) and AlpES [87]

Ecosystem Service	Indicator type	Definition	Unit of measure
Surface water for drinking with minor or no treatments	Supply Flow Demand	Water availability Water use Water abstraction	m^3 ha^{-1} y^1 m^3 ha^{-1} y^1 m^3 ha^{-1} y^1
Biomass production from grassland	Supply Flow Demand	Gross fodder production Net fodder energy content Livestock feed energy requirements	t DM ha^{-1} y^1 MJ NEL ha^{-1} y^1 MJ NEL ha^{-1} y^1
Fuel wood	Supply Flow Demand	Forest biomass increment Wood removals Fuel wood requirements	m^3 ha^{-1} y^{-1} m^3 ha^{-1} y^{-1} m^3 y^{-1}
Filtration of surface water by ecosystem types	Flow and Supply Demand	Nitrogen removals Nitrogen loads	kg ha^{-1} y^{-1} kg ha^{-1} y^{-1}
Protection against avalanches, mudslides and rockfalls	Supply Flow Demand	Site-protecting forest Object-protecting forest Infrastructure in hazard zones	% % %
CO2 sequestration by forests and bogs	Flow and supply Demand	CO2 sequestration by forests CO2 emissions	t CO_2 ha^{-1} y^{-1} t CO_2 ha^{-1} y^{-1}
Outdoor recreation activities	Supply Flow Demand	Outdoor recreation availability Visitation rate Beneficiaries	index index index
Symbolic Alpine plants and animals, landscapes	Supply Flow Demand	Habitats of symbolic species Occurrence in hotel names Desired symbolic species and landscapes	index nr. of hotels not determined

The table below dives deeper into the nature of these ecosystem services, again quoting from the study:

Table 18 - Detailed description of ecosystem services in the Alpine region. Source: quotations from Interreg Alpine Space (EU) and AlpES [87]

Ecosystem service in the Alpine region	Description
Surface water for drinking with minor or no treatments	The Alps are a vital water source in the region, supporting life for millions of people across Europe. The iconic, high elevation mountains here store millions of cubic meters of water in natural and artificial lakes as snow and ice. They also provide a consistent flow of water downstream to the Danube, the Rhone, the Po, and the Rhine. It is for this reason that the Alps are sometimes referred to as Europe's "water tower". (page 17)
Biomass production from grassland	The Alpine Space has a long history of grassland production, a history that has shaped the many cultures across this range. In most corners of the Alps, one can still find traditional farms raising livestock such as cows, goats, horses and sheep on alpine pastures. These pastures are fairly common because the high altitudes and steep slopes of much of the Alps make most other means of agricultural production unfeasible in these areas. The milk, meat, and local varieties of cheese that these operations produce are important for maintaining the cultural integrity of traditional rural ways of life and they all depend on a major ecosystem service:

	grassland biomass growth. Every year, alpine communities benefit from the fodder that grows freely in high elevation meadows as cows and other livestock transform this grassy material into valuable food products. (page 25)
Fuel wood	Large swaths of forested land are one of the defining features of the Alps. These numerous forests provide for many social and economic benefits: one of the most significant being timber. Timber can be processed in numerous ways and serves a variety of purposes: from constructing buildings to being burned as fuel. Traditionally, fuel wood was used in homes all across the Alps. Today, the use of fuel wood is less consistent, and varies dramatically by region. However, as alternative and sustainable energy sources become more sought after, fuel wood is once again becoming a vital energy source across the region. (page 33)
Filtration of surface water by ecosystem type	Water purification is one of the many regulating services provided by ecosystems. Pollutants such as metals, oils, excess nutrients and sediment are processed and filtered out as water moves through wetland areas, forests, and riparian zones. Water purification depends on filtration and absorption by soil particles and living organisms in the water and soil. As Europe's "Water Tower", this regulating function is especially pertinent in the Alps. Nutrient pollution, and especially nitrogen, can have deleterious ecological and biogeochemical effects on the environment. For example, high nitrogen levels are a leading cause of eutrophication of surface waters, as they can induce excessive algal growth. The major causes of nutrient pollution are anthropogenic fertilizers, sewage, and industrial wastewater discharged into the environment. Thus, nitrogen is the focus of this set of indicators: "Filtration of surface water by ecosystem types." (page 41)
Protection against avalanches, mudslides and rockfalls	In mountainous areas characterised by considerable topographic variation and abundant ice, snow and water, one of the most important functions of forests is helping to prevent and mitigate rockfalls, mudslides, and avalanches. The Alps rank amongst the most forested areas in Europe, with about half of their area covered by woodlands. However, not all forests have a protective function to people and human infrastructures. According to Brang et al. (2001), protective forests are identified by the simultaneous presence of (1) people or assets that may be damaged, (2) a natural hazard or a potentially adverse climate that may cause damage and (3) a forest that has the potential to prevent or mitigate this potential damage. This ES is of particular importance in many municipalities of the Alpine Space, where the topographic, geomorphologic and climatic conditions account for an elevated potential for natural hazard events. (page 47)
CO_2 sequestration by forests and bogs	The vast amounts of fossil fuels being burned around the globe mean that carbon dioxide (CO_2) is one of the most powerful drivers of global climate change. As no major reductions in CO_2 pollution are occurring at a global scale, the capacity of natural environments to sequester CO_2 is becoming more and more vital. Thus, any large-scale CO_2 sinks have a positive regulating effect not just locally, but globally as well. In the Alpine Space, the ecosystems with the largest sequestration capacity are forests and bogs. Every year, these ecosystems sequester CO_2 by storing it in biomass that is created as plants and trees grow. (page 55)
Outdoor recreation activities	There exists a whole category of ecosystem services concerned with non-material benefits, entitled cultural ecosystem services. This category includes aesthetic appreciation and inspiration, cultural identity, sense of home, and spiritual experience related to the natural environment. Typically, opportunities for recreation are considered within this category.

	Nature-based opportunities for recreation (e.g. walking and playing sports in parks and urban green spaces or hiking in the mountains) play an important role in maintaining mental and physical health, as many studies have demonstrated. Measuring the potential benefit of outdoor recreation is an important piece in the Alpine Space puzzle. (page 61)
Symbolic alpine plants, animals and landscapes	The Alps are one of the richest biodiversity hotspots in Europe and are home to many endemic plant and animal species. These species have become intertwined with the many cultures that have developed here; they have symbolic meaning to people who call the Alps home. A well-known example is the edelweiss, a beautiful, diminutive white flower found high in rocky mountain environs. The edelweiss has been a symbol for different alpine militaries, represented intrepidness in the mountains, and even been a part of many songs from the region. Many other species have symbolic meaning in the Alps, including ibex, chamois, golden eagle, alpenrose, larch, and more.[57] (page 69)

Remarks made in this study on the link between human activities and their impact on ecosystem services merit being cited here [87]:

Political and economic processes, together with social changes, are altering many structures in the Alpine Space. For example, they have resulted in agglomeration processes in the valleys; the average size of farms is increasing, while their number and diversity are decreasing. Agriculture has slowly vanished from many hillsides and Alpine pastures, instead concentrating in extensive holdings found in the lowlands. This change is causing a loss in biodiversity, as species-rich Alpine pastures are overgrown by forests.

Moreover, socio-economic trends such as marginalization and urbanization are changing the population distribution and land use across the Alps. Younger people are moving away from remote regions to urban settlements with greater education and work opportunities, leaving some areas to face ageing, depopulation and isolation. Areas where agricultural land has been abandoned, but neither tourism nor urbanization occurs, risk becoming more and more marginalized.

On the other hand, regions that are easily accessible and rich in tourist and cultural attractions are experiencing growing populations, intensified commuter flows and high seasonal tourism. These trends bring a different set of problems to sustainable development, such as pollution, soil sealing and reduction of open spaces. These are only some of the general socio-economic trends and changes that the Alps currently face, the impacts of which vary greatly across the diverse countries, regions and communities found here.

Climate change is another major threat to Alpine ecosystems. One obvious outcome of climate change is that glaciers are melting at an ever-accelerating rate. This melting results in a cascade of downstream problems, such as dwindling glacier-fed rivers and the consequent lack of drinking water. Changes in precipitation, snow cover patterns and glacier storage are expected to alter the Alpine water cycle. This could potentially lead to more droughts in summer, more floods and landslides in winter, and greater variability in the water supply throughout the year. Furthermore, the rising snowline poses a serious risk of upward migration of Alpine plants and the expansion of exotic

[57] The authors of the report note that this indicator is particularly difficult to quantify: "The intangible nature of symbols, especially their value, use, and extent, render traditional spatial analysis methods exceedingly difficult. This set of indicators thus develops novel methodologies to assess this service. Supply of this service is evaluated by examining the geographic ranges of the selected culturally important plant and animal species. […] Appraising the value of these symbols proves to be challenging but is vital in a deeper understanding of the benefits we draw from the environment around us. This is especially true as land-use and climate changes threaten many of the species that are most important to the cultures found in the Alpine Space." Interreg Alpine Space (EU) and AlpES, *Ecosystem Services in the Alps: A Short Report*.

species, thus substantially altering plant communities. A warming world has major effects upon the natural systems of the Alps and every day new impacts are being uncovered.

Ecosystem services are also provided by grasslands, as can be appreciated in the figure below.

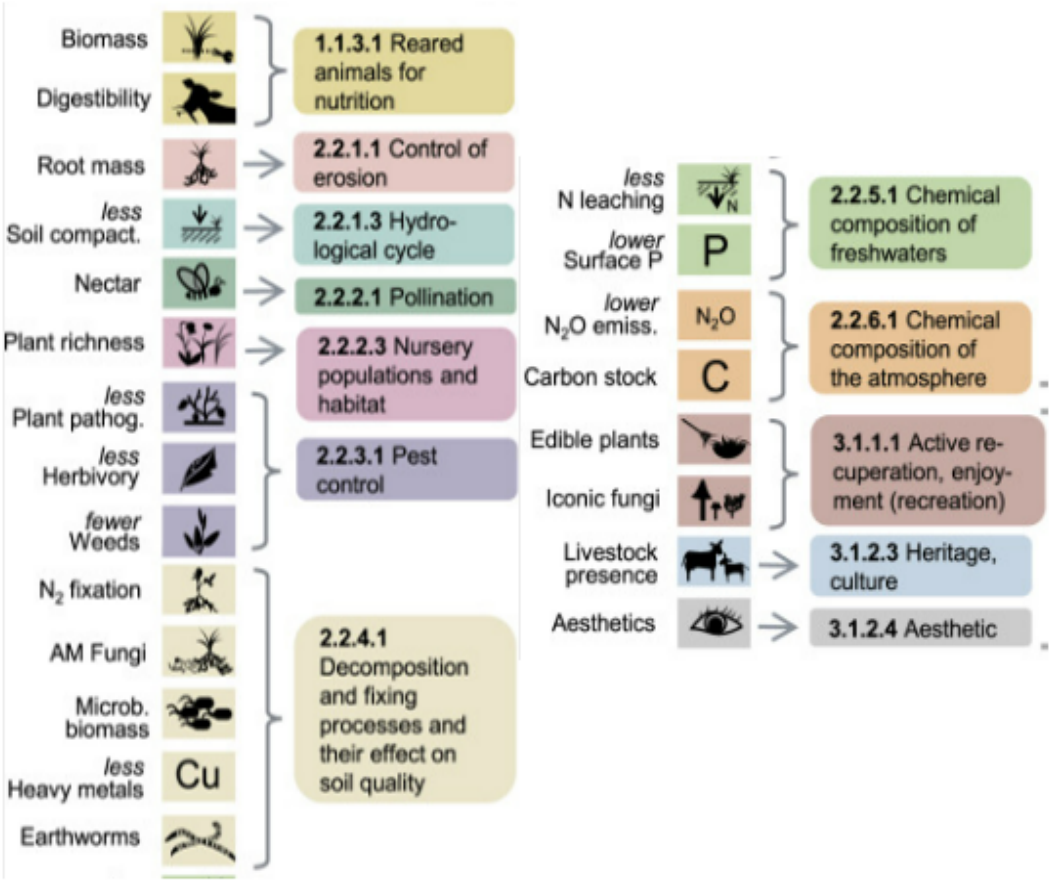


Figure 51 - Main ecosystem services provided by grasslands. Source: Richter et al [97].

Meanwhile, the Rhône River in and of itself provides the typical ecosystem services that can be attributed to a river, as per the following:

Table 19 - Ecosystem services provided by major river systems (such as the Rhône). Source: OHM Vallée du Rhône [98]

Type of ecosystem service	Detailed services
Regulation services	Flood prevention, flood regulation, drought mitigation, erosion regulation, water purification, local climate regulation, aquifer recharge, carbon storage, biodiversity, waste degradation, soil maintenance
Cultural services	Scientific interest, education, cultural/spiritual interest, entertainment, landscape/aesthetic amenities, artistic inspiration, tourism, sports and leisure
Supply services	Plant biomass, animal biomass, water for industry and agriculture, drinking water, sediment extraction, wood, energy, transportation

As for the alluvial plain of the Rhône River valley, which ranges from less than a kilometre to five kilometres wide [99], it provides the ecosystem services typical of any alluvial plain:

Table 20 - Ecosystem services provided by the Rhône River alluvial floodplain in Switzerland. Source: Petsch et al [100].

Theme of ecosystem service	Detailed services

Supporting services	Soil formation: Improve habitat quality for plants, increase macrophyte primary productivity, provide a sink and source of nutrients Nutrient cycling: Flux and exchange of organic and inorganic matter, biomass production, ecosystem functioning, water purification Primary production: Biomass for higher trophic levels and provisioning services Habitat provisioning: Habitat area suitable for biodiversity
Regulating services	Water regulation: Reduce catastrophic floods, regulate runoff and recharge aquifers Erosion control: Shore protection, soil protection Water purification and waste treatment: Improvement of water quality, nutrient cycling Disease regulation: Improvement of water quality by reducing coliforms and other pathogens Climate regulation: Short-term control of local climate and long-term control of global changes
Provisioning services	Water supply: Provision of water of quality for human consumption and ecological balance and maintenance of biodiversity Food provisioning: Provision of living biomass including fish for food consumption and as a social and economic asset for society Ornamental market: Provision of fish and macrophytes for the ornamental market Genetic resource: Provision of genetic diversity can buffer anthropogenic pressures and maintain biodiversity production Hydropower generation: Energy source and water retention for consumption and leisure
Cultural services	Spiritual and religious: Space for the local community to practice their religious rituals, sense of belonging Recreation and ecotourism: Water sports, freshwater beach recreation, bird watching Aesthetic: Contemplation of nature Cultural: Practice of regional and historical gatherings and popular festivities

It should be noted that some of these ecosystem services may be diminished in places where the Rhône River has been subject to correction.

Finally, a significant share of agricultural subsidies in Switzerland encourages and/or rewards agricultural practices that develop ecosystem services and/or preserve biodiversity, which enhances ecosystem services. Swiss agricultural policy supports ecosystem services primarily through direct payments to farmers that are conditional on environmental and ecological performance, known as "proof of ecological performance" (PEP). Today, direct payments are designed not to encourage production volume but to compensate for public and ecological services provided by farmers, such as habitat maintenance and species diversity promotion.

Ecosystem services identified and paid for under Swiss policy include:[58]

[58] Stefan Mann et al., "Landscape Quality Payments in Switzerland: The Congruence between Policy and Preferences," *Journal of Policy Modeling* 45, no. 2 (2023): 251-65, https://doi.org/10.1016/j.jpolmod.2023.03.007.; Federal Office for Agriculture (FOAG), "Contributions à La Biodiversité," May 1, 2025, https://www.blw.admin.ch/fr/contributions-biodiversite.; Federal Office for Agriculture (FOAG), "Prestations Écologiques Requises," April 16, 2025, https://www.blw.admin.ch/fr/prestations-ecologiques-requises.

- Biodiversity and species habitat conservation (ecological compensation areas with semi-natural habitats, buffer zones, hedges, and traditional orchards)
- Soil protection and nutrient management (balanced nutrient use, soil health analysis, crop rotations, cover crops)
- Water regulation and protection through soil management and pesticide restrictions
- Landscape preservation, especially cultural landscapes in alpine and upland areas
- Animal welfare as part of ecological requirements

Predators

The main predators in the Valais Canton and the animals they prey on are as follows:

Table 21 - Principal predators of the Valais Canton and their prey. Source: see sources in-line in the table

Predator Name	Scientific Name	Typical Prey	Presence/Notes
Wolf	Canis lupus	Deer, chamois, livestock	Several packs; monitored and managed[59]
Lynx	Lynx lynx	Roe deer, small mammals	Lower density in some regions; monitored[60]
Fox	Vulpes vulpes	Small mammals, birds (incl. domestic species), invertebrates	Widespread, common predator [101]
Golden Jackal	Canis aureus	Small mammals, occasional birds	Recently arrived, still rare [101]
Golden Eagle	Aquila chrysaetos	Marmots, young foxes, young ungulates, birds, carcasses	Prominent bird of prey in mountain regions[61]
Eagle Owl	Bubo bubo	Small rodents, small mammals, birds, reptiles	Recently reintroduced, still rare [102]
Brown Bear*	Ursus arctos	Large mammals, berries (omnivore)	Occasional visitor, not resident [101]
Bearded Vulture*	Gypaetus barbatus	Bones, carrion	Scavenger, not a direct predator [101]

*Brown bear and bearded vulture are not permanent residents or direct predators of live prey, but their occasional or scavenging roles merit mention.

Wolves were reintroduced to the Valais in 1995 [103]. They currently number above 70, in 13 different packs, 4 of which cross national borders [104]. They were responsible for the deaths of 401 livestock in the year 2023, but their numbers are also regulated by hunting [105]; farmers have difficulty accepting the argument that wolves are good for forests, and they advocate vocally for greater regulation of wolf populations.[62] The following quotation (translated) from Bernard, 2024 [106], addresses the changes brought about by the reintroduction of wolves:

[59] Tribune de Genève, "Le Valais a recensé 51 loups l'année dernière," January 26, 2023, https://www.tdg.ch/le-valais-a-recense-51-loups-en-2022-482104449628. SwissCommunity, "The Quartet of Predators Is Complete Again," November 4, 2015, https://www.swisscommunity.org/en/news-media/swiss-revue/article/the-quartet-of-predators-is-complete-again.

[60] S. W. I. swissinfo.ch, *Lynx and Wolf Are Popular Predators*, February 16, 2000, https://www.swissinfo.ch/eng/aging-society/lynx-and-wolf-are-popular-predators/1421262. François Biollaz et al., "Statut Du Lynx En Valais Quatre Décennies Après Son Retour: Suivi Au Moyen de Pièges Picturegraphiques," *Bulletin Annuel de La Murithienne*, no. 133 (2015): 29-44.

[61] House of Switzerland, "Typical Fauna from the Swiss Mountains." Station ornithologique suisse, *Vogelarten: Aigle royal*, 2025, https://www.vogelwarte.ch/fr/les-oiseaux-de-suisse/aigle-royal/.

[62] Wolf packs prey on deer, which eat and damage young tree shoots. In the presence of wolves, deer populations recede and trees can take root better, thus improving avalanche control. SwissCommunity, "The Quartet of Predators Is Complete Again."

The threat posed by wolves is proving particularly worrying, profoundly affecting farming practices and the local balance. The presence of wolves has already led to a drastic decline in the number of small ruminant farms in the side valleys, with major consequences such as the abandonment of grazing on certain plots of land suitable only for small ruminants, resulting in the gradual closure of landscapes [250]. The presence of wolves also has a significant social impact, causing daily stress for farmers and other residents. Today, some cattle farmers are even reluctant to send their young livestock to the mountain pastures for fear of attacks. Thus, the presence of large predators has profound and complex repercussions on the social, economic and environmental balance of the territories concerned.

Lynxes have been back in the Valais Canton since the late 1970s, but their numbers are falling due to poaching [107], and they are no longer considered a significant threat to livestock [105]; rather, they prey on roe deer and small mammals. Foxes, which are widespread in the Valais, can prey on smaller birds including domesticated agricultural species such as chickens, ducks, and geese. In theory, any of the species listed in the table that eat large mammals or birds could pose a threat to agriculture, provided that their habitat overlaps with that of their potential prey. Agricultural systems in the studied territory

5.3 Agricultural systems in the studied territory

5.3.1 Overview of agriculture in the country

The following are a few key statistics on agriculture in Switzerland: in 2024, Swiss farms [108]

- Represent 38% of the country's total surface area
- Produce approximately 48% of Swiss food consumption (in calories)
- Are partly engaged in organic agriculture: 18% of the surface area and 16.5% of farms
- Are engaged in strong protection of biodiversity on 12% of the agricultural surface area

The following data show that the total number of farms in mountain and hilly regions in Switzerland is undergoing a steep decline (50% drop from 2016 to 2024), but that a significant proportion of UAA is still situated in mountain and hilly regions (41% of total UAA).

Table 22 - Key indicators of Swiss agriculture and their evolution over time. Source: Barjolle, 2025 [108]

Key indicators		Total	Mountains and hills	Mountains and hills as a % of total
Number of farms		46,400 (2024) 52,000 (2016)	11,400 (2024) 30,000 (2016)	24.5% (2024) 55% (2016)
Occupation	Full time	60% (currently decreasing)		
	Part-time	40%		
Utilised Agricultural Area	Cultivated land (ha)	1,042,000 (2024) 1,049,000 (2015)	405,400	41%
	Grassland area in meadows and pastures	604,000 500,000 ha	500,000	100%

Key indicators		Total	Mountains and hills	Mountains and hills as a % of total
	Alpine pastures			
Animals (number)	Cattle	1,560,000 incl. 850,000 female cows		
Share of the active population in agriculture, forestry and fishing		2.6% (2024) 3.4% (2010)		
Share of GDP		0.76% (2024) 1.2% (2015)		

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Share of GDP		0.76% (2024) 1.2% (2015)		

5.3.2 Overall introduction of the farming system in the territory

A statistical analysis of agriculture in the Valais Canton is conducted across two chapters.

- The first attempts to answer the following question: how is agricultural land used? This chapter examines what Valais land produces and how many hectares are used for production.
- The second chapter aims to answer the following question: what are Valais farms like? The idea is to create an ideal-typical categorisation to understand the different profiles of farms in the Valais Canton.

The section therefore has a first approach based on agricultural land and a second based on farms, which are intended to complement each other to better understand agriculture in the Valais Canton.

These two sections are preceded by a preface that explains the notion of "agricultural zones," which is an important concept mobilised in Swiss agricultural policy.

It is worth noting that in the Valais Canton, "in the 1990s, a new approach to setting up in farming emerged, motivated by aspects of identity and culture and supported by direct payments under agricultural policy. Market liberalisation (lower customs barriers, less price support) and growing social demand for agriculture as a landscape activity encouraged the emergence of new forms of farming based on processing and direct sales or on agritourism services." [109]



Figure 52 - Picture of a mountain pasture in the Val d'Illiez facing the dents du Midi. Source: Antoinette Bernard

5.3.3 Agricultural zones

Before delving into the main farm types and ideotypes in the Valais Canton, it is helpful to get the lay of the land geographically. The land-use illustration provided above provided a first indication of the geographic distribution of agricultural production. In this section, two additional maps are provided that shed light on the geographical distribution of agricultural activity in the Canton.
First, the Swiss Federal office of agriculture provides an additional source of information, as it classifies six types of agricultural zones that form the basis for the subsidies regime allocated to farms in that zone. There are six classifications, reflecting climate, altitude, and land use considerations:

- Plain
- Hilly/steep
- Mountain 1 (subsequently referred to as M1)
- Mountain 2 (M2)
- Mountain 3 (M3)
- Mountain 4 (M4)

Agriculture in the Valais is mainly organised on a small scale. Most farms are in mountain areas: 71.4% of Valais farms are in these zones. In mountain areas, cattle farms have an average of 25 cows per farm, compared with 61 cows on the plains [109].

Direct payments, introduced in 1993, are designed to support farmers in maintaining reliable food supplies and preserving the landscapes they cultivate. Farmers in upland and mountainous regions receive extra payments to account for the more challenging farming conditions they face. In the subsequent analysis discussing ideotypes of farmers, data is presented on the geographical distribution of farms according to these six agricultural zones.
The first map below shows in detail the agricultural zones in the Valais Canton, as per the federal distribution. This makes it possible to see, where the report cites M1, M2, etc., what geographical part of the Valais is being spoken about.
The second map is based on data from the Federal office of statistics and the Liechtenstein Office for Construction and Infrastructure and is published by the main Swiss ornithology association. It provides geographical information on agricultural production, divided into four categories: arable land, grassland used year-round, special crops (orchards, vineyards, horticulture), and Alpine pastures only grazed in summer. These track very well with the analysis conducted above. Indeed, the Valais Canton (see zoom), is characterised by a mix of horticulture/ arboriculture/ viticulture on

the *northern* hillsides along the Rhône plain; natural prairies and local pastures at intermediate altitudes; and high-altitude grazing meadows (*alpages*). There are just a few areas of arable land in beige, in the Rhône River plain leading down to Lake Geneva, at the border with the Vaud Canton.

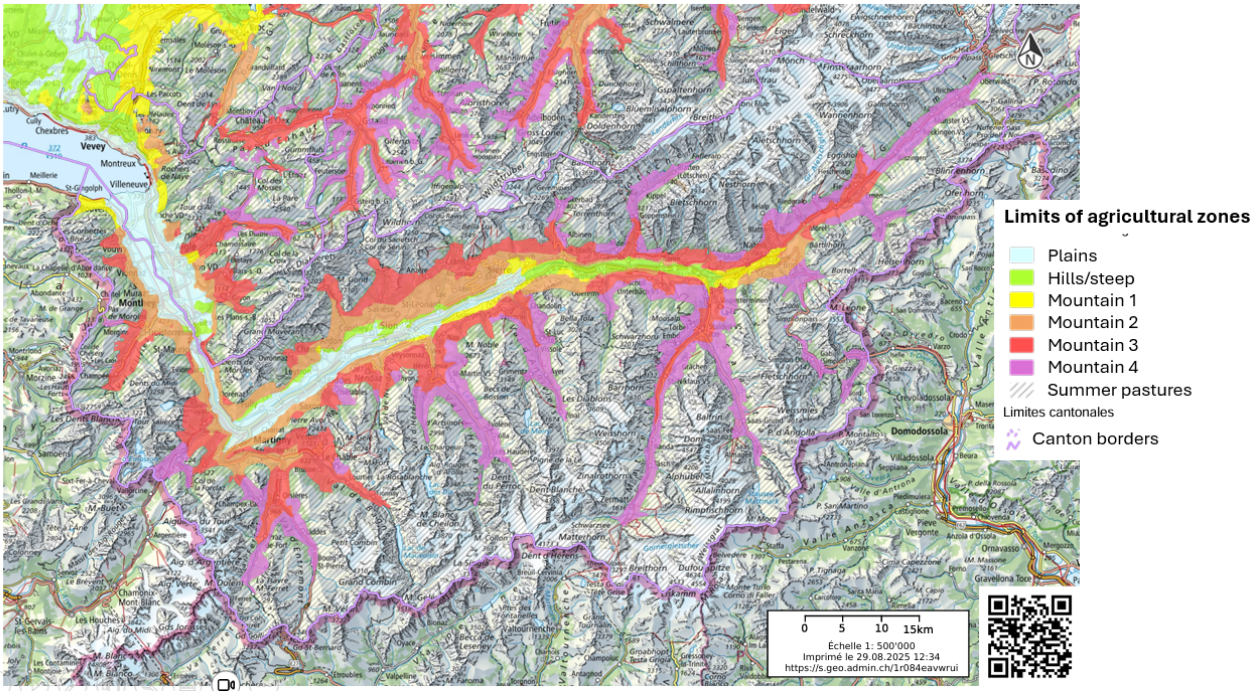


Figure 53 - Limits of agricultural zones delimited by the federal government. Source: Confédération Suisse [110]

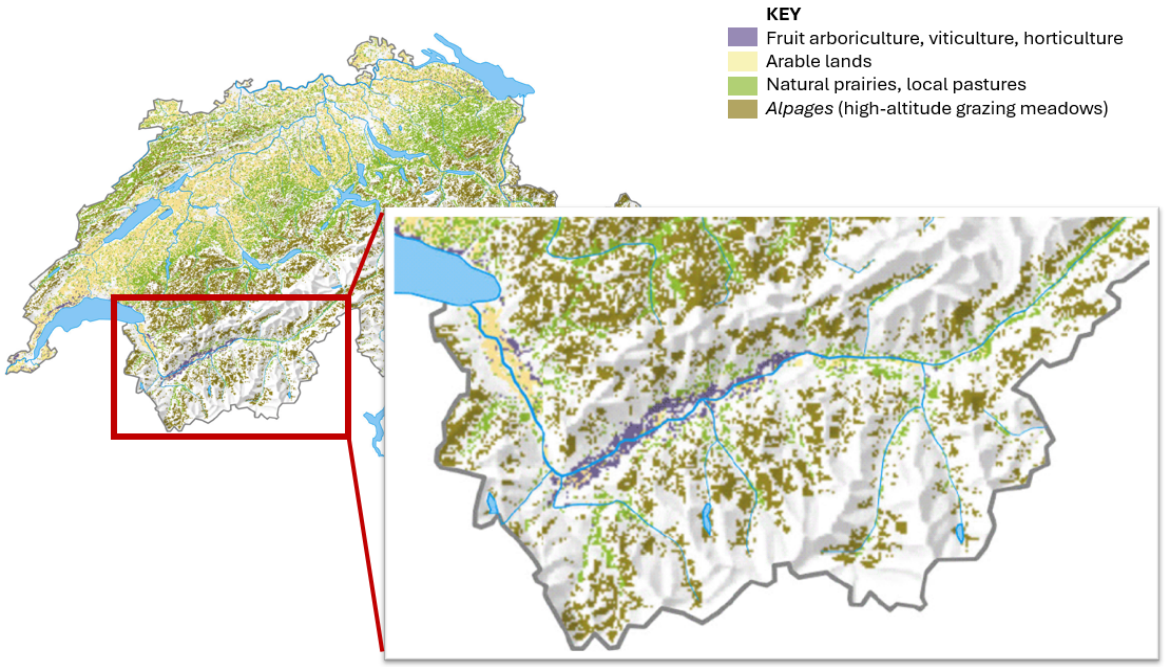


Figure 54 - Agricultural land-use across Switzerland. Source: Station ornithologique suisse [111]

5.3.4 Overall presentation of the farming sectors in Valais

We will begin by understanding the uses to which Valais farmland is put to answer the following question: what is the use of Valais's Utilised Agricultural Area (UAA)? Here is an initial overall diagram, based on the categories created, which gives an initial representative overview of agriculture in the Valais:

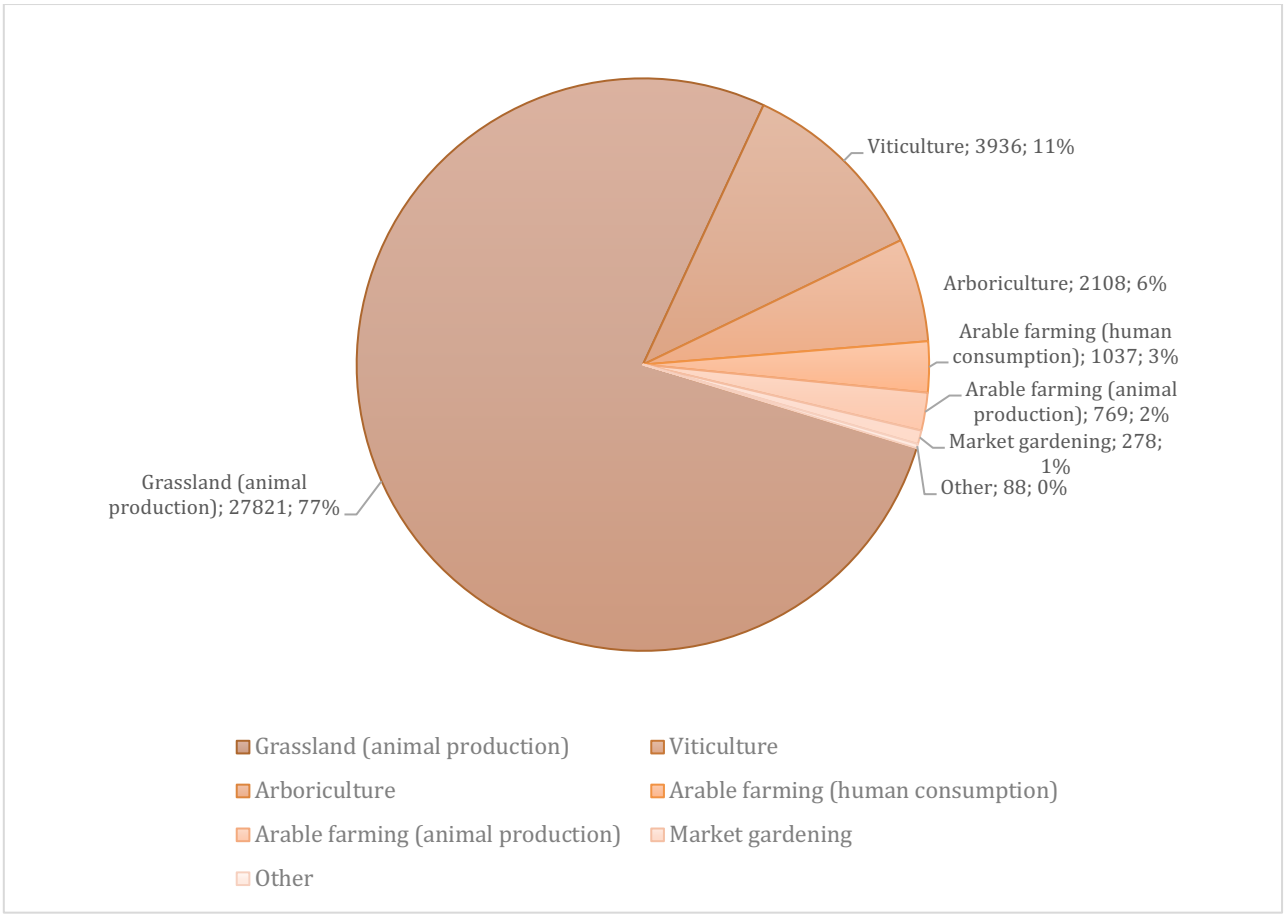


Figure 55 - Valais UUA by type of land use (ha and %). Source: Bagnoud, 2024 [79]

With a total of 36,037 ha of farmland, grassland clearly dominates agriculture in the Valais. In fact, livestock production accounts for the vast majority: if we add up all the land used for this purpose, we arrive at 79% of agricultural land. The choice of a *wine-growing* category is confirmed here, given that it is the second most important sector for the Valais, occupying 11% of farmland, followed by arboriculture with 6% and field crops, with a total of 5%. The marginality of the market gardening sector may come as a surprise. In fact, as well as producing everyday foodstuffs and certain flagship products such as asparagus, one might think that a larger proportion of the UAA would be reserved for this sector. But in fact, market gardening in the Valais occupies just 278 hectares of the 36,037 hectares of farmland. But what do these categories mean, and what exactly do they correspond to? To answer this question, we're going to look at these categories in detail and understand the choices that were made to create them.

Grassland

This category covers all grassland, whether meadow, pasture or litter. There are essentially six types of grassland.
The first type is *other permanent grassland*, which corresponds to permanent grassland that has existed in this form for more than 6 years and is mown at least once a year to produce fodder[63] . Unlike the next category, as we shall see, they do not form part of the areas for the promotion of biodiversity and represent 10,076 ha. The second category is *extensive pasture* (9,358 ha), which is an Area for the Promotion of Biodiversity (SPB) and is therefore subject to the relatively strict rules laid down in the Direct Payments Ordinance (OPD). These are nutrient-poor areas, generally located on sloping land. For example, apart from the droppings of animals grazing on the land, no manuring is allowed and pesticides are not permitted, with the exception of "problem plants", which may only

[63] Information received by e-mail from an employee of the OFAG's direct payments office.

be treated on a plant-by-plant basis.[64] The other well-represented categories are pasture (2,594 ha), low-intensity grassland (considered as BPS - 2,585 ha), extensive grassland (considered as BPS - 1,810 ha) and artificial grassland (1,247 ha). The other categories are present in the Valais but remain marginal.

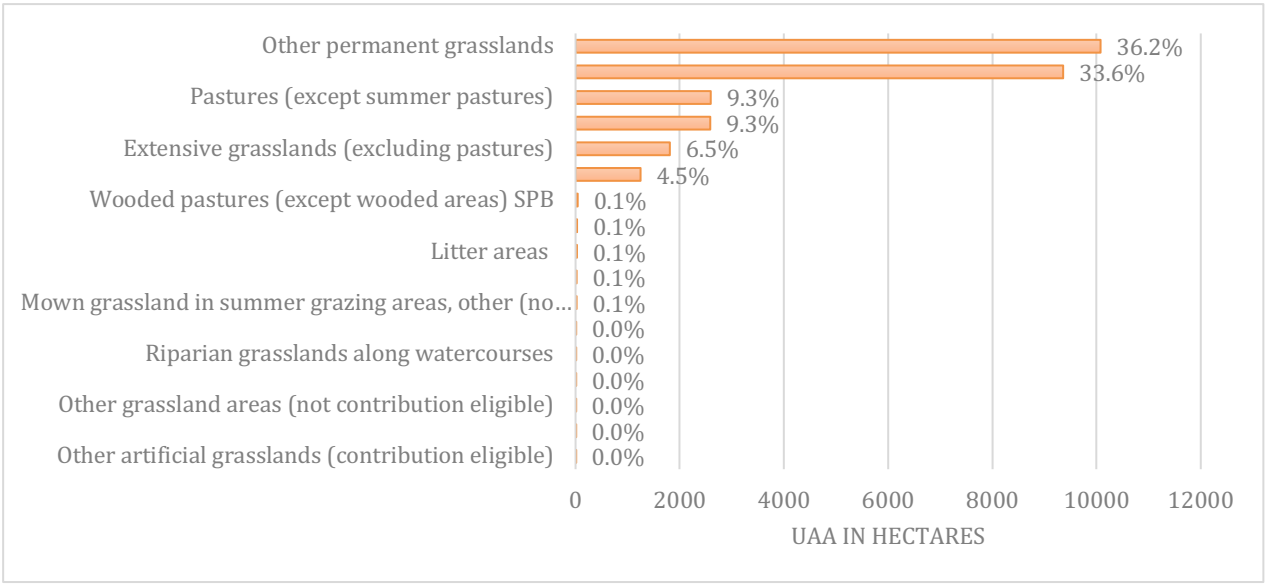


Figure 56 - Grassland sub-categories for animal production in UAA (number and percent). Source: Bagnoud, 2024 [79]

The grassland areas in the Valais are therefore roughly made up of 57% meadows, 43% pastures, and around 50% of these areas are considered as PPS.

Vineyards

This category is much less diverse than the previous one. It is essentially made up of vines. Only a small 0.2%, i.e. 9 ha, is reserved for vine nurseries. Even if you know that vines stay in place for many years, you must wonder where the seedlings for the Valais vineyards come from. Approximately 1,056 ha of vineyards are wine-growing areas with natural biodiversity that are considered as PPS. As such, like grassland, they are subject to stricter regulations: there are restrictions to be complied with, particularly regarding manuring, pesticides and mowing.

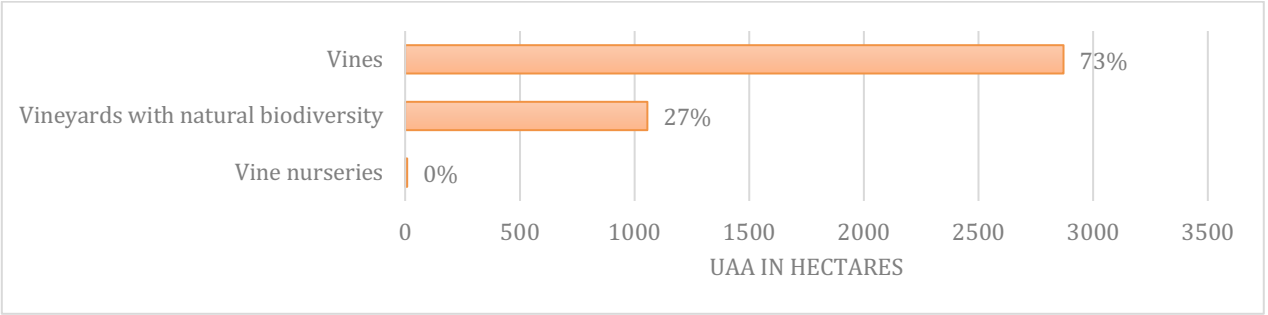


Figure 57 - Vineyard sub-categories in UAA (number and percent). Source: Bagnoud, 2024 [79]

Fruit growing

The climate conditions in the Valais are favourable to the cultivation of certain fruit crops such as apricots. The main crops are apples (976 ha), stone fruits such as apricots and cherries (721 ha), and pears (296 ha). There are also 32 ha of chestnut groves. Although aromatic and medicinal plants (48 ha) and perennial berries (30 ha) are not trees, we have chosen to classify them here because they are woody and perennial plants. Their production is therefore important in the Valais, because the difference in density between shrubs and trees must be considered.

[64] A great deal of information on SPBs can be found on the website promoting biodiversity in Swiss agriculture: http://www.bff-spb.ch/les-surfaces-de-promotion-de-la-biodiversite/

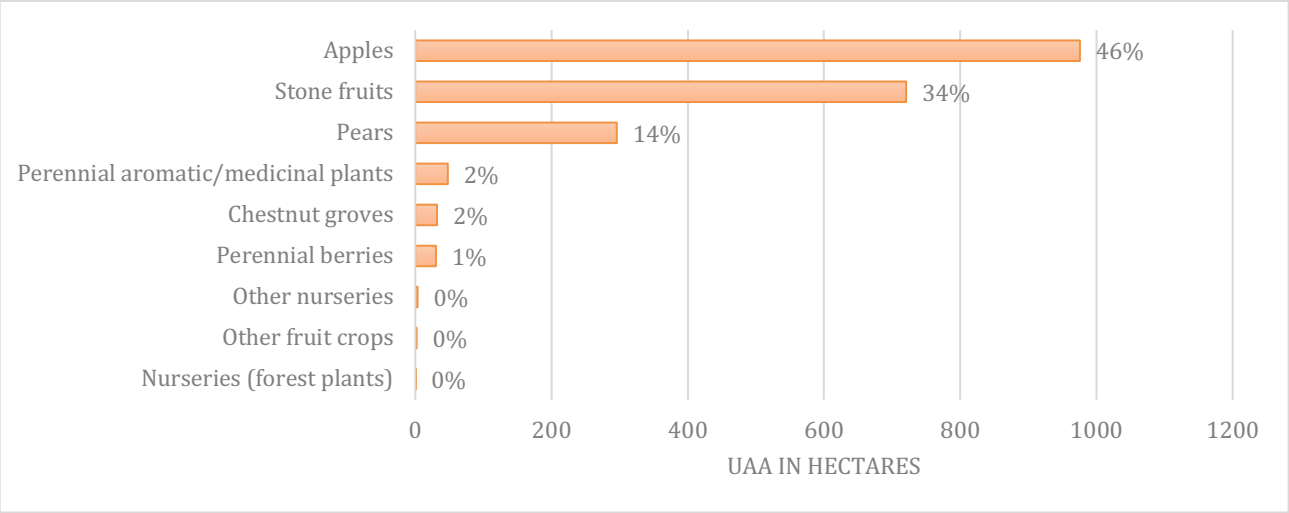


Figure 58 - Arboriculture subcategories in UAA (number and percent). Source: Bagnoud, 2024 [79]

Field crops (for human consumption)

I have tried to make a distinction between field crops that produce food for human consumption and those that produce food for animal production, because we thought it would be interesting to see how much of the UAA, in addition to grassland, was used for animal production. However, this distinction should be treated with caution. For some categories it is obvious whether they are for human consumption or for animal production, but for others it is much less obvious, and sometimes some crops can be used for both purposes. we have therefore tried to make this distinction as clearly as possible, with the help of an OFAG employee. By field crops we mean not only cereals, oilseeds and protein crops, but also potatoes and sugar beet (Swiss Confederation, Agroscope). In the Valais, we can immediately see a diversity of crops, although some are still in the majority. Winter wheat (431 ha) dominates, followed by rye (154 ha), potatoes (130 ha) and sugar beet (81 ha).

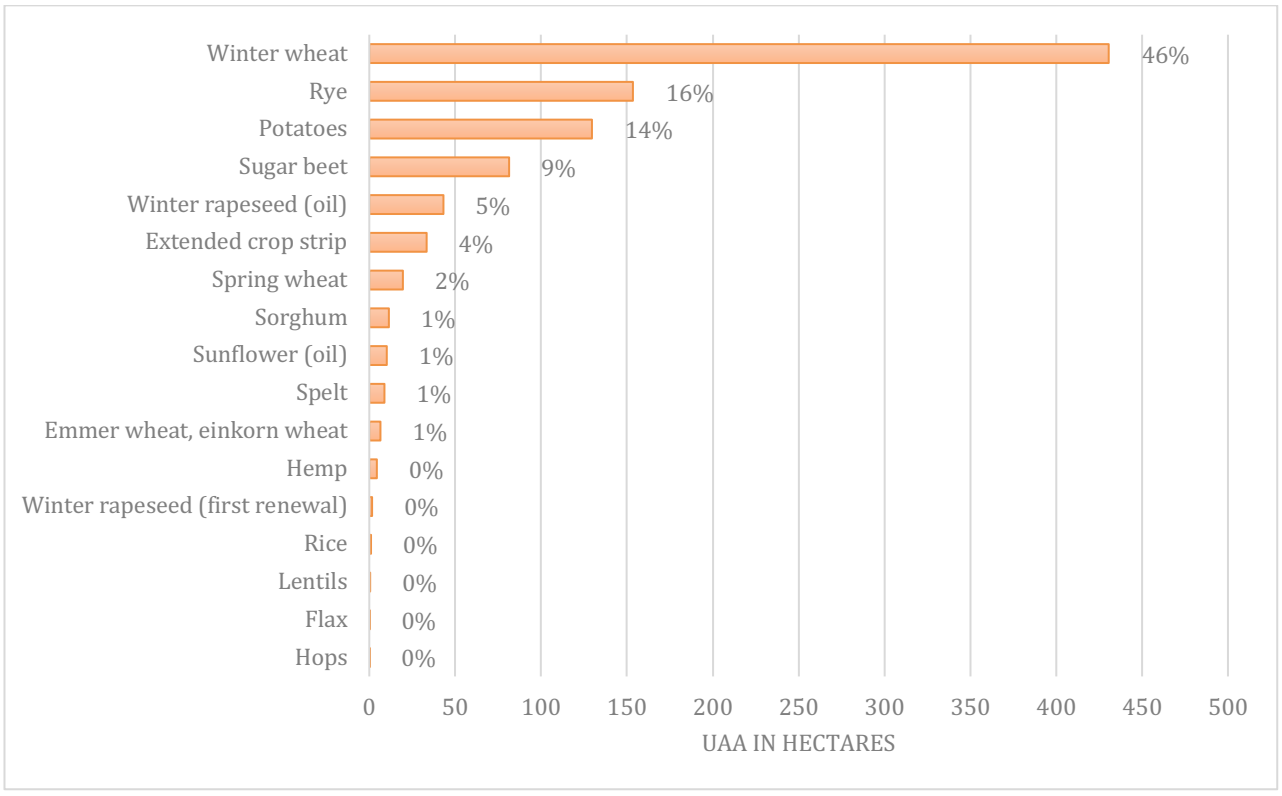


Figure 59 - Percentage of field crop sub-categories (human consumption) (percent and UAA). Source: Bagnoud, 2024 [79]

Field crops (for livestock production)

The production of fodder for livestock is largely dominated by maize. Silage maize and green maize account for 497 ha and grain maize 241 ha. All the other categories are grown in the Valais, but to a lesser extent.

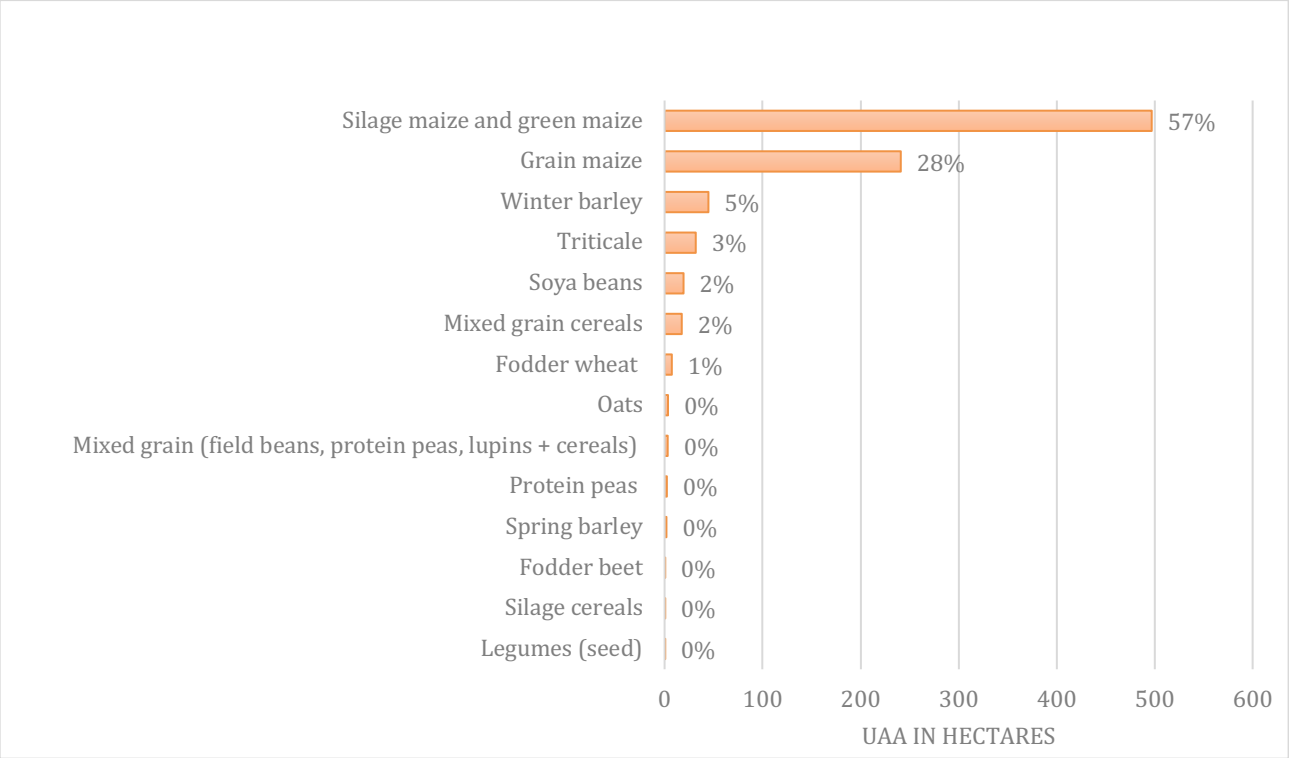


Figure 60 - Percentage of field crop sub-categories (for animal production) (percent and UAA). Source: Bagnoud, 2024 [79]

Market gardening

This category covers all production of perennial or annual plants that are not woody and that do not fall into the field crop category because of the way they are grown.

More than half of market garden production is classified as *annual field market gardening (excluding preserved vegetables)*, representing 147 ha. Asparagus, mentioned above, occupies 53 ha. Annual berries are also important in this category, accounting for 44 ha.

The most interesting aspect of this study is the *permaculture* category, which represents a total of one hectare. Admittedly, this is a very small figure, but it is important to highlight the fact that permaculture is recognised by the Swiss Confederation as a professional method. It is defined in the acreage catalogue as *"a mixture of different crops on a small scale, with more than 50% special crops"*. According to Article 15 of the Federal Ordinance on Agricultural Terminology and the Recognition of Forms of Farming of 7 December 1998 (= OTerm, RS 910.1), *"Special crops include vines, hops, fruit crops, small fruit, vegetables (excluding preserved vegetables), tobacco, medicinal and aromatic plants and mushrooms"*. This definition highlights the fact that permaculture is polyculture. We will, of course, come back to the definition of permaculture.

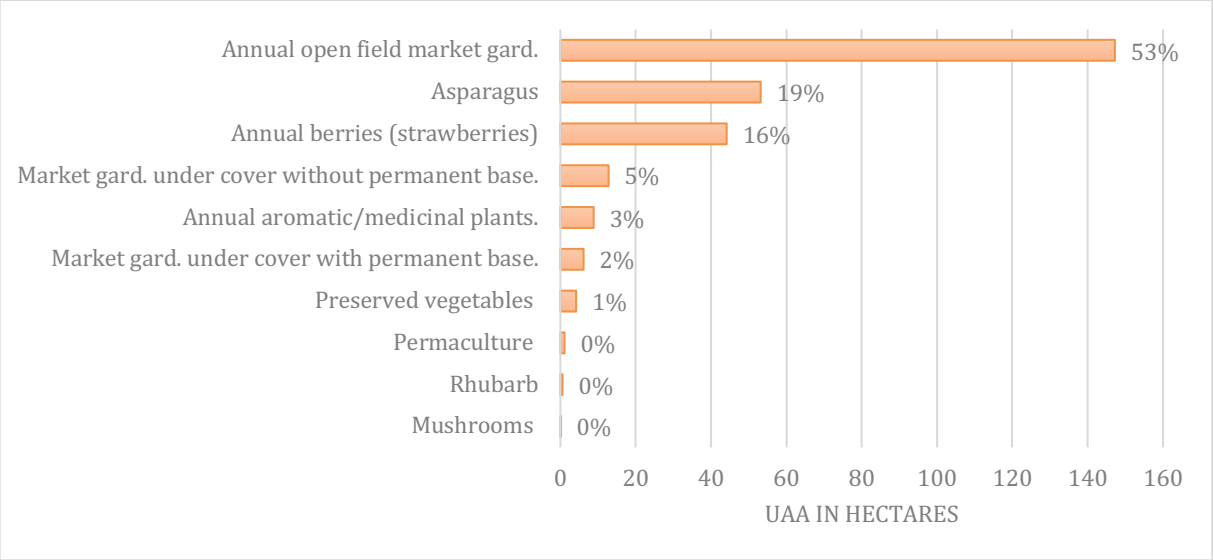


Figure 61 - Percentage of market garden sub-categories (percent and UAA). Source: Bagnoud, 2024 [79]

Other crops

I had to create a category for *other crops*, firstly because a number of these crops didn't fit into the other categories, where it was impossible to know exactly what they produced because they are themselves more diverse categories; and secondly, some categories stood out from the most common ones, because they don't fit into the Valaisan food system.

In this category, there are essentially seven SPBs, representing 126 ha out of a total of 148 ha. A few "other" categories are included here, as it is impossible with the information obtained to determine their exact production. The remainder are horticultural crops, Christmas trees or ornamental bushes, which account for a very small number of UAAs.

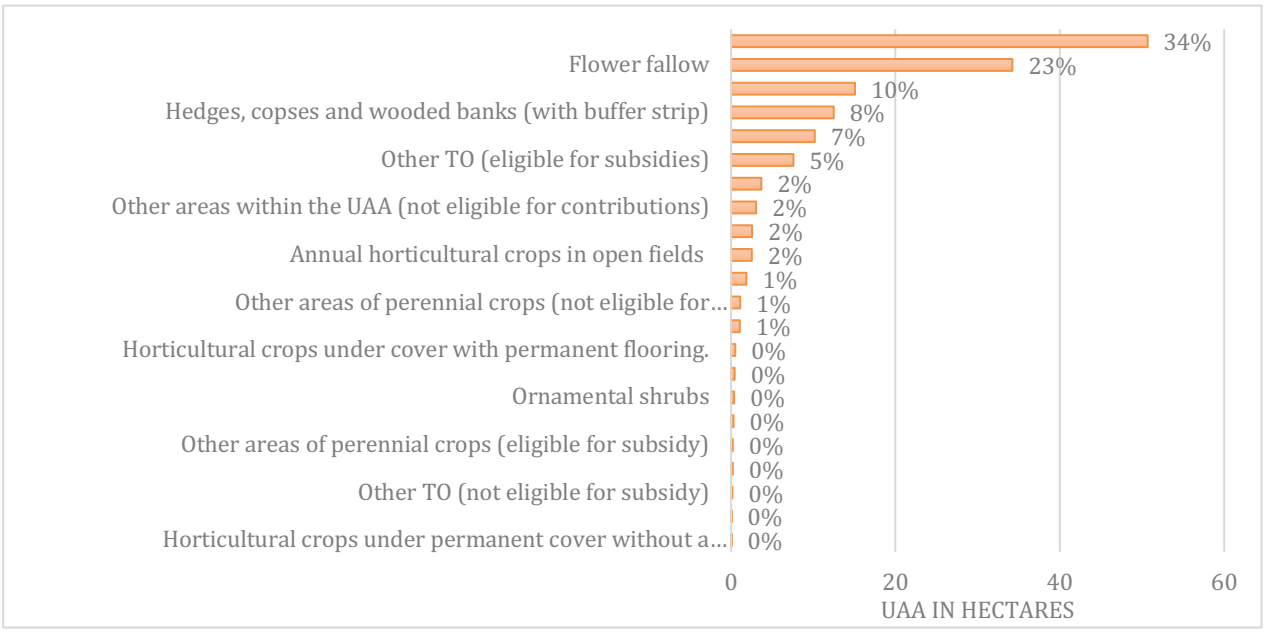


Figure 62 - Percentage of sub-categories in the other group (percent and UAA). Source: Bagnoud, 2024 [79]

In our quest to understand agriculture in the Valais today, we have already seen how UAAs are used. More than three quarters of this land is meadow and pastureland, which is largely used for livestock rearing: this activity is very present in the Valais landscape and is characteristic of mountain farming.

We will now analyse the different types of livestock farming found in the Valais. To do this, we use livestock units (LU), which enable us to compare different livestock farms. For example, according to the synoptic table of contributions according to land use (2018), a dairy cow corresponds to 1 LU, a mother sow to 0.55 LU, a milking ewe to 0.25 LU, a milking goat to 0.20 LU and 100 laying hens to 1 LU. We're going to look at different categories that we have created for the same reasons mentioned above in relation to UAAs. These categories are presented hierarchically: from the most to the least numerous livestock.

Cattle breeding

Unsurprisingly, the most important livestock in raclette country is cattle, with a total of 19,014 LU. Dairy cows make up just over half of the Valais cattle herd. Cows fall into this category as soon as they are milked. The "other cows" category includes mother cows. The other categories are calves and young cattle.

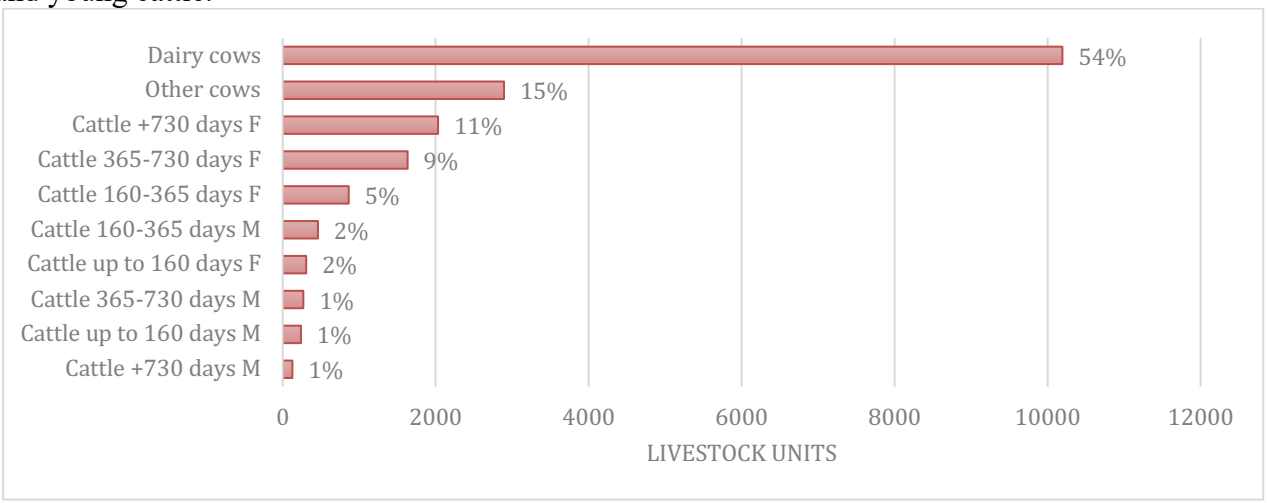


Figure 63 - Percentage breakdown of the cattle rearing category (percent and LU). Source: Bagnoud, 2024 [79]

Sheep farming

Sheep come second with 5,025 LU. This time, the proportion of ewes milked is very marginal. Almost all Valais sheep are adult ewes that are not milked.

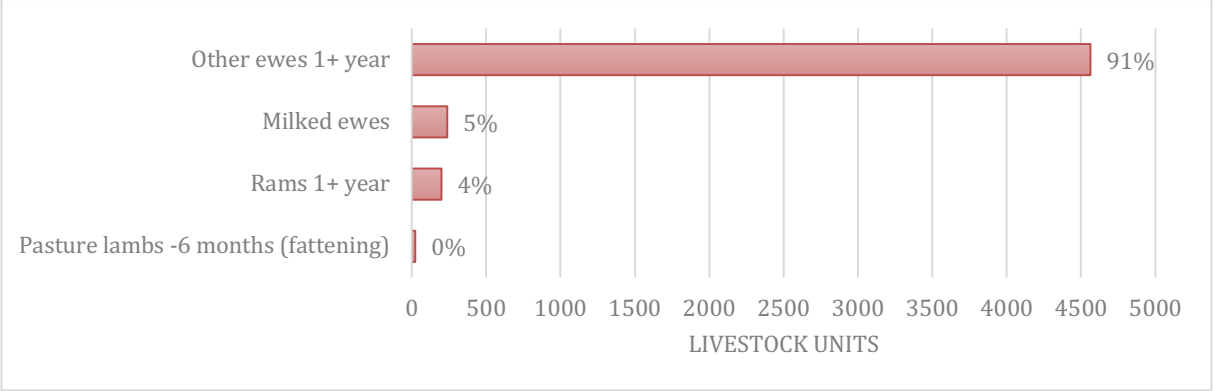


Figure 64 - Percentage breakdown of sheep category (percent and LU). Source: Bagnoud, 2024 [79]

Breeding or keeping horses

There are many horses in the Valais. However, these animals do not enter the food chain. As AGRIDEA (2018) states: "*Swiss horse breeding does not pursue a food production objective*".

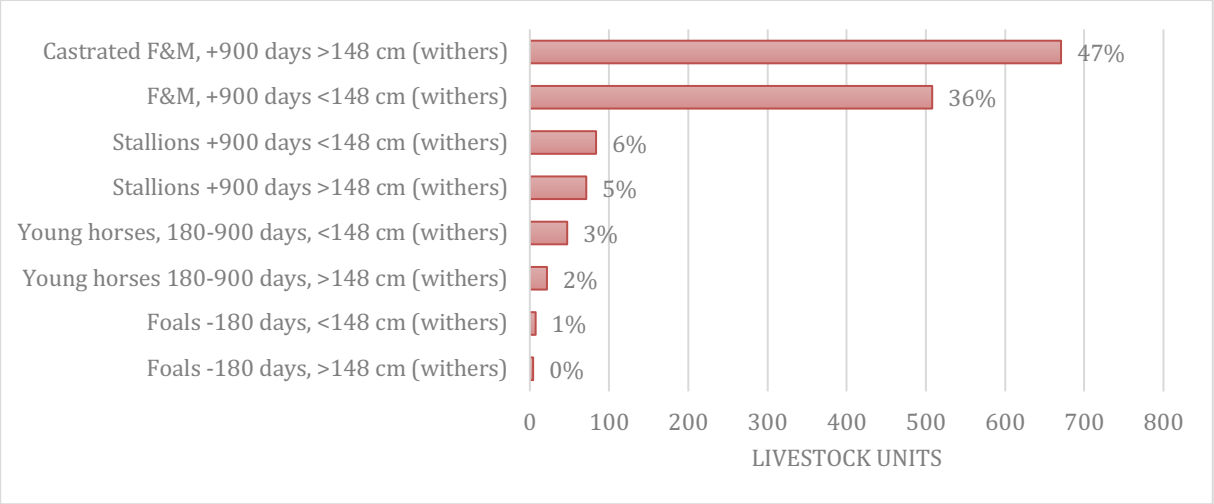


Figure 65 - Percentage breakdown of the equine slaughtering/holding category (percent and LU). Source: Bagnoud, 2024 [79]

Goat farming

There is a total of 939 LU of goats in the Valais. The proportion of milked goats is higher than the proportion of ewes, but remains marginal compared with cattle. The other goats are kept either for meat production to promote regional breeds or for pleasure.

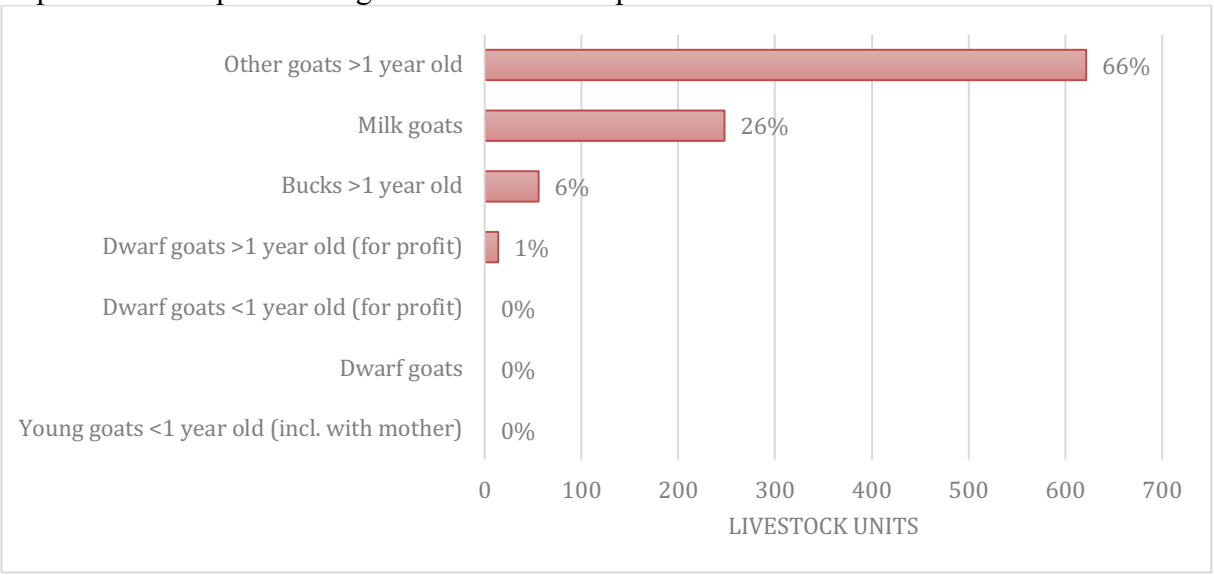


Figure 66 - Percentage breakdown of the goat rearing category (percent and LU)). Source: Bagnoud, 2024 [79]

Poultry farming

Of the 563 LU of poultry, almost all are laying hens. The other categories are almost non-existent.

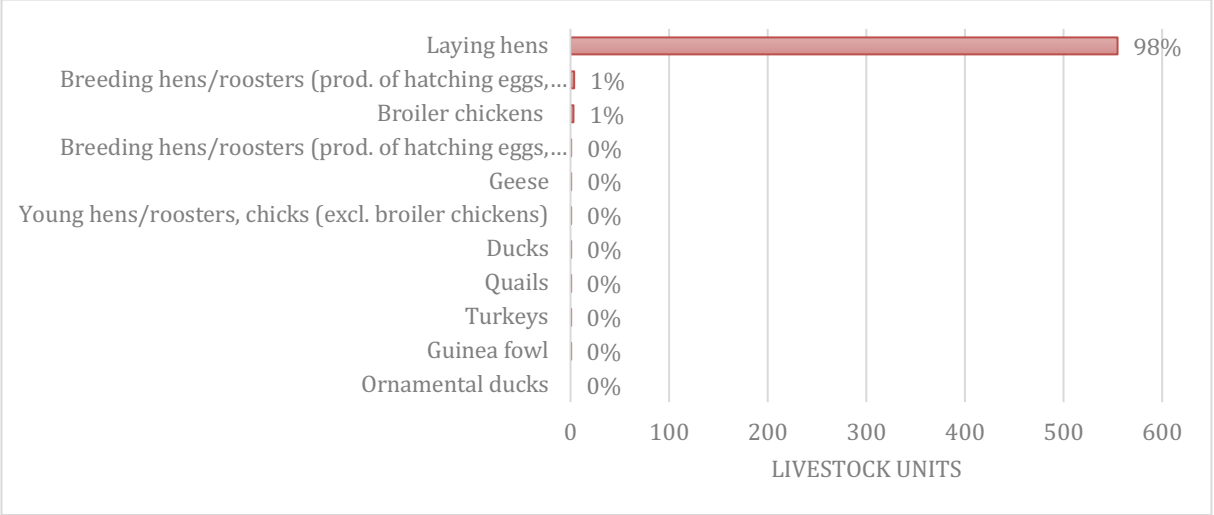


Figure 67 - Percentage breakdown of the poultry farming category (percent and LU). Source: Bagnoud, 2024 [79]

Pig farming

Pig farms are rather rare: there are only 262 LU in the Valais. Almost all of these are pigs for meat production or to replace sows.

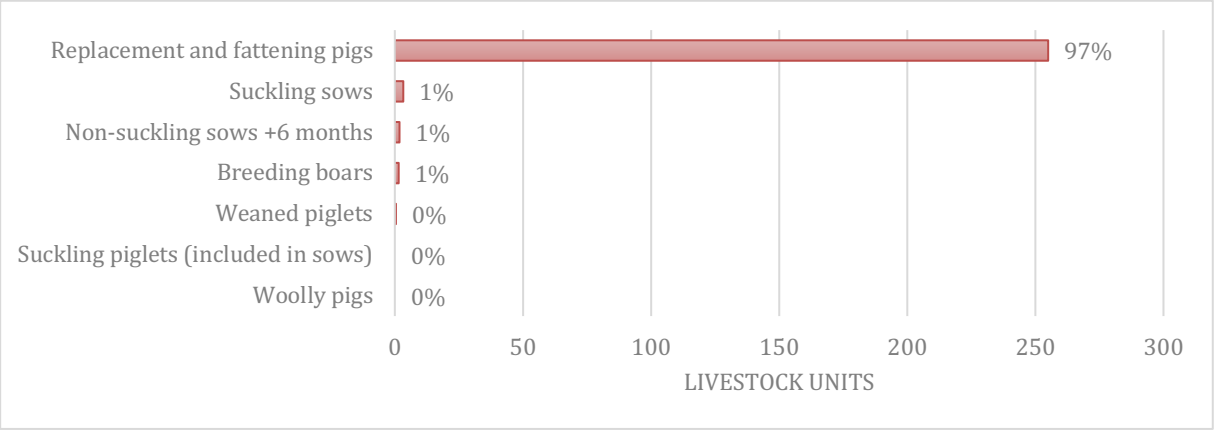


Figure 68 - Percentage breakdown of pig farming category (percent and LU). Source: Bagnoud, 2024 [79]

Other farms

There are a number of farms that are not very common in the Valais. They are few in number and represent only 60 LU in total. This category therefore includes farms with alpacas, llamas, fallow deer, red deer and rabbits.

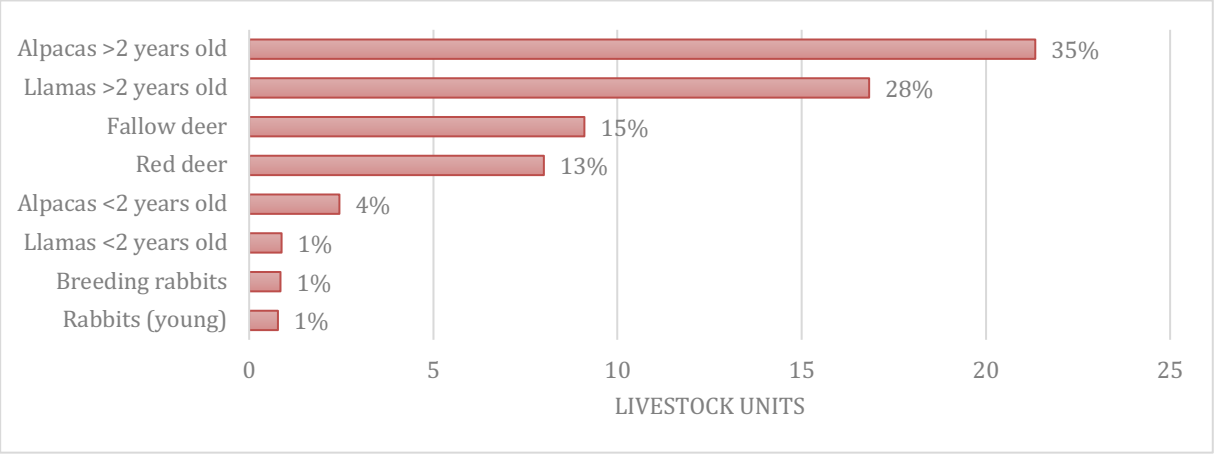


Figure 69 - Percentage breakdown of the other livestock category (percent and LU). Source: Bagnoud, 2024 [79]

In view of what we have discussed so far, we can say that agriculture in the Valais follows the logic of conventional farming. The first important finding is that there are only 346 organic farms, compared with 2,145 conventional (or integrated) farms. Even if some farmers are organic without certification, particularly in the case of assembly farms, the vast majority of farms in the Valais are conventional. The second observation relates to the way in which agricultural statistics are compiled in the Valais Canton and Switzerland, and even in the context of this study. There is a categorization according to type of production. These categories are characteristic of a conventional logic. You don't need to do any in-depth analysis to understand this. You only have to go to the Rhône plain to see monocultures of fruit trees on the plains, and monocultures of vines on the mountainsides. So, we are in a logic of specialization and major simplification of agrosystems, which is part of the conventional logic (Morel, 2018 p. 27).

Other trends are confirmed by the agricultural statistics for the Canton of Valais. Agricultural modernization is leading to a reduction in the number of farms and a trend towards larger farms. This is what is happening in the Valais. Between 2011 and 2020, the Valais lost 1,043 farms of less than 10 hectares. This trend is less marked for farms of between 10 and 30 hectares, with a loss of 95 farms. Only farms of 30 hectares or more have increased: 38 more farms. And this despite the fact that the UAA rose from 1,051,866 in 2011 to 1,055,034 in 2020. As a result, the average surface area

per farm has increased: from 18.3 hectares in 2011 to 21.2 in 2020 (Service de l'agriculture du Valais, 2022). The dependence of Valais agriculture on oil and pesticides is clear.
There has certainly been an increase in awareness, as we shall see from the speeches made by Valais farmers, particularly in view of the fact that the Valais was a pioneer in integrated production. However, we are currently a long way from achieving the high level of sustainability that the need to respect the planet's limits requires a significant reduction in the flow of materials and energy.

5.3.5 Importance of organic farming

Organic farming in Switzerland is unique in that its criteria, as applied by Bio Suisse, the federation of organic farmers, are more stringent than either the Federal government specifications or the EU specifications. A recent study provides insight into organic farming in Switzerland and its contribution to social and environmental outcomes. Basing themselves on the FAO Sustainability of Agriculture and Food Assessment (SAFA) Guidelines, a team of researchers identified that organic farming was relatively high-ranking: Average median theme values per dimension were as follows: [65]

1. 62% for Good Governance (s.d. = 17%)
2. 77% for Environmental Integrity (s.d. = 9.6%)
3. 70% for Economic Resilience (s.d. = 7%)
4. 87% for Social Well-being (s.d. = 6%)

The below figure taken from the article shows the performance of organic farms in terms of individual thematic indicators. What stands out is that most indicators associated with agroecology as a set of farming practices (animal welfare, water, land, biodiversity, atmosphere…) attain a median score of 65% or higher.

[65] Michael Curran et al., "Representative Farm-Based Sustainability Assessment of the Organic Sector in Switzerland Using the SMART-Farm Tool," *Frontiers in Sustainable Food Systems* 4 (November 2020), https://doi.org/10.3389/fsufs.2020.554362. Specifically, the Bio Suisse standard "contains more ambitious criteria, including a mandatory whole-farm approach, lower limits for concentrate feed in the diets of ruminants (10% vs. 40%) and promotion of on-farm biodiversity."

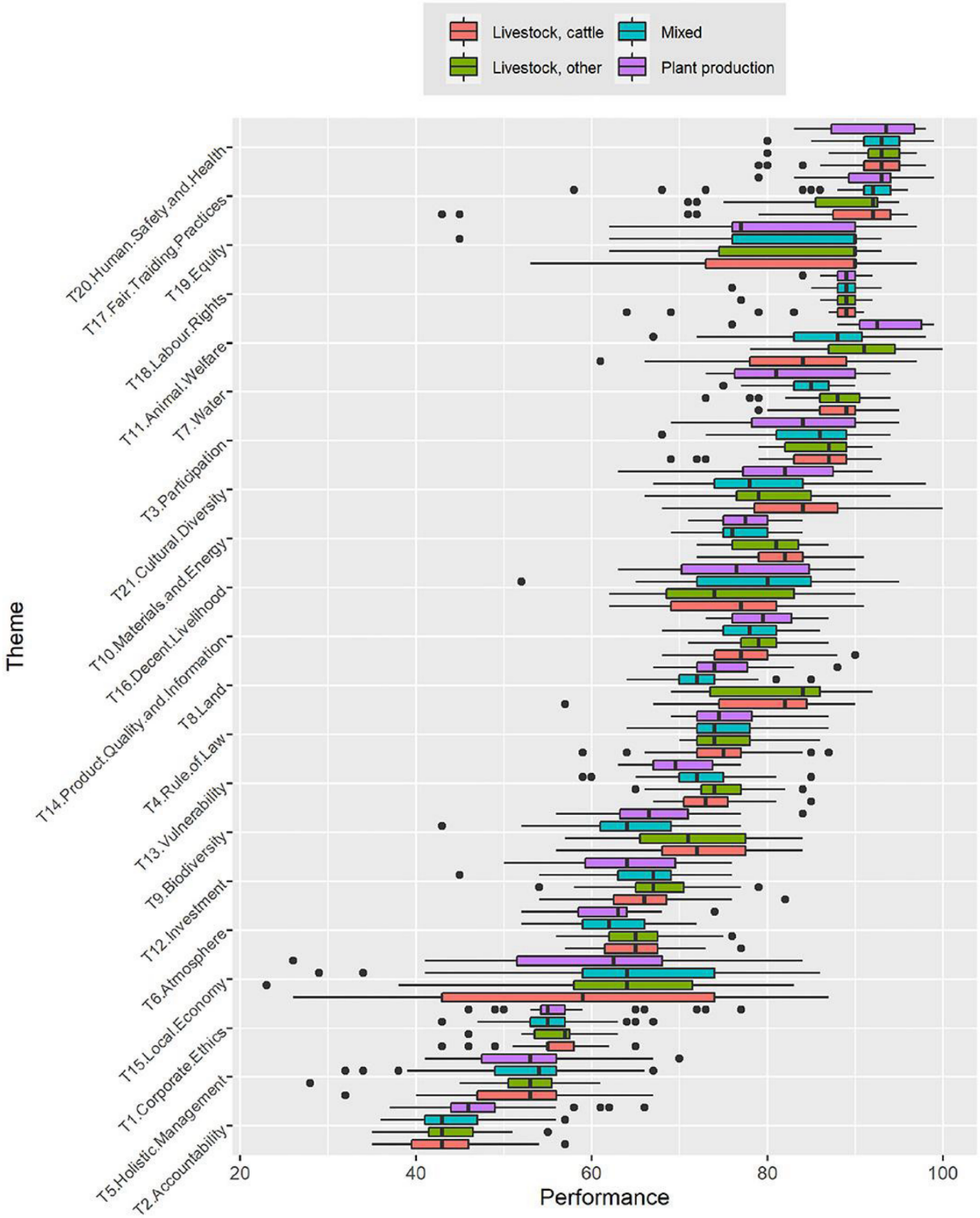


Figure 70 - Theme performance (in % goal fulfillment) according to simplified farm type. Source: Curran et al. (2020) [112]

5.4 Policies and Institutional Environment

5.4.1 Agricultural policy in the territory

Switzerland, a small country that is not a member of the European Union, has an agricultural sector characterized by small family farms, with an average size of 21 hectares and a predominance of grassland (75% of the UAA) [113]. In 2024, there were approximately 47,000 farms, employing around 1.7% of the country's working population. Every four years, the Federal Council adapts and adopts a new agricultural policy (AP) guiding the 3.6 billion Swiss francs allocated to agriculture in the state budget.

The Swiss food system, including production and consumption, is also the largest contributor to the national ecological footprint (28%) [114], and it is estimated that our poor diet is responsible for around CHF 18 billion in direct and indirect health-related costs [115].

The Swiss Constitution (Art. 104, added by popular referendum with a 75% yes vote in 1996) assigns three main tasks to agriculture:

- Ensuring security of supply;
- Conserving natural resources and maintaining the rural landscape;
- Maintaining decentralized land use.

These missions have evolved to include sustainability as an additional objective, integrating economic, environmental and social dimensions. The multifunctionality[66] of agriculture is therefore recognized in the Federal Constitution, highlighting its multiple roles, particularly in maintaining production, protecting natural resources, preserving landscapes, and maintaining rural employment. Agricultural policy thus seeks to balance and weigh the various economic, ecological, and social objectives while meeting society's expectations.

Article 104.3 of the Swiss Constitution lays out in more detail the ambition for agricultural policy in Switzerland. Specifically, the Constitution states that

"The Confederation shall organise measures in such a manner that the agricultural sector fulfils its multi-functional duties. It has the following powers and duties:

a. supplementing revenues from agriculture by means of direct subsidies in order to achieve of fair and adequate remuneration for the services provided, subject to proof of compliance with ecological requirements.
b. encouraging by means of economically advantageous incentives methods of production that are specifically near-natural and respectful of both the environment and livestock.
c. legislating on declarations of origin, quality, production methods and processing procedures for foodstuffs.
d. protecting the environment against the detrimental effects of the excessive use of fertilisers, chemicals and other auxiliary agents.
e. at its discretion, encouraging agricultural research, counselling and education and subsidise investments.
f. at its discretion, legislating on the consolidation of agricultural property holdings.

For these purposes, the Confederation shall provide both funds earmarked for the agricultural sector and general federal funds." [116]

Two aspects that stand out from this article are the Confederation's commitment to support farmers with revenue supplements and subsidies, and the importance of environmental considerations, including for these subsidies. Article 104*a*, which immediately follows article 104.3, sets out the Confederation's ambitions with regards to national food security.

[66] The multifunctionality of agriculture refers to considering the diversity of the economic, social, and environmental benefits of agriculture.

History of agricultural policy

The evolution of Swiss agricultural policy can be divided into several key phases. From 1848 (creation of the Swiss federal state) to 1920, the Confederation established a liberal economy in which trade with other countries was encouraged. Switzerland imported more foodstuffs, and this dependence did not seem to cause any concern.

However, the situation changed with the First World War. From 1920 to 1960, Switzerland implemented a protectionist system to support its agriculture. Agriculture became a pillar of national defence, with laws promoting investment and support for small family farms. It was following this period that the first direct payments to support mountain farming were introduced in 1959.

From the 1980s onwards, Switzerland faced external pressures, particularly through the GATT[67] negotiations, and internal economic pressures due to production surpluses and high agricultural commodity prices. These challenges led to a significant change in Swiss agricultural policy, with a gradual (re)liberalisation of agricultural markets and the widespread introduction of direct payments from 1993-1994 onwards. These payments marked the beginning of the decoupling of agricultural prices and incomes, and the introduction of ecological services as a prerequisite for direct payments.

Impacts and challenges of Swiss agricultural policy

Swiss agricultural policy has several positive effects, including preserving a supply based on domestic production and ensuring the maintenance of cultivated landscapes. However, agriculture, as shaped by previous agricultural policies, now exerts significant pressure on natural resources, with high use of fertilisers and pesticides, and significant pressure on biodiversity [117].

Economic and social challenges are also increasing for farms, with low wages and growing societal pressure. These challenges came to light in 2024 when Europe and Switzerland were marked by anger and protests from the agricultural community in response to changes in their working conditions. In Switzerland, the main demands were for fairer and more equitable pay in a world where production costs are rising without a corresponding increase in sales prices, greater recognition and, above all, a reduction in the bureaucratic burden imposed by agricultural policy.

One of the major challenges for the future is to feed a growing population while maintaining a high level of self-sufficiency. Intensive agriculture, although necessary to maintain high production levels, places significant pressure on soil, water and biodiversity. Furthermore, the use of fertilisers and pesticides, although regulated, remains a major concern for the environment. Swiss agricultural policy must also strike a balance between market liberalisation and price protection to ensure sustainable agriculture. Recent votes on issues such as food safety and pesticide use demonstrate the importance of these issues in public debate.

Recent reforms and prospects

Recent reforms to Swiss agricultural policy aim to reduce emissions, use resources efficiently and ensure sufficient food supplies. These reforms include contributions for biodiversity, collective projects for the protection of natural resources, and the creation of agricultural systems adapted to local conditions. Direct payments thus play a central role in supporting farmers while promoting sustainable production practices by requiring minimum ecological services.

In 2021, the review of the Agricultural Policy 22+ (AP22+) was suspended by the National Council, after the same decision had been taken by the Council of States. One of the reasons given was a lack of consistency in the various proposals presented. As a result of this

[67] WTO, "The General Agreement on Tariffs and Trade (GATT 1947)," 1947, https://www.wto.org/english/docs_e/legal_e/gatt47_e.htm. An international free trade agreement signed by 23 countries with the aim of harmonizing customs policies and promoting the free movement of goods.

suspension, the Federal Council had to submit a document to Parliament on the "future direction of agricultural policy" in 2022. This allowed parliamentary discussions on PA22+ to reopen in 2023, and it was finally approved in a reduced form and will come into force in 2025. In particular, the biodiversity and climate targets have been revised downwards.

This Federal Council document on "the future direction of agricultural policy" lays the foundations for agricultural policy development in the coming years. In particular, the document shifts the focus to a systemic "farm to fork" approach, concentrating primarily on the objective of food security. Farmers have welcomed this systemic approach, as it allows them to share responsibility for a sustainable and healthy food system with other actors in the food chain. Based on this document, the Federal Office for Agriculture (FOAG) now has a mandate to lay the groundwork for future agricultural policy for 2030+ (AP 30+). Parliamentary deliberations will begin in 2026.

The future PA30+ agricultural policy will need to address the four objectives outlined in the document, namely address these four objectives described in the document "Future direction of agricultural policy" by the Federal Council:

- Guaranteeing food security on the basis of diversified domestic food production corresponding to at least the current level of self-sufficiency;
- Reducing the ecological footprint, from agricultural production to food consumption, taking imports into account;
- Improving the economic and social prospects for agriculture and the agri-food sector;
- Simplification of instruments and reduction of administrative burdens.

Current discussions surrounding this PA30+ policy are marked by points of tension, particularly concerning the involvement of processing and distribution stakeholders, freedom of consumption patterns, and animal production and consumption.

It is interesting to note that, until recently, food had been considered almost exclusively at the agricultural level, reducing the scope of action of "Food" solely at the agricultural level. Even today in Switzerland, most public policies relating to food are found at the agricultural level, through agricultural policy. At the processing, distribution and consumption levels, the measures in place relate almost exclusively to food safety in order to avoid the risk of contamination. As a result, incentives and regulations are not used at these stages of production and consumption to guide stakeholders towards healthier and more environmentally friendly processing and consumption.

Goals of Swiss agricultural policy

The Federal Office for Agriculture (FOAG) sets out the overarching objectives of Swiss agricultural policy, within the framework of existing regulations. It defines the features of agriculture in Switzerland that are to be protected, while underlining the contributions that farms are expected to make to features such as the landscape, food supply, and biodiversity. FOAG makes the distinction between the functions expected of two different kinds of farms: ordinary farms (*exploitations*), and farms utilising summer pastures (*estivage*).

Direct payments and subsidies

As of the latest reform of Swiss policy on agricultural subsidies, subsidies (direct payments) are distributed to farmers on a two-tier system.

First, at the basic level, farms must show proof that they are practicing environmentally friendly agriculture if they wish to receive any payments at all. This is called “Proof of Ecological Performance (Prestations écologiques requises, or PER).” Compliance with the PERs is a prerequisite for receiving any direct payments at all. There are six PERs, relating to the following:[68]

- Animal welfare: Observe the provisions of the Animal Welfare Act.

[68] Swiss Farmers, *Labels and Programmes Switzerland*, 2025, https://www.swiss-farmers.ch/knowledge/production/labels-and-programmes/. Federal Office for Agriculture (FOAG), “Prestations Écologiques Requises,” April 16, 2025.

- Fertiliser use: Demonstrate the balanced use of fertilisers. Farms are required to establish a nutrient balance and are only permitted to apply as much phosphorus and nitrogen as their crops require for growth. Further, some of the fertilised elements escape in the form of gas during storage and spreading of farm manure. These losses must be kept to a minimum.
- Soil protection: This is achieved by ensuring optimal soil coverage using winter crops or green manure, for example. The purpose of cover crops is to prevent erosion and nutrient leaching. Protection against erosion aims to prevent significant soil loss due to the exploitation of arable land. Further, soil must be analysed at least once every ten years in order to optimise the distribution of fertilisers across the various plots. The analysis indicates the quantity of fertilising elements present in the soil.
- Pesticides/plant protection: Plant protection products must be applied selectively taking into account risk models for various pests and diseases as well as epidemiological observations. Tolerance thresholds, which must not be exceeded, indicate when action should be taken to eliminate pests. Additional measures relate to water protection and using vegetated buffer strips to reduce drift and runoff.
- Biodiversity: Farms are required to allocate at least 7% of their utilised agricultural area (3.5% for special crops) to promoting biodiversity. To do this, farmers have several types of biodiversity promotion areas (BPA) at their disposal.
- Crop rotation: To meet the conditions imposed for the PERs, farms with more than three hectares of open land must comply with regular crop rotation.

Second, since 2023 it has become possible for farmers to earn additional subsidies if they engage in so-called "Contributions to production systems (Contributions aux systèmes de production, or CSP)." The main themes in the CSP are as follows [118],[119]:

- Supporting organic agriculture, both its plant-related and animal-related provisions
- Respecting the environment when using plant protection products: non-recourse to herbicides, and insecticides, and promoting helpful organisms
- Contributions to functional biodiversity
- Preserving soil fertility: cover crops, direct sowing, strip sowing and mulch sowing
- Managing nitrogen balance in the soil in annual crops: nitrogen application cannot be above 90% of the need of the plants
- Animal husbandry:
    - animal-friendly housing systems, regular time outdoors, pasturing outdoors,
    - increasing the productive lifespan of cows
    - promoting milk and meat production that is adapted to local conditions - intended to help farms that meet their fodder requirements mainly through grass, hay, second-cut hay and grass silage

As concerns ordinary farms, according to the Federal Office for Agriculture (FOAG), direct payments exist to support and reward the following features of agricultural activities [120]:

- Contributions to the cultivated landscape: "The Confederation provides support for the preservation of the cultivated landscape. It pays a contribution for the maintenance of open landscapes to compensate for natural handicaps in hilly and mountainous regions. Contributions for sloping land and steep slopes encourage the use of land that is difficult to farm. The Confederation pays a contribution to year-round farms for taking their animals to alpine pastures. Summer grazing farms receive a summer grazing contribution for the sustainable use of alpine pastures."
- Contributions to food supply: "The Confederation promotes the supply of food to the population through contributions to security of supply. It supports food production in various regions of Switzerland and the cultivation of different crops."
- Contributions to biodiversity: "Biodiversity refers to the variety of life forms. It provides numerous ecosystem services, many of which are fundamental to agriculture. Examples

include pollination, soil fertility and natural pest control. The Swiss Confederation intends to compensate farmers for the appropriate use of their land by granting biodiversity contributions. In this way, it aims to preserve and promote native species and their habitats in agriculture."

- Contributions to overall landscape quality: "These contributions make it possible to take into account regional needs and cultural values related to the landscape, such as maintaining wooded pastures, caring for chestnut groves, or promoting arable farming in mountain regions. In this way, they help to maintain, encourage, and develop attractive landscapes."
- Contributions to overall production systems: "The Confederation promotes environmentally friendly and animal-friendly forms of production in Swiss agriculture through production system contributions."
- Contributions to effective use of resources: "The Confederation promotes environmentally friendly agricultural practices through contributions towards the efficient use of resources. In this way, it supports farmers in optimising resource use and reducing environmental impact."
- Contribution to transition: this is a measure to help farmers adapt to the new agricultural policy: "The transitional contribution enables the transition to the direct payment system under the 2014-2017 agricultural policy to take place under socially acceptable conditions. Farms have had time to react and adapt to the changes, where necessary."

As an example, under the "biodiversity" heading, the Federation gives subsidies for farms that have high-intensity biodiversity infrastructure, such as grasslands, hedges, or flower fallow (see complete list in footnote).[69] Depending on the "quality level" of this infrastructure, and depending on their location in the agricultural "zones" described above, farmers receive a set amount of subsidies, in Swiss francs, for each hectare fitting the description of a contribution to biodiversity [121].

Meanwhile, summer alpine pasture farms (*exploitations d'estivage*), resembling what can be seen above, are seen as contributing to a different set of objectives, of which there are three [122]:

- Contributions to the cultivated landscape: "The Confederation provides support for the preservation of the cultivated landscape. It pays a contribution for the maintenance of open landscapes to compensate for natural handicaps in hilly and mountainous regions. Contributions for sloping land and steep slopes encourage the use of land that is difficult to farm. The Confederation pays a contribution to year-round farms for taking their animals to alpine pastures. Summer grazing farms receive a summer grazing contribution for the sustainable use of alpine pastures."
- Contributions to landscape quality: "These contributions make it possible to take into account regional needs and cultural values related to the landscape, such as maintaining wooded pastures, caring for chestnut groves, or promoting arable farming in mountain regions. In this way, they help to maintain, encourage, and develop attractive landscapes."
- Contributions to biodiversity: the stated goal is identical to that of ordinary farms: "Biodiversity refers to the variety of life forms. It provides numerous ecosystem services, many of which are fundamental to agriculture. Examples include pollination, soil fertility and natural pest control. The Swiss Confederation intends to compensate farmers for the appropriate use of their land by granting biodiversity contributions. In this way, it aims to preserve and promote native species and their habitats in agriculture."

[69] The examples given by FOAG are:). extensive grasslands, low-intensity grasslands, extensive pastures, wooded pastures, litter areas, hedges, copses and wooded banks, riparian grasslands, flower fallow, rotational fallow, extensive crop strips, field margins on arable land, vineyard areas with natural biodiversity, and areas promoting biodiversity specific to the region, standard fruit trees, and isolated native trees suited to the site and tree-lined avenues. Federal Office for Agriculture (FOAG) and Federal Department of Economy, Training, and Research (DEFR), *Paiements Directs, Contribution in Situ, Contributions à Des Cultures Particulières et Supplément Pour Les Céréales Aux Exploitations à l'année* (2024).

Thus, both ordinary farms and summer alpine pasture farms are expected to contribute to the quality of landscape and to the conservation of biodiversity.
As a counterpart, to access these subsidies, Swiss farms must provide "Proof of Ecological Performance" (Prestations écologiques requises/PER), which concern six themes as detailed above: animal welfare, fertiliser balance, biodiversity, crop rotation, soil protection, and plant protection. This is the subject of the following section.

As for opportunities at the Cantonal level, ACAV[70] has published a list of nine agricultural initiatives inspired by themes in the CSP for which Valais farmers are eligible [123], while the Valais Canton has laid out seven CSP measures that are specific to viticulture [124].

Swiss agricultural policy is thus a complex and evolving system that responds to the challenges of sustainability, competitiveness, and food security. Future reforms will need to continue to balance these different objectives while taking into account growing social, economic, and environmental pressures.

Land use and land reform policies
The main land use and land reform policies that can have an impact on the agroecological transition are embedded within Swiss agricultural policy, particularly its focus on environmentally friendly agriculture. Direct payments that are conditional on ecological requirements and biodiversity protection tend, for example, to favour extensive agriculture as opposed to intensive agriculture, and they also protect traditional land use categories such as alpine grazing. The policies encourage diversified land use and promote maintenance of unfertilized meadows and extensive grasslands, which is coherent with agroecological practices.

More specifically, Swiss agricultural policy mandates that at least 7% of every farm's surface area consist of "ecological compensation areas" (ECAs). These are semi-natural habitats consisting of extensively used grassland, hedgerows and bushes, wildflower strips, or other elements. Virtually all surfaces falling under the ECA definition must pesticide- and fertiliser-free, and in extensive meadows grass must be mown at specific times allowing flowers to turn into seeds [125]. Farmers must comply with the ECA policy if they are to receive direct payments. The policy therefore impacts land use and supports the agroecological transition.

An additional policy impacting land use is the revision of direct payments in 2001, whereby additional financial incentives were provided to farmers for linking up ECAs at the local level. Receipt of subsidies is conditional on there being a regional plan to develop these networks [126]. This policy promotes ecological corridors and wildlife conservation.

Within the Valais Canton, one development that has transformed land use is the development of the Raclette cheese PDO (Appellation d'Origine Contrôlée/Protected Designation of Origin). Initially, the PDO was meant to protect traditional forms of raclette production, such as extensive grazing in high alpine meadows, and production characterised by "heating milk over a wood fire, fluctuations in milk quality depending on the day, weather and pastures, managing lactic cultures for curdling, removing and pressing cheese in cloths on a daily basis." [106] However, the PDO did not include any environmental or altitude considerations, the consequence of which is that intensive farms in the plains began to produce raclette under the PDO. As a result, as Bernard (2024) observes (translated from French),

> *"By professionalising and structuring the sector, [the PDO] has made production more profitable, including for farms located outside the traditional areas of origin. This creates a risk of denaturing the product, with a gradual loss of its link to its origins, particularly if the production of Raclette du Valais expands into the plains. Paradoxically, this expansion,*

[70] Association pour les Contrôles Agricoles en Valais (Association for Agricultural Monitoring in the Valais), mandated by the Valais Canton for enforcing agricultural norms, including PERs.

authorised by the PDO zone defined in the specifications, could weaken the authenticity and specificity of the product, thereby compromising the added value that the PDO label is supposed to guarantee." [106]

Thus, the spread of the raclette production into the plains is a novelty that has followed the introduction of the PDO. The decline in traditional practices in higher-altitude valleys has an impact on the ecological balance of the region: it may "alter local biodiversity and modify ecological dynamics, thereby compromising the long-term sustainability of ecosystems." [106] Specifically, new breeds of cows introduced for their higher productivity are heavier and modify the local soil structure, and the abandonment of wood fires has reduced logging activities at middle and high altitudes, which alters the ecological balance of the terroir [106]. The raclette PDO is discussed in greater detail as a case study in the section on Categories and ideal types of farms (above).

Productivity improvement strategies

Soil health

At the Federal level, as noted above in the section on environmental regulations, the Swiss Federal Council has adopted a Soil Strategy with six overarching objectives (see above). Further, as a reminder, farmers are also obligated to show proof of ecological performance (*prestations écologiques requises*, or PER) to receive direct payments. Three of the PER relate to soil health [127]:

- Diversify crop rotations and maintain ecological compensation areas (minimum 7% of land) to prevent degradation and protect structure
- Balance fertiliser application and limit use of plant protection products
- Adopt core soil conservation practices to qualify for direct payments, including reduced tillage and continuous soil cover

Conditionality of these PER mean that soil health is at the forefront of Swiss agricultural policy, including at the Cantonal level. Finally, as explained above, the Canton has in place a plan to protect Crop Rotation Areas (Surfaces d'Assolement, or SDAs), including protecting soil fertility and promoting crop rotation.

Water management

The Valais is one of Switzerland's driest Cantons, so water management is of critical importance. Federal policy for water management and its overarching Cantonal declination has been explored above, as has the Canton's Water Strategy.

In addition to the overall policy orientations mentioned above, at the Cantonal level, subsidies can be obtained for several items relating to water [128]:

- Irrigation works
- Drainage
- Connection to potable water mains
- Installation of water troughs for animals
- Restoration of small waterways (10 cubic metres per second max.)
- Drip irrigation

It is worth mentioning a specificity of the Valais Canton, which is its "bisses." A bisse is an open trench that carries precious water from mountain streams - not without some acrobatics - to dry meadows and fields, vineyards and orchards [129]. Historically, there were up to 600 bisses in use. Today, there are 300 known bisses, of which 200 are still in use today [130]. Numerous hiking trails run alongside them. In the Picturegraph below from the Bisse de Clavau in the Valais Canton, one observes the hiking trail in grey to the left and the bisse water channel running uphill of the trail, to the right. The bisse is used to irrigate the surrounding vineyards.

Regions where bisses are implanted are mainly in the valleys leading down to Sion and those leading down to Brig, which have very low rainfall, as can be appreciated in the map below:

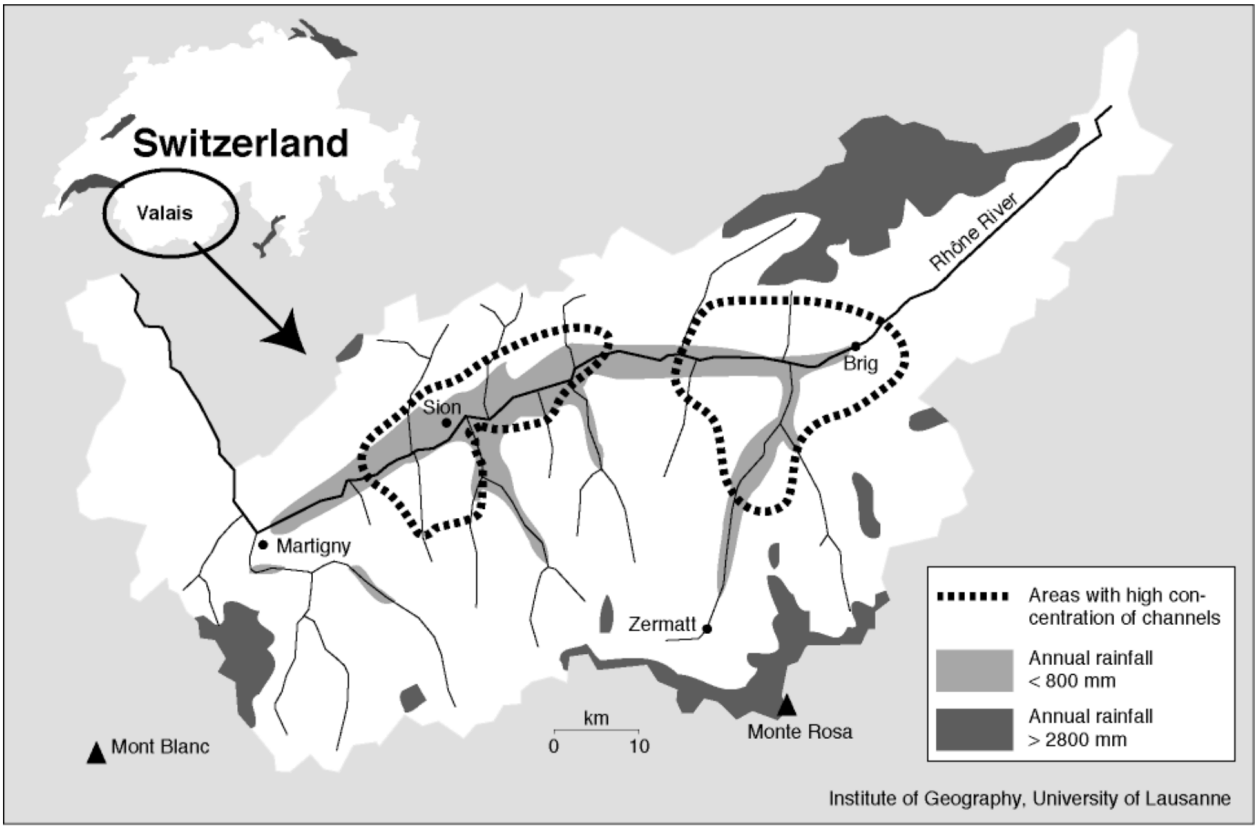


Figure 71 - Areas of concentration of bisses (water channels) within the Valais Canton. Source: Reynard [131]

Bisse maintenance is one of the water-related infrastructure projects that are eligible for Cantonal subsidies [128]. The subject is abundantly mentioned in on the website of the Valais Canton's Water Strategy, where it is clear that the interest in preserving the bisse is as much landscape-oriented as it is agriculture-oriented [132].



Figure 72 - Bisse de Clavau, Valais Canton. Source: Les Bisses du Valais, cited in House of Switzerland [133]

Crop selection

At the Federal level, the Federal Office for Agriculture (FOAG) is mandated to "ensuring a supply of high-quality varieties, seeds and seedlings for Swiss agriculture. To this end, it regulates the production and marketing of seeds and seedlings in ordinances." Official recognition in the national

catalogue of varieties requires two-year trials to confirm that the variety in question is more productive than existing varieties [134].
In addition to productivity, sustainability is taken into consideration when varieties are added to the national catalogue. Specifically, new varieties must be more "robust" than existing varieties, meaning that they [134]:

- are less susceptible to pests
- must be able to withstand extreme weather conditions
- require little mineral fertiliser
- require few phytosanitary measures

This means that crops permitted to be cultivated in the Valais Canton should, in theory, become more resilient over time through continued genetic amelioration, provided there is no trade-off between productivity on the one hand, and robustness on the other.
Agroscope, an agency of FOAG, also publishes annually the most-recommended varieties for a large panel of specie/crop families: cereals, rapeseed, fodder plants, maize, sunflower, potatoes, etc [135].
As for local initiatives, through bibliographical research, it was possible to identify a few crop and livestock improvement projects in the Valais Canton:

- Agroscope, the research arm of FOAG, has an entire station devoted to grapevine/wine experimentation in the Valais Canton and leads a large number of research projects concurrently in this field [136]. To give one example, a multi-stakeholder project is currently underway to catalogue and ameliorate varieties of the Arvine grape variety, taking into consideration climate change resilience and how growing conditions impact the wine's final flavour [137]
- A 2021-2025 project has as its objective to identify varieties of strawberries and raspberries that are both agronomically sound and easy to market (tasty, colourful, long-conservation, etc.) [138]
- Agroscope introduced two new varieties (Mia and Elsa) of disease-resistant apricot in 2018 [139], but the two varieties had very little uptake by farmers, for reasons related to economic viability, competition with other international varieties, and lack of auto-fertilisation capacity for these two varieties [140] Agroscope is also working on apple and pear varieties, but it is unclear whether these trials are located in the Valais Canton.
- A local biodiversity organisation is cataloguing and promoting the use of ancient varieties of crops, such as beans, buckwheat, and millet [141]
- There has been some movement regarding the breeds of milk cows raised in the traditional raclette-producing valleys of the Valais Canton. For example, the main indigenous cow breed in the Val d'Hérens is the d'Hérens variety, while the indigenous cow breeds in the Val d'Illiez are the Simmental, Red Holstein and Swiss Fleckvieh. In order to meet their milk quotas, farmers in the Val d'Hérens have recently begun to turn away from their traditional cow breed and raise the more productive Simmental, Grise, Swiss Fleckvieh or Red Holstein breeds, which has a negative impact on soil quality due to the heavier weight of these animals [106].

Sustainability and climate resilience measures

According to the Valais Canton, "In Switzerland, global warming is happening twice as fast as the global average. Due to its geographical location, the average temperature there has risen by 2.6°C since 1864, compared to around 1.3°C globally. The Valais region is particularly affected by this phenomenon of accelerated warming." [142]

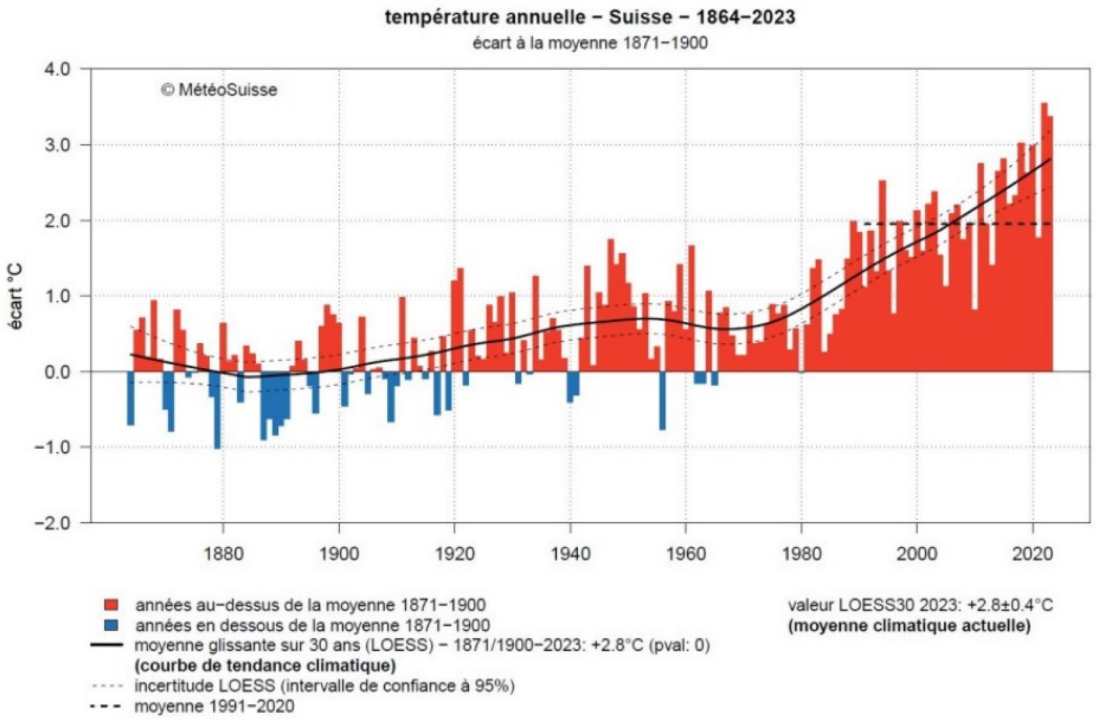


Figure 73 - Annual average temperature in Switzerland, 1864 to 2023 - departure from the mean of 1871 to 1990 . Source: Reynard, 2024 [143]

At the same time, precipitation has become increasingly erratic, as this example of overabundant rainfall from October 2024 illustrates:

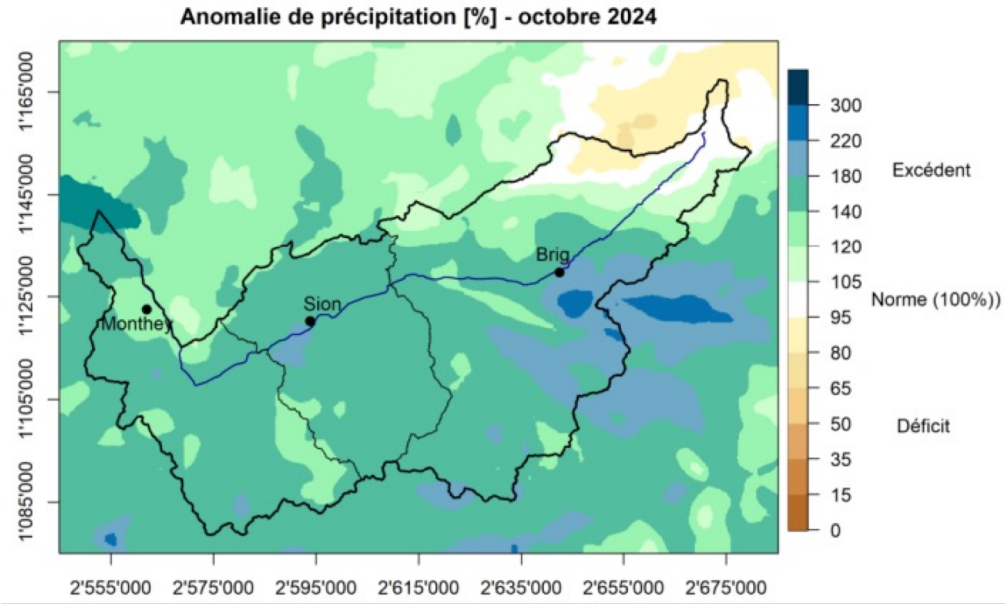


Figure 74 - Deviation from normal precipitation volumes in the Valais Canton in October 2024. Source: Canton du Valais, 2024 [144]

In response to these challenges, the following are some initiatives and local actions supporting sustainability and climate resilience, by theme.

Crop diversification

- As noted above, farmers in the Valais can receive direct payments only if they comply with PERs, one of which is increased crop rotation [145]
- The Valais Canton has a strategy in place to 2030 for arboriculture and horticulture, part of whose actions will include promoting crop diversification, and preparing for growing new crops, in response to climate change [146]

- In response to increasingly hot summer temperatures, one farmer in the Valais Canton is planting olive trees in his grape plantations [147]
- In response to unpredictable weather, especially frost, which has a strong impact on apricots, arboriculturists in the Valais Canton have started to grow peaches instead [148]
- Internationally, research is being undertaken on developing grapevine varieties that are more resistant to frost, high temperatures, and drought, research which could potentially trickle down into the Valais Canton [149]
- Since 1992, a collaborative project between Agroscope and the Society of Valais Vine Nursery Growers has acted to preserve 1,400 different types of the 17 indigenous and traditional grape varieties [150]
- A study on grapevine varieties in the Valais found "a considerable reduction in crop risk when a grape variety is added to a portfolio of existing varieties." [151]
- Further, in general and at the Federal level, Switzerland has "a more flexible legal framework than the European Union when it comes to the marketing and distribution of non-certified seeds. While the EU system (so far) requires varieties to be registered in an official catalogue based on strict criteria of distinctness, uniformity, and stability (DUS), Swiss legislation allows for the distribution of so-called "niche" varieties: which are heterogeneous and evolutive: without requiring certification." [152] This means that local varieties more adapted to climate change are more easily grown than they are in EU countries
- At the national level, trials are underway to introduce sorghum as a new, climate-resistant fodder crop [153]

Efficient water management

As noted above, the Confederation and the Valais Canton have ambitious regulations that back national and local efforts to regulate water quality and quantity of water, including in relation to agriculture. As concerns adaptations to climate change, the following initiatives can be mentioned in the Valais canton:

- The Canton encourages Communes to take up water management in a collective fashion and provides subsidies for joint action. The explicit goal is not climate change adaptation, but some items on the work list include actions that could relate to adaptation, namely "encourage and develop multiple uses of water" and "optimise water supply and management" [154]
- The Valais Canton has in place a fund specifically dedicated to resilience and adaptation to climate change. One of the three areas of funding for which communes are eligible is "optimisation of water use" [155]
- In an experimental setting in the Val de Bagnes, research was conducted on how to optimise water use under climate change conditions; recommendations included creating water retention basins and directing more water to irrigation as opposed to hydroelectric installations [156]
- Railroad company BLS, whose tracks fall within the Valais Canton, relies on forests for landslide prevention, but the current varieties of trees that perform this function is not adapted to climate change, and irrigation is required to maintain them. BLS is thus experimenting with new tree species that will place less pressure on local water resources while being resilient to climate change [157]

Soil health restoration

Measures to promote soil health and soil restoration have been described in detail in the section on environmental regulations by theme. In addition, the Valais Canton, in the context of its obligations under Crop Rotation Areas ("Surfaces d'assolement" or SDAs), is invited to identify and designate

land that could be the subject of revalorisation or rehabilitation to compensate any loss in SDAs [158].

Cover cropping, reduced tillage, organic amendments

Initiatives to promote cover crops in the Swiss canton of Valais have already been listed above, in the sections on environmental regulations as well as productivity improvement strategies. The Swiss Soil Strategy, also detailed above, includes objectives relating to soil cover, as does the conditionality for PERs. Above and beyond the PERs, the Contribution au Système de Production (CSP) described above also promote cover cropping, reduced tillage, and a balance in organic amendments.

Integrated pest management

Swiss agricultural policy, as described above in its federal form and translated at the Canton level, implicitly promotes Integrated Pest Management (IPM) through its strong emphasis on pesticide reduction, sustainable soil management, agricultural research and extension services, and promotion and protection of useful organisms (biocontrol).

FOAG describes integrated pest management as a pyramid built upon preventive measures, followed by decision support, non-chemical control, and chemical control as a final resort (full text in footnote).[71] Some of the measures mentioned are supported by the Valais Canton.

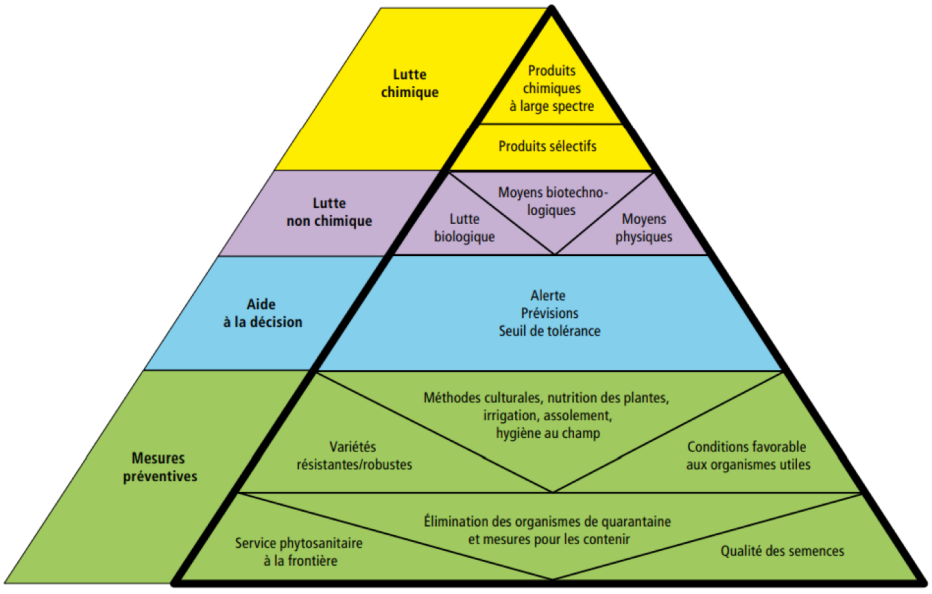


Figure 75 - FOAG pyramid of Integrated Pest Management (IPM). Source: Federal Office for Agriculture, 2024 [159]

The Valais Canton has adopted a Directive on Plant Protection (Directive sur la protection des cultures, DPC - 2022, last amended 2025). The Directive states that the Canton aims towards (Article 1) [160]:

- the preservation of crops against harmful organisms
- the promotion of environmentally friendly crop protection
- the reduction of risks associated with the use of plant protection products
- support for the control of harmful organisms

To this end, the Canton commits to the following actions (Article 2):

- funding for pest control

[71] Federal Office for Agriculture (FOAG), "Protection Durable Des Végétaux," December 4, 2024, https://www.blw.admin.ch/fr/protection-durable-des-vegetaux. "(1) At the farm level, farmers have various preventive measures at their disposal to reduce the pressure exerted by pests or diseases: choosing resistant varieties, methods that promote beneficial organisms and natural control, crop rotation and balanced fertilization. (2) Decision-making tools enable farmers to decide whether direct intervention is necessary to protect plants. Agro-meteorological models provide information on the occurrence of certain diseases or pests (Agrometeo). Observation of the situation in the field and data published by cantonal plant protection services are also valuable sources of information. (3) When direct control becomes necessary, biological, biotechnological or physical control methods can be used. Chemicals are only used as a last resort. Nowadays, chemicals are still often used because alternative solutions are often less effective, less cost-effective or non-existent."

- preventive and curative pest control
- strategies for the use of plant protection products in vineyards, orchards, market gardens and field crops
- aid for farmers or for the funding of mandates to develop methods of pest control

To give a single example of support for IPM, the Canton finances the use of confusion control of pest species, also known as sexual confusion, on crops such as grapevine, apples, and pears (Articles 8 to 16). This technique is more environmentally friendly than pesticides, since no insects are killed.[72]
Further, as indicated in the last bullet point above, help is available to farmers who use novel, low-pesticide practices to deal with pests (Articles 30 to 36). In theory, therefore, the Cantonal DPC can work to decrease reliance on synthetic pesticides while promoting preventive and low-toxicity pest control.
Agripedia has published a long list of low-pesticide or no-pesticide practices in both annual crops and perennial crops (such as vines and fruit trees) that are eligible for Federal CSP subsidies. Interestingly, of these practices, the measure for "Strips sown for beneficial organisms" is the single highest-paying CSP, standing at 4,000 CHF per hectare for perennial crops [161] and 3,300 CHF per hectare for annual crops [162]. This is a reminder that Swiss plant protection policy goes beyond mere bans on pesticides.

Agroforestry

Difficulty was experienced while trying to find specific examples of agroforestry in the Valais Canton. Existing research projects on agroforestry, for example, either did not fall within the Valais Canton or focussed on minority agricultural activities, such as arable crops.[73]
Some ideas on what can be achieved, however, can be taken from the Agro4estrerie project, which developed and provided financial assistance to agroforestry projects in nearby Cantons (Genève, Jura, Neuchâtel, and Vaud). The following project structure taken from Agro4esterie could be applied in the Valais to develop agroforestry on for arable crops, horticulture, and animal husbandry [163]:

- Initial and final audits
- Agroforestry training courses
- Implementation of a new sylvo-pastoral system
- Enhancement of grass strips in sylvo-pastoral systems
- Integration of poultry into fruit production systems
- Optimisation of land use and fodder production in grasslands not already engaged in biodiversity protection ("non-SPB grassland")
- Optimal structuring of poultry and pig grazing areas

In particular, the item "Optimisation of land use and forage production in grasslands" supported by the Agro4esterie project is relevant to the Valais Canton's cow industry. The measure proposes the following agroforestry practice, for the following reasons [164]:
"…planting bushes and fodder trees in non-SPB grasslands in order to optimise pasture management and provide an additional source of fodder for livestock. The addition of woody structures to grasslands has many advantages: it increases soil stability thanks to the root system, reduces soil and nutrient loss through erosion, and improves the microclimate by increasing shaded areas. Fodder bushes and trees provide animals with high-quality fodder at selected times, i.e. by controlling the animals' access to the plants according to their needs. They provide fodder in the summer (when grass growth is low)."

[72] Sexual confusion works by releasing synthetic sex pheromone molecules into crops, mimicking those emitted by females. These pheromones saturate the air, disorienting males who can no longer locate females to mate with, preventing egg laying and limiting the growth of pest populations. This technique is widely used in viticulture and arboriculture, particularly to control moths that damage grape clusters or apples. It does not kill insects but instead blocks their reproduction, thus reducing the use of chemical insecticide treatments. Its effectiveness often depends on the area treated and often requires collective coordination between farmers in the same area.
[73] See for instance Eidgenössische Technische Hochschule Zürich, "Traditional Agroforestry Systems," 2025, https://fe.ethz.ch/en/research/dendrology-and-vegetation-science/projects/traditionelle-agroforstliche-systeme.html. and Agforward, "Farmer Research Groups," 2014, https://www.agforward.eu/FarmerNetworks.html.

This measure could in theory be put in place in pastures in the Valais Canton, provided that the change to the landscape is not deemed as problematic under existing statutes.



Figure 76 - Cows feeding on low bushes as part of an agroforestry system in animal husbandry. Source: Agrofost, 2020 [164]

Other agroforestry experiments in the Agro4esterie project which could apply to less prominent agricultural activities in the Valais Canton include planting trees in rows in the middle of annual crops [164]. Further, orchards on steep hillsides can serve as pastures for livestock, as in the Picturegraph below.



Figure 77 - Ponies grazing on grass inside an apricot orchard in the Valais Canton. Source: Agroscope [165]

One experiment in viticulture in a neighbouring Canton merit being mentioned: In Rivaz in the nearby Vaud Canton, a winemaker has adopted intensive agroecology and agroforestry. His practices include planting trees in-between the rows of grapevine, but also using cover crops, including legumes that fix nitrogen, alongside berries and vegetables. According to his experience, his soils are more fertile, the trees attract water from deep in the ground (which feeds the grapevines) and provide shade for the vines, while plant diseases have decreased [166].

Regenerative agriculture

While regenerative agriculture is not, in and of itself, named as a priority at the Federal or Cantonal level, this type of agriculture is compatible with some elements of Federal and Cantonal law and strategies.

This can be appreciated by examining the definition of regenerative agriculture, which stands upon on five pillars, each having to do with soil health [167],[168]:

- Do not disturb the soil: Soils support a complex network of microorganisms that deliver several ecosystem services such as nutrient cycling and carbon storage. Disturbing this through tillage or ploughing sets the system back
- Keep the soil covered: Bare soil is more at risk of erosion due to extreme heat, frost, and rain. By growing a cover crop or adding organic residue, one can protect it
- Grow a diverse range of crops: Soils thrive on variety. By growing a mix of crops in the same system, farmers can feed their soil the balanced nutrients needed for them to flourish
- Keep living roots in the soil: Living roots in the soil build soil biodiversity, fertility, and water quality. Reintroducing perennials is a quick way of integrating year-round living roots
- Integrate animals: By integrating crops and livestock into the same system through planned grazing, farmers can dramatically increase soil fertility while reducing the need for synthetic inputs

Some of these pillars are in line with Federal and Cantonal policy as described in previous sections. For instance, the Swiss Soil Strategy promotes crop diversification, one PER is dedicated to crop rotation and another to cover crops, and one of the CSPs promotes no-till agriculture. In addition, the Soil Strategy includes an item on restoration of degraded soils, as quoted above.[74] Finally, all regulations and incentives to reduce pesticide use indirectly act in favour of regenerative agriculture, since soil biodiversity is preserved.

However, items directly related to keeping living roots in the soil and integrating animals were not found in the main Federal legislative texts or strategies on this topic (although keeping living roots in the soil is compatible with cover crops). This is noteworthy because it is only when all five pillars are mobilised at once that regenerative agriculture can take place.

Input subsidies

Swiss agricultural policy does not specifically tag subsidies to specific types of expenses. Although they must comply with strict regulations for environmental stewardship, farmers are free to spend their subsidies as they please. As described above, these "direct payments" are conditional upon environmental and animal-welfare performance, and they were put into place in 1993.

At present, direct payments to farmers are around 2.8 billion CHF, a level that has been more or less stable since the year 2010. As can be seen below, the amount of direct payments paid to Swiss farmers since the payments were put in place in 1993. Overall direct payments to Swiss farmers rapidly increased from 1993, when they were put in place, to approximately 2010. After this date, total payments plateaued at around 2.7 to 2.8 Bn CHF, as can be seen in this graphic based on FOAG data:

[74] "Restore degraded soils: Where possible and reasonable, degraded soils are restored and improved so that they are once again able to fulfil the functions typical of their site, and that their fertility is reinstated." Federal Office for the Environment (FOEN), "Swiss National Soil Strategy."

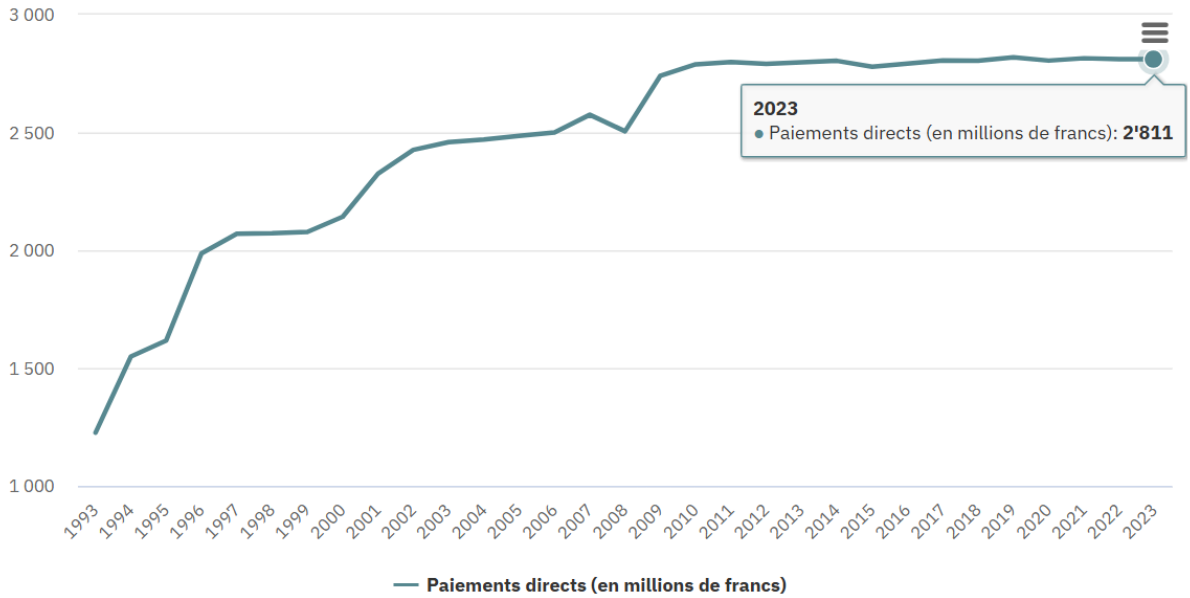


Figure 78 - Increase in direct payments to farmers since 1993

Source: FOAG data, visual by La Vie économique [169]
These direct payments represent, on average, 20% of a farm's income [169]. In theory, this money can be used to purchase inputs.

Credit access

Access to credit is in part implemented through so-called Cantonal agricultural credit institutions (*Caisses de crédit agricoles Cantonales*). These independent institutions are expected to deliver financial assistance to agricultures on behalf of the Confederation. They deliver different kinds of financial products of interest to farmers:[75]

- The initial aid for young farmers is "an interest-free repayable loan granted to farmers under the age of 35. These funds can be used, in particular, to purchase real estate or equipment, repay debts or invest in construction."
- Investment loans are also "interest-free repayable loans. They are granted, for example, for the purchase, construction or conversion of agricultural buildings for residential or operational use, but also for other construction projects that contribute to the diversification of activities or ecological improvement."
- Farm support is intended to "reschedule debts and overcome financial difficulties. Farmers can also take advantage of this interest-free loan if they have to cease their activity and aid or loan repayments are due."

There are also private and NGO initiatives to support farmers, such as the following:[76]

- Aide suisse à la montagne (Swiss Mountain Aid) distributes non-repayable grants to promote, among other things, investment in rural and residential buildings, developments, reorganisations, direct marketing and agrotourism. This support is reserved for farmers based in mountain areas [170].
- Coop: Parrainage pour les régions de montagne (Coop Sponsorship for Mountain Regions) is also aimed at farms located in mountain areas. This organisation allocates grants for the renovation of homes and barns, measures to streamline activities and investments in infrastructure [171].

[75] The descriptions in bullet points below are translated from Raiffeisen, "Agriculture: subventions et soutien financier," 2025, https://www.raiffeisen.ch/rch/fr/clients-entreprises/investissement-financement/agricole/subventions-pour-lagriculture.html.
[76] The descriptions in bullet points below are translated from Raiffeisen, "Agriculture: subventions et soutien financier."

- La Fondation suisse pour la promotion de l'accession à la propriété du logement (The Swiss Foundation for the Promotion of Home Ownership) supports farmers in various economic situations. It grants loans for the purchase, construction or conversion of housing and for energy-efficient renovations [172].
- The Stiftung zur Erhaltung der bäuerlichen Familienbetriebe (Foundation for the Preservation of Family Farms) grants interest-free loans for investments in free-range housing, rural buildings, processing facilities, marketing projects, or housing. Environmentally friendly agriculture is one of the conditions for receiving aid [173].

Structural improvements

Land improvements encompass all structural measures designed to make farming more efficient, to conserve the soil and to improve production conditions; in Valais, they currently centre on land consolidation (including by farm) and Regional Development Projects (RDPs) as key instruments.

In the broadest sense, land improvements are defined as measures and works that ensure the rational use of land, facilitate its cultivation, protect it against natural degradation and improve production conditions. Typically, this includes land consolidation, the construction or repair of rural roads, water supply systems, land drainage, irrigation and electrical connections. A distinction is made between land consolidation, which concerns only ownership relations, and comprehensive land improvements, which combine land consolidation with construction or ecological measures in rural areas.

Funding is based on a joint Confederation-cantons initiative, involving non-repayable grants and investment loans, with the Confederation assuming strategic leadership and the cantons responsible for operational implementation.

The specific measures include:

- Planning measures: preliminary studies, preliminary agricultural planning, land consolidation (ownership and tenancy), and the development of general plans.
- Construction measures: farm tracks, irrigation, drinking water or irrigation water supply, drainage, electricity, farm buildings or mountain pasture buildings, etc.
- Ecological and public interest measures: renaturation, promotion of biodiversity, protection against natural hazards, landscape measures, integrated into comprehensive land improvement schemes.
- Rural Development Programmes (RDPs). RDPs are federal and cantonal instruments aimed at creating added value in agriculture, strengthening cross-sectoral collaboration and achieving objectives of public interest (ecological, social, cultural). RDPs provide a framework by financing and coordinating a set of interconnected measures: improvement or creation of agricultural infrastructure (roads, irrigation, buildings, electricity, water), promotion of regional products, networking between agriculture, crafts, catering and tourism, agritourism projects, sales and tasting facilities, and farm revitalisation. Rural Development Programmes (RDPs) therefore complement 'traditional' land improvements by placing greater emphasis on regional economic factors (value chains, tourism, processing), whilst also contributing to the maintenance and modernisation of rural infrastructure. Finally, the RDPs fund infrastructure to improve the climate resilience of farms (rainwater harvesting, sustainable greenhouses) and the promotion of local products through short supply chains (by reducing the number of intermediaries in the sector), thereby enhancing food sovereignty and economic resilience.

In Valais, all measures are being implemented. It should be noted that land consolidation plays a key role in combating extreme fragmentation, particularly in the side valleys where some plots are so small that farming them is not profitable. For example, the land consolidation project based on farming operations in the Lötschental (taking around ten years to complete, finished in 2020) is cited

as a Swiss pilot project: all farmed plots (both owned and leased) are pooled and then redistributed among farmers, without altering land ownership or undertaking any construction work. This 'land consolidation through farming' improves the coherence of cultivated blocks, reduces travel and encourages the maintenance of farms on less profitable land, whilst still allowing for the sale or inheritance of plots.

As already noted, RDPs provide an operational framework for a territorial agroecological transition by promoting multi-stakeholder cooperation, local adaptation and the integration of environmental objectives into concrete projects. In Valais, 11 active RDPs are already enhancing sustainability through partnerships, acting as a catalyst for resilient, small-scale agroecology. They support sustainable practices whilst maintaining agricultural competitiveness in complex topographical contexts. By mobilising farmers, local authorities, the tourism sector and economic stakeholders around projects, the RDPs effectively create collective dynamics conducive to agroecology. They enable the explicit integration of ecological (biodiversity, resource conservation), social and cultural objectives, going beyond the purely economic dimension.

It is worth noting that Valais has undertaken initiatives that serve as a model for replication elsewhere: this participatory approach is seen as inspiring for collective transitions in other regions, as evidenced by the French ECLAT project, which organised a visit to Valais a few years ago.

5.4.2 Overview of Swiss environmental legislation

Legislation to protect the environment has existed in Switzerland since the 19Th century. As the Federal Office for the Environment (FOEN) explains, the growing body of environmental protection legislation emerged successively, usually in response to a landmark event or report that brought to light environmental issues that are pertinent to the Swiss population. Further, some of these landmark legislations were accompanied by modifications to the Swiss constitution. For example,
"In 1971, there was a popular vote in which over 90 per cent approved the inclusion in the Federal Constitution of an article on environmental protection. The new legislation was passed amid wider public debate on environmental problems in the 1970s. The public had been shaken by the oil crisis, the Club of Rome's "The Limits to Growth" report, and the "Global 2000" report commissioned by the US government on the environmental situation around the world." [174]
Similarly, the Waters Protection Act of 1957 emerged in a context of a growing awareness of the problem of water pollution by factories, businesses and ordinary citizens; the Act came on the back of a modification of the Constitution to protect Swiss lakes and rivers. Other legislations aimed to protect indigenous plants, animal life, landscapes and monuments, such as the Nature and Cultural Heritage Act of 1966. Waste management was addressed by a slew of legislations in the 1990s and early 2000s. Legislations to regulate toxic substances and chemicals came online from 1969, and forest-preservation and management legislation has existed since the 19th century [174].
As for the natural conservation and preservation of animal and plant species, legislative action began in earnest in the context of increasing awareness, in the 1970s and 1980s, of threats to biodiversity in Switzerland. In 1983 the Federal Act on the Protection of the Environment (also known as the Environmental Protection Act, or EPA) was adopted to address these threats as well as more comprehensive issues. As of its latest amendment (April 2025), its key provisions are the following:[77]

- Broad Environmental Protection: The Act addresses various environmental issues, including air and water pollution, waste disposal, noise control, and soil degradation.
- Polluter Pays Principle: The EPA enforces the principle that those responsible for environmental damage must cover the costs associated with its prevention or cleanup.
- Environmental Impact Assessment (EIA): The EPA requires that significant projects: especially in infrastructure and industry: undergo an Environmental Impact Assessment to analyse potential environmental impacts before approval.

[77] Law Gratis, "Environmental Laws at Switzerland," March 27, 2025, https://www.lawgratis.com/blog-detail/environmental-laws-at-switzerland. Federal Act of 7 October 1983 on the Protection of the Environment (Environmental Protection Act, EPA), SR 814.01.

- Precautionary Principle: The law adopts a precautionary approach, regulating or restricting activities that could pose environmental risks, even if scientific certainty about the harm is not yet established.

The act sets out the respective responsibilities of the Confederation and the Cantons for acting to address these issues and reporting on progress.
Further, 1987 saw the adoption of the Rothenthurm Initiative. As FOEN explains, the Convention "demanded stricter protections for natural habitats. It led to the conservation of wetland biotopes and moorland being enshrined in the Constitution. Protections were subsequently increased for other endangered habitats such as floodplains, amphibian spawning grounds and dry grasslands." [174] In 2007, legislation has made it easier to call for "the creation of parks of national importance in regions of especially high natural and scenic value." [174] Additional legislation was voted between 1991 and 2011 to further protect water resources and their contribution to biodiversity.[78]
Finally, Switzerland is party to a number of international agreements that seek to protect the environment in a systemic fashion, such as the 1992 Biodiversity Convention and 1992 Climate Change Convention; the 1997 Kyoto Protocol and 2015 Paris Agreement; and the Stockholm Convention on Persistent Organic Pollutants. A timeline of the main environmental legislations at the Federal level is given in Figure 79 - Timeline of the most important pieces of environmental legislation in Switzerland. Source: Federal Office for the Environment (FOEN), 2022 [174] According to FOEN, the guiding principles of federal environmental law are [174]:.

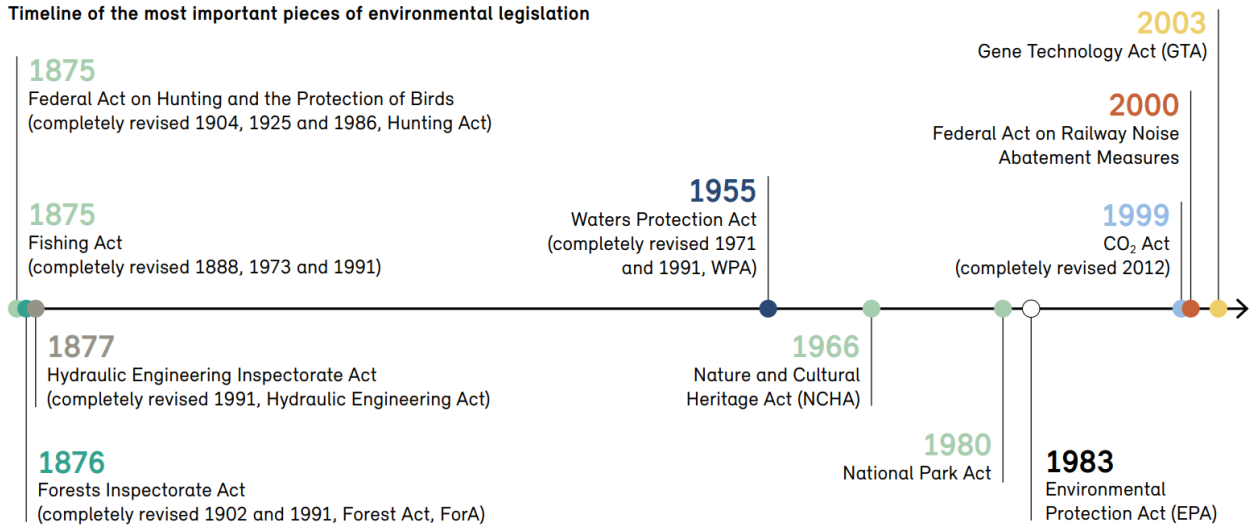


Figure 79 - Timeline of the most important pieces of environmental legislation in Switzerland. Source: Federal Office for the Environment (FOEN), 2022 [174] According to FOEN, the guiding principles of federal environmental law are [174]:

- The precautionary principle: "Prevention is better than cure" is the guiding principle behind Swiss environmental law. The idea is that forward-looking, environmentally sound planning and action is more cost-effective in the long term and causes less environmental impact than subsequent improvements or attempts to remediate environmental damage."
- The polluter pays principle: "This principle is based on the belief that the costs of remediating environmental pollution or damage should be borne not by the general public but by those who are directly responsible for them. Anyone polluting or damaging the environment should have to pay to rectify that damage or pollution."
- The holistic approach: "The aim of environmental law is to reduce the overall burden on the environment. Its various aspects should therefore always be given equal consideration. One-

[78] "Following a popular initiative, in 1991 the new Waters Protection Act was broadened to include minimum flow regulations, which state that a residual volume of water must be left in streams and rivers that are used for hydropower. Previously, conservation laws focused primarily on keeping water clean, but they now recognize that rivers and lakes can fulfil their function as a habitat for plants and animals only if they carry sufficient water and have the space they need to develop naturally. These riverine zones were laid down in law in 2011 in a further revision of the Waters Protection Act." Federal Office for the Environment (FOEN), "Swiss Environmental Law: A Brief Guide."

sided measures that protect one area at the expense of an excessive impact on the others must be avoided."
- The sustainability principle: "Our planet has a limited supply of natural resources. According to the sustainability principle, they should be used only to an extent that preserves them intact for future generations."
- The cooperation principle: "Swiss environmental law is not simply ordained but rather developed and jointly implemented in a broad-based decision-making process. A whole range of stakeholders is included in drafting acts, ordinances and implementation guides, from political parties to the Cantons and business and environmental organisations, and individual sectors. This approach ensures that practicable and efficient solutions are found."

The main vectors for achieving environmental protection are setting targets; establishing requirements and bans; economic instruments; information, consulting and education; and cooperation with the private sector. Cantons play a critical role in enforcing Federal legislation, with varying degrees of delegation of initiative and enforcement powers to the next administrative entities (communes), although their activities fall under the supervision of the Federal government [174].

Environmental regulations by theme

Meanwhile, regulations pertaining to the environment can be grouped according to their impact on the following natural capital and/or climate change considerations:

- Water quantity and quality
- Soil quantity and quality
- Air quality and pollution
- Forest protection
- Landscape protection
- Biodiversity conservation
- Greenhouse gas (GHG) emissions/Climate change
- Plant protection products (pesticides)

The legislations pertinent to each theme are discussed in this section.

For the sake of simplification, Federal from Cantonal legislation has not been separated out, as the two are deeply intertwined (hence the title of subsections: "Federal and Cantonal regulatory framework"). Typically, a Canton is responsible for operationalising the general direction that is given by Federal statute. In some cases, broad authority is given to Cantons to go beyond the Federal mandate. An example is that of protected areas: the Federal government designates habitats of national importance, but it delegates their protection and maintenance to the Cantons, in addition to mandating the Cantons to establish their own inventoried sites of biotopes of regional and local importance (see above, for example, the map of protected sites in the Valais that were established by Cantonal, as opposed to Federal, decree). The sections labelled "Regulations specific to the Valais Canton" explore Cantonal legislations and policies that are relevant to the given theme.

Water quantity and quality

Federal and Cantonal regulatory framework

Switzerland's water resources are above all protected by the Waters Protection Act of 1991 (WPA, last updated 2025). The Act aims to reconcile the different types of water use by humans (agriculture, drinking water, leisure…) and by wildlife (fish and indigenous fauna and flora), while maintaining the natural functioning of the hydrogeological cycle. A particular number of provisions in the WPA are relevant to agriculture [175]:

- Article 12: Special cases in areas covered by public sewers states that under certain conditions, domestic wastewater can be used agriculturally together with liquid manure (of cattle or pigs)
- Article 14: Animal husbandry farms set out guidelines for responsible management of manure

- Article 27: Soil use sets limits for pesticide use around areas of contribution to drinkable water wells
- Art 29: Permits states that a permit is required of any person who withdraws water from a watercourse, or who withdraws significant water from lakes or groundwater. However, Article 32: Exceptions says that in exceptional cases and for a limited amount of time, there may be a derogation to Article 29, for instance in case of an urgent need for agricultural irrigation
- Article 33: Increase of the minimum residual flow adds protections for water that is of interest for habitats/biodiversity or for its contribution to the landscape
- Article 37: Operations on surface waters is relevant to biodiversity, as it states that any modification to a river's course must retain habitats for diversified fauna and flora as well as for suitable vegetation on the riverbanks
- Article 38: Rehabilitation of waters states that Cantons must ensure that waters are rehabilitated: potentially this could concern agriculture, since fertilisers, pesticides, and manure runoff may negatively impact running water, lakes, and groundwater
- Article 43: Conservation of groundwater resources states that drainage of a zone which results in the lowering of the groundwater table is authorised only if agricultural utilisation cannot be ensured in any other way

The Waters Protection Act is complemented by the Water Protection Ordinance, which implements the WPA. Water is also indirectly protected from toxic substances, including pesticides, through the Chemicals Act (see below section on Plant protection products).

Cantons are highly involved in water regulation: in the words of Mauch and Reynard [176],
"Sovereignty over (public) waters are assigned to the Cantons. Hence, they are responsible for the allocation of permits, licences and concessions relating to different water uses, such as navigation, fishing and the production of hydroelectric power. In addition to these tasks, the Cantons are responsible for the implementation of water protection legislation and the management of watercourses by means of hydrological engineering infrastructure. While their activities must respect the framework of the federal legislation, they still have considerable room for manoeuvre, which also gives rise to far greater diversity in the administrative structures at Cantonal level as compared with the federal administration."

An example of this empowerment of Cantons in water policy can be found in the Swiss Federal Act on Spatial Planning (Spatial Planning Act, or SPA) of 1979 (last amended 2019), where water briefly appears in Article 3. The SPA states that Cantons and communes are responsible for managing land use such that they "take account of the natural environment and of the needs of the population and the economy," and that they must support efforts to "protect natural resources such as soil, air, water, forests and the landscape." [177] This Cantonal mission directly impacts agriculture, as agriculture has a salient role in soil, air, and water use, and also fashions the landscapes of the Valais Canton.
Cantons are also at the forefront of the Federal Law on the Regulation of Watercourses (1991, last amended 2025), which enumerates Cantonal responsibility for managing potential damage from surface waters, namely floods and erosion [178]. Agriculture does not explicitly appear as a consideration, but in theory agricultural land could be concerned by any public works that aim at regulating the quantity and/or location of watercourse flow.
The final Federal legislation that weighs on water in the Valais Canton is the Federal Law on the Use of Hydraulic Forces (1916, last amended 2025) [179]. It mostly consists of rules relating to new hydroelectric installations, as well as instructions for resolving conflicts over land use and revenue from hydroelectric dams. Agriculture is not mentioned, but agriculture has historically been impacted insofar as hydroelectric dams (which number around 230, see "Climate and topography") may have covered former grazing lands, and the flow of rivers downstream of hydroelectric dams is more limited.

Finally, some of the orientation of Swiss policies relating to water can be found in the Federal Act on Agriculture (Agriculture Act, AgricA) of 1998 (last amended 2025), which deals extensively with the risk to water posed by pesticides. For example, the Act states (Art. 6*b*.1) that "risks to humans, animals and the environment from the use of plant protection products shall be reduced and the quality of drinking water, surface waters and groundwater shall be improved." The Article adds that if it becomes apparent that targets for a given pollutant will not be met according to the imposed timeline, then the pollutant will simply be banned (Art. 6*b*.8). Other articles within the Act underline that receipt of subsidies is contingent on responsible custodianship of water resources (Articles 76, 87*a*, and 170).

Regulations specific to the Valais Canton

At the Cantonal level, a unique characteristic of the Valais Canton is that all lateral waterways belong to and are governed by communes; only the Rhône River belongs to the Canton. The Valais Canton has therefore put in place an objectively ambitious Cantonal Water Strategy to improve collective governance of water resources [180]. According to the website of the Valais Canton's Water Strategy, the following measures are encouraged in the Strategy [132]:

"Concrete measures aimed at water resource management are being implemented in the agricultural sector. In arboriculture, in-situ tests are being carried out on various water-efficient irrigation methods, such as drip irrigation and micro-sprinklers. Solutions for real-time monitoring of plant needs, water supply and irrigation are being analyzed on state-owned land and implemented on farms. In viticulture, the use of drip irrigation is encouraged. Various projects are underway in the vineyards. In the Alpine region, a technical guide entitled 'Aménagement des alpages' (Management of Alpine pastures) has been produced, which deals with the issue of water. Water resource management concerns all branches of production. It is a central element of agriculture."

Further, "At the structural level, an approach based on production zones is being implemented and a collective analysis of needs and resources is required. In the plains, irrigation systems are being modernized and implemented in a rational manner, incorporating current technologies (frequency converters, etc.). On the hillsides, support is being provided for the rehabilitation of irrigation systems and the restoration of agricultural irrigation channels. In mountain regions, projects aimed at ensuring the sustainability of water resources are being implemented. Several mountain pastures are receiving support to rehabilitate water catchment and supply systems."

Thus, the Cantonal Water Strategy promotes productivity improvements, with a sustainability angle. In greater detail, the Strategy has 8 main lines of action and 39 independent measures [181]. The main measures that impact agriculture are as follows:

- Measure 3: elaborating a law on water
- Measure 4: common planning and use of infrastructure within catchment areas
- Measures 6 through 8: research, awareness-raising and skills transfer in the domain of water resource management
- Measure 16: reducing the leaching of farm fertilisers
- Measure 30: optimising irrigation management
- Measure 31: maintaining and enhancing irrigation infrastructure
- Measure 39: continuing efforts to connect/network various small biotopes

Further, there are laws at the Cantonal level that impact water uses in ways that directly relate to agriculture. One example is the Cantonal Law on Water Protection (voted 2013, last amended 2014). It states, for example, that [182]:

- Article 14: Information and counselling: The department in charge of agriculture in the Cantonal administration must advise farmers on good cultural practices and impress upon them the need to protect waterways from pesticides and fertilisers, both organic and synthetic
- Article 26: Wastewater treatment: As in WPA article 12, it is said that the mixing of used domestic water or water derived from cheese-making with slurry is allowed

- Article 29: On-farm fertilisers: The law puts into place strict rules relating to manure and slurry and the buildings used to store it, including the possibility of livestock seizure by the state if buildings are not in conformity with local regulations
- Articles 37-44: Any authorization to undertake major works on, or withdraw water from, a public waterway is subject to consultation with, among others, the Cantonal services in charge of agriculture

The Cantonal counterpart (1990, last amended 2025) to the abovementioned Federal Law on the Use of Hydraulic Forces does not add any significant provisions relating to agriculture, except insofar as it states that new and existing hydroelectric installations should respect the existing landscape (Article 43) [183].

This theoretically prevents high-altitude pastures from damming.
Finally, the Cantonal counterpart (2022, last amended 2023) to the abovementioned Federal Law on the Regulation of Watercourses makes no mention of agriculture, although it does mention landscape protection twice [184].

As of 2002, it was said that [176]: "In general, the Cantons or local authorities are responsible for water management and very few of them reflect the boundaries of regional or local water catchment areas. Hence, the criteria for the definition of management units are actually based on political-administrative structures as opposed to natural boundaries of water basins."

While this remains true, practices have evolved, with greater attention posed to trans-Cantonal boundaries so as to manage water policy from a catchment basin perspective [185].

Soil quantity and quality
The main topics related to soil quantity and quality that one finds in Swiss legislation are soil fertility and soil pollution; the themes are deeply intertwined.

Federal and Cantonal regulatory framework
The oldest Federal statute to discuss soil pollution is the Waters Protection Act of 1955 mentioned above; however, the statute was completely overhauled in 1971 and in 1991. This makes the Environmental Protection Act (EPA) of 1983 the second-oldest statute to address soil pollution. Specifically, the EPA provides a framework for soil conservation, pollution prevention, and restoration and/or remediation of contaminated sites. The EPA defines soil pollution as follows (Art. 7) [84]: "Soil pollution is the physical, chemical and biological modification of the natural condition of the soil. Soil means the unsealed top layer of land where plants may grow."
Provisions for soil preservation from pollution appear in the following articles of the law:

- Article 33: Measures against soil pollution states that Cantons and the Confederation must take measures to protect soil fertility based on existing statutes
- Article 34: Stricter measures against soil pollution states that the Cantons and the Confederation have the prerogative to act when soil fertility is threatened. This includes *(note: here we list only those provisions which relate to agriculture in some way):*
    - Article 34.1: the right to restrict "the use of substances and organisms or physical impacts on soil"
    - Article 34.2: the right to restrict soil use if "soil pollution endangers humans, animals or plants"
    - Article 34.3: the right to enact measures to reduce soil pollution that results from hazardous use of soil for "horticulture, agriculture or forestry"
- Article 35: Guide values and soil remediation values states that the benchmark for measuring the degree beyond which soil pollution becomes dangerous is the level of threat to "humans, animals or plants"
- Other articles set out the pathways for addressing soil pollution through remediation, but pollution from agricultural activities are not at the forefront of these articles.

The EPA provisions thereby impact agriculture in the following way: according to the law, agricultural practices must not harm soil fertility and must not induce soil pollution. Further, levels of soil pollution that could harm the health of humans, animals, or plants trigger action by the Canton or the Confederation to remediate the situation.
As noted above, the Waters Protection Act (WPA) also regulates soil use. The part of the legislation dealing with soils is mainly concerned with ensuring that soil use is compatible with the environmental protection of water resources.
This is why the main article dealing with soils, Article 27: Soil use states that state-of-the-art practices must be used to ensure that pesticides and fertilizers do not wash away or leach into water resources [175]:
"Article 27.1: Soils shall be used according to the state of the art, in such a way that waters are not adversely affected in any way, in particular avoiding both washing away and leaching of fertilizers and plant treatment products."
The remainder of Article 27 defines the acceptable level levels of pesticides in areas surrounding drinking water wells (0.1 µg/l), and it adds that the Federal Council may enact relevant legislation. Thus, the WPA impacts soil use in agriculture by enacting a clear, statutory commitment to reducing water pollution caused by agricultural activities.
Another Federal statute governing soil preservation is the Ordinance relating to Impacts on the Soil (OSol) of 1998 (last amended 2025). The Ordinance lays out a robust statutory framework for soil conservation, as follows [186]:

- Section 1: defines soil fertility and defines the different types of chemicals, biological, or physical threats to soil
- Section 2: lays out the various initiatives to be undertaken by the public authorities to observe, monitor, and assess chemical, biological, and physical damage to the soil
- Section 3: addresses the problem of persistent compaction and erosion and the problem of erosion related to soil stripping, including mentions of the risks posed by heavy machinery and the benefits of well-adapted crop rotation
- Section 4 through 6: address what is to be done when key indicators are overcome and the respective responsibilities of the Cantons and the Confederation in this matter

Thus, the VBBo directly relates to agricultural activity, insofar as it mandates the protection of soils from a variety of threats directly emanating from agriculture (chemical, biological, or physical).
Further, the Federal Spatial Planning Act (SPA) mentioned above also provides some guidance on soil use:

- Article 1: Aims states that the Confederation, Cantons and communes must work together to "protect natural resources such as soil [emphasis added], air, water, forests and the landscape"
- Article 3: Planning principles states that part of preserving the countryside is that "sufficient areas of suitable arable land, in particular crop rotation areas, should be reserved for agriculture"

In terms of impact on agriculture, these two provisions work in tandem to protect responsible soil use by farmers.
More recent activity at the Federal level presents levers through which to protect soils across the Confederation. For instance, on 8 May 2020 the Federal Council adopted the Swiss Soil Strategy. In the words of the FOEN [187],
"This strategy calls for soil consumption to be reduced to net zero by 2050. This means that if soil functions are lost because of a new development, for example. they must be compensated for elsewhere by soil being deposited there. Other objectives include establishing a path towards sustainable soil use, minimal soil consumption, protections against harmful impacts, and the restoration of degraded soils. The Strategy must be implemented as part of spatial planning, agriculture, forestry, construction, the management of greenfield events, in settlement areas, in the handling of degraded soils, and at the international level."
The Strategy sets six overall objectives including zero net soil use, and it promotes practices such as reduced tillage, permanent soil cover, and integrated nutrient management. The Federal Office for the Environment (FOEV) describes the six overarching objectives [188]:

- "Reduce soil consumption
  The objective is that, from 2050 onwards, net soil use in Switzerland will be zero. It will still be possible to build on soil, but if this results in functions being lost, they must be offset elsewhere by improving the soil at that site."

- "Manage soil consumption on the basis of an overall perspective
  Soil functions are factored into planning, and the associated balancing of interests, so that soil consumption can be managed in the interests of sustainable development. The soil data required to do so is available."

- "Protect soil from harmful impacts
  Soil use does not result in any physical, chemical or biological impacts that might result in a lasting degradation of soil functions and thus soil fertility. Soil use takes account of its current condition and sensitivity, so that ecological soil functions and thus soil fertility are preserved."

- "Restore degraded soils
  Where possible and reasonable, degraded soils are restored and improved so that they are once again able to fulfil the functions typical of their site, and that their fertility is reinstated."

- "Improve awareness of the value and sensitivity of soil
  Soil is seen as a valuable, sensitive and finite basis of existence, so that action surrounding sustainable soil management finds the necessary level of acceptance."

- "Strengthen international commitment
  Switzerland's economic and social well-being depends not only on its own soil, but also on the preservation of soils abroad. Switzerland is thus an advocate for sustainable soil management at the global level."

In line with these objectives, the Soil Strategy addresses the following five problems related to agricultural soil use [188]:

- Soil compaction as a result of agricultural use
- Soil erosion as a result of agricultural use
- Decline in soil organic matter as a result of agricultural use
- Pollution from agriculture
- Biodiversity loss as a result of agriculture

The Confederation has adopted three additional measures for the sustainable protection of soil as a resource [187]:

- The crop rotation areas sectoral plan
- National Competence Centre for Soil (known by its German acronym KOBO)
- A system for recording information about soils throughout Switzerland

It is also worth recalling that protection of soils is one of the six main criteria for accessing direct payments. Specifically, the main agricultural technique imposed by the law is continuous soil cover to prevent erosion and nutrient drainage [145].

<u>Regulations specific to the Valais Canton</u>

The Valais Environmental Protection Act (LcPE) of 2019 (last amended 2022) complements federal laws. Its main contribution is to assign responsibilities for soil surveillance and evaluation. Specifically, Article 51 states that [189]:

- Article 51.1: physical impacts (erosion, compaction, sealing) for built-up areas are monitored at the municipal level
- Article 51.2: chemical and biological damages are managed at the Cantonal level

- Article 51.3: physical impacts (erosion, compaction, sealing) for agricultural or sylvicultural areas are monitored, respectively, by the service in charge of agriculture and the service in charge of forests

Some agricultural policies relating to agricultural soil health are also implemented at the Valais Canton level. Like other Cantons in the Federation, the Valais has a set quota of high-quality agricultural land that enjoys statutory protection. These are called Crop Rotation Areas (Surfaces d'assolement" or SDAs), and they currently stand at 7,350 hectares for the Valais Canton [190]. The Canton is mandated to keep SDAs above this quota and to protect agricultural use of these lands. Realisation of these objectives occurs under the joint authority of the Cantonal services for environment; territorial development; forests, nature, and landscapes, under the leadership of the Cantonal Agricultural Service (Service Cantonal de l'agriculture) [190].

The Valais Canton also has a strategy bringing together various administrative services (environment; territorial development; forests, nature, and landscapes) under the leadership of the Agricultural Service (Service de l'agriculture) to protect agricultural and viticultural soils in the Canton. Each of the strategy's objectives are related to agriculture. They are the following [89]:

- To ensure the observation, monitoring and assessment of the physical quality of agricultural soils, both qualitatively and quantitatively
- To give advance notice of building permit applications for any project located in an agricultural area and having a potential impact on the soil
- To raise awareness and inform the various stakeholders who use or exploit soil resources
- To ensure that the Cantonal quota of SDAs is maintained, in close collaboration with the Service du Développement Territorial, or SDT, and that the agro-pedological quality of crop rotation of these SDAs is protected
- To centralise, refine and complete soil data for the Valais, in collaboration with the Cantonal Soil Competence Centre (CCS-VS) and the FOEN, with the aim of eventually mapping the soils of the Valais.

In terms of its agricultural impact, this strategy potentially impacts farmers who wish to build on their agricultural land, while making it incumbent for those holding SDAs to maintain the agro-pedological quality of crop rotation areas.

Air quality and pollution

Federal and Cantonal regulatory framework

The two main Federal legislations that regulate air quality are the Environmental Protection Act (EPA) and Ordinance on Air Pollution Control (OPair/OAPC).

The EPA defines air pollution in its Article 7 [84]:

"Air pollution means modification of the natural condition of the air, in particular, through smoke, soot, dust, gases, aerosols, steams, odours or waste heat."

As concerns agriculture, the key word in the definition is "gases," as agricultural activity releases a number of problematic substances, such as ammonia (NH_3), methane (CH_4), and nitrous oxide (N_2O). Livestock farming also emits smaller amounts of nitrogen oxides (NOx), non-methane volatile organic compounds (NMVOCs), carbon dioxide (CO_2), carbon monoxide (CO), and fine particulate matter (PM10 and PM2.5), especially from manure management, animal housing, and feed handling.

The EPA goes on to explain that it is the public authorities' responsibility to limit air pollution as much as possible, using the precautionary principle. Articles that might relate to agriculture include the following [84]:

- Article 11: Principles states that, provided that it is "economically acceptable," emissions should be limited "as much as technology and operating conditions allow," as a "precautionary measure." It adds that if the effects are expected to be "harmful or a nuisance," then stricter measures are to be taken
- Article 12: Limitation of emissions explains that emissions are to be limited using a variety of tools, all of which potentially relate to agriculture:

    - a. emission limit values
    - b. regulations on construction and equipment
    - c. traffic or operating regulations
    - d. regulations on the heat insulation of buildings
    - e. regulations on thermal and motor fuels
- Articles 13 through 15 describe the ambient pollution limit values:
- Article 13: Ambient limit values states that it is up to the Federal Council to stipulate by ordinance the ambient limit values, taking into account "the effects of pollution levels on particularly sensitive groups such as children, the sick, the elderly and pregnant women."
- Article 14: Ambient limit values for air pollution describes the criteria for determining the acceptable pollution limits. The criteria are that limits are to be set such that pollution:
    - a. does not endanger people, animals or plants, their biological communities and habitats
    - b. does not seriously affect the well-being of the population
    - c. does not damage buildings
    - d. does not harm soil fertility, vegetation or waters
- Article 44 states that if sources of air pollution are expected to cause harmful effects or nuisances, then the relevant authorities must draw up and enforce action plans to reduce or eliminate these effects within a set time

These provisions are relevant to agriculture since airborne emissions from agriculture - such as the gasses mentioned above and dust and fine particles - are subject to all of these regulations. The Canton, which is tasked with enforcement, may take action to alter agricultural practices to control emissions whenever there is a presumption that they may harm humans, animals, or plants.
Concretely, the Federal injunction to limit emissions "as much as technology and operating conditions allow" means that best agricultural practices need to be followed as relates to reducing emissions.

Taking the example of ammonia emissions, according to the Federal Office for the Environment, this means practices such as [191]:

- Feed measures: protein supply not exceeding the animals' requirements in order to limit nitrogen emissions.
- In the barn: as little dirt as possible, barn systems that reduce emissions (for cattle, e.g. walking areas with cross slopes and urine collection channels, raised feeding stalls).
- Farm manure storage: slurry store with effective and durable cover.
- Slurry spreading emission-reducing spreading with spreader hose, spreader shoe, slurry drill; spreading on cool days and in the evening.
- Manure spreading incorporate into arable land within four hours.

The second main Federal legislation dealing with air pollution is the Ordinance on Air Pollution Control (OPair) (1985, last amended 2025). However, this regulation seems to be only marginally concerned with agriculture: most articles of the law relate to emissions from "stationary installations," which includes buildings, and appliances and machinery (Article 2), but not fields.

Agricultural emissions appear to be concerned by just two stipulations [192]:

- Article 20*b*: Requirements which states that vehicles not destined for road travel must respect emissions requirements for thermal engines (this would appear to apply to tractors and sylvicultural engines)
- Appendix 2, Chapter 5 which mentions good practices for spreading manure to limit ammonia emissions, as well as regulations on smoke from smoking installations (meat, transformed meat, and fish)

Emissions from agricultural lands, such as the gasses mentioned above and fine particles, are not addressed in the OPAir.

Regulations specific to the Valais Canton

The Valais Canton monitors air pollution for contaminants such as ozone (O3), nitrogen dioxide, dust, particles (PM10, PM2.5), and emissions limits. At present, results over the long run are satisfactory on all of these emissions except ozone everywhere and PM2.5 in plain areas, as can be seen in the figure below. A live observatory of air pollutants in the Valais Canton, split into three geographical subsections, shows that (for instance on 5 September 2025) the vast majority of air pollution indicators are below the maximum thresholds [193].

Table 24 - State of air pollution in the Valais Canton as of August 2024. Source: Canton du Valais [194]

		Poussières fines		Dioxyde d'azote	Retombées de poussières
Région type	**Ozone** (O_3)	PM10	PM2.5	(NO_2)	
RÉGION RURALE D'ALTITUDE	👎	👍	👍	👍	👍
RÉGION RURALE DE PLAINE	👎	👍	✊	👍	👍
CENTRE URBAIN	👎	👍	👍	👍	👍
PROXIMITÉ INDUSTRIELLE	👎	👍	👍	👍	👍

The main interrelation between these pollutants and agriculture are that:

- Nitrogen dioxide is emitted by thermal engines, such as tractors
- Agricultural work on soils, and above all the harvest, releases fine particles (PM10, PM2.5) and dust

This means that farmers whose practices release excessive amounts of these pollutants may be subject to remedial action by the Canton.

Other legal and non-legal instruments in the Valais Canton fail to mention agricultural pollution. For instance, the Valais Environmental Protection Act (LcPE) of 2019 (last amended 2022), just like the Federal Ordinance on Air Pollution, does not mention gas emissions from agriculture. Just like the Federal plan, it focusses almost exclusively on stationary emissions and thermal vehicles or machinery. The same applies to the Valais Canton's Cantonal Plan for Measures for Air Protection (established 8 April 2009, last amended April 2009). The 18 measures of the plan, although they are concrete and progress has been made, only relate to agriculture insofar as measure 5.4.4. regulates diesel engines on sylvicultural machinery [195].

Forest protection

Federal and Cantonal regulatory framework

The Swiss Constitution (enacted 1999, last amended 2024) in its 77th article makes forest management, protection, and conservation a national priority. Specifically, it states that:

- Article 77.1: the Confederation shall ensure that the forests are able to fulfil their protective, commercial and public amenity functions
- Article 77.2: it shall lay down principles on the protection of the forests
- Article 77.3: it shall encourage measures for the conservation of the forests

The role of the Cantons with regards to forest management, protection, and conservation is not specified.

The overarching Federal legislation protecting forests is the Federal Act on Forests (Forest Act, ForA) of 1991 (last amended 2025). It includes comprehensive provisions for forest management and conservation, with the following stated objectives (Article 1) [196]:

- conserve the forest in its area and spatial distribution

- protect the forest as a close-to-nature community
- ensure that the forest can fulfil its functions, in particular its protective, social and economic functions (forest functions)
- promote and maintain the forestry sector
- contribute to the protection of human life and important material assets against avalanches, landslides, erosion and rockfall (natural events).

The main provisions of the Forest Act impacting agriculture (other than forestry/sylviculture) are the following:

- Article 5: Prohibition on deforestation and derogations states that deforestation is prohibited, except in extremely precise and constraining circumstances
  → Article 7: Compensation for deforestation adds that any deforestation must be compensated with giving away forest land elsewhere within in the region and with appropriate species. It notes, however, that measures other than compensation can take place if the deforestation takes place "to conserve arable land and areas of ecological or landscape value."
- Article 13: Demarcation of forest and land-use zones states that forest boundaries are established and that wooded areas outside these limits are not considered forest
- Article 26*a*: Prevention of harmful organisms states that the Confederation and Cantons may take action against harmful organisms that may considerably compromise forest functions

These stipulations create clear boundaries for the expansion of agricultural activity into wooded areas (generally restricted); address what is to be done if a harmful organism enters forests from agricultural zones; and introduce some leniency as concerns deforestation in areas of ecological or landscape value. The Federal Ordinance on Forests (1992, last amended 2025) expands on this article by defining what are areas of "ecological" or "landscape" importance. In the Ordinance (Article 9), the main definitions that potentially includes and/or impacts farmland are (sub-article a) farmland included in the Federal Inventory of Landscapes and Natural Monuments of National Importance (of which there is some in the Valais Canton), and (sub-article b) designated landscape protection zones as defined in the Spatial Planning Act of 1979 (SPA) [197]. In other words, protected farmland in the Valais potentially enjoys a less stringent application of the non-deforestation principle.

<u>Regulations specific to the Valais Canton</u>

In addition to being responsible for the implementation of the Federal legislation listed above, the Valais Canton has its own set of local laws regarding forestry.[79] The main local legislative instrument is the Law on Forests and Natural Hazards (LcFDN - 2011, last amended 2018) [198]. Few of the provisions pertain to agriculture, but there are at least four:

- Article 16: Compensation for forest clearing states that in the event of deforestation that is to be compensated, the compensation can take the form of a financial fee instead of the usual practice of compensation (giving forested land elsewhere back to the Canton) if the compensation were to harm (among others) agricultural activities
- Article 23: Distance relative to the forest states that slight adjustments to the terrain near a forest, such as terracing, levelling, or agricultural planting, can be made up to 3 meters from the forest edge
- Article 25: Circulation of motorised vehicles states that agricultural vehicles may use forest roads so long as this is allowed by the local administration
- Article 27: Detrimental exploitation says that any practices that fall below the threshold for deforestation but nonetheless harm the forest are restricted and subject to action by the forest service

[79] Note that the Cantonal Law on the Protection of the Environment (LcPE) of 2010 (last amended 2022) has no provisions for forests, as it is mainly dedicated to spelling out governance arrangements for the implementation of Federal legislation relating to the environment.

The few provisions relating to agriculture in the LcFDN serve to protect and facilitate agricultural practices, but also to prevent detrimental use of forests by farmers and their livestock.
The Valais Canton is also responsible for setting its own definition of what constitutes a forest [199]. It also steers so-called Regional Compensation Projects, which are initiatives to improve the environment somewhere in the Canton as compensation for deforestation. For example, such Projects may include [200]:

- opening up agricultural or forestry areas
- creating and revitalising wetland biotopes
- creating and revitalising dry habitats
- creating or renaturing riparian habitats
- planting hedges or windbreaks
- creating tiered forest edges
- landscape enhancement
- maintaining traditional forms of forestry

Individuals or entities who wish to deforest but cannot provide forest compensation in kind may pay a fee which is given to these Regional Compensation Projects [200].
The Canton is responsible for managing protected forest areas, such as those highlighted in the section on protected areas above.
A particularity of the Valais Canton is that the main problem in the Canton is not deforestation, but rather natural progression of the forest into formerly non-forested areas. According to the Forests, Nature, and Landscape Service of the Canton, forests gain approximately 1,000 hectares per year out of 130,000 total hectares of forest [201].

The Canton explains that while this may seem beneficial, it in fact poses problems:
"Although this expansion may have beneficial effects (improved protection against natural hazards, CO_2 sinks, increased timber resources, purification and storage of drinking water, etc.), it also has the effect of transforming the traditional open landscape of our valleys: villages and settlements in mountain regions are increasingly surrounded by forest, agricultural land is being lost and the biodiversity characteristic of open landscapes is greatly reduced." [201]
Still according to the Service, communes are often helpless in the face of this process because landowners and farm operators have no real financial incentive to deforest and put the land to use. The Canton has therefore published a guide for communes to help them determine priority action areas in response to this threat. It is worth underlining that independently of the forests' threat to "biodiversity" of open landscapes, the notion that the "landscape" in and of itself should be preserved appears here, as it often does in Swiss legislation on the environment - see the following section.

Landscape protection

Federal and Cantonal regulatory framework
Several pieces of Federal legislation relating to landscape protection are relevant to agriculture. They include the Nature and Cultural Heritage Act of 1966 (NCHA - last amended 2025) and the Spatial Planning Act of 1979 (SPA - last amended 2019). The Federal Inventory of Landscapes and Natural Monuments is an emanation of a 1977 Ordinance of the Swiss Federal Council implementing the NCHA; we discuss it in the Valais Canton section.
The NCHA provides a robust legal framework for the protection of traditional Swiss landscapes and their associated biodiversity. The aims of the NCHA are extensive and are laid out in its first article.[80]

[80] They are: to carefully manage and protect heritage landscapes and heritage sites, historic sites, and the country's natural and cultural monuments, and to promote their preservation and upkeep; to support the Cantons in fulfilling their tasks in the fields of nature protection, cultural heritage protection and monument preservation, and to ensure cooperation with them; to support the endeavors of organizations active in the fields of nature protection, cultural heritage protection or monument preservation; to protect indigenous flora and fauna, their biological diversity and their natural habitats; to promote the conservation of biological diversity and the sustainable use of its components through the fair and equitable sharing of benefits arising from genetic resources; and to promote science and research and the education and training of experts in the fields of nature protection, cultural heritage protection and monument

The first seventeen articles relate to the "who" and "how" of inventories of sites of national or regional interest. The main article that concerns agriculture is Article 18 [202]:

- Article 18*a*: Protection of animal and plant species states that
    - Article 18 *a*.1: animal and plant species must be preserved through conservation of "sufficiently extensive habitats (biotopes)."
    - Article 18 *a*.2: regarding pesticides, if "pest control measures" are taken, "particularly by using toxic substances," then "care must be taken not to endanger animal and plant species deserving protection"
    - Article 18 *a*.3: the Confederation may promote the resettlement in suitable sites of species that have become extinct in the wild in Switzerland or whose numbers are threatened [see implications for large predators]
- Article 18*b*: Biotopes of regional and local importance and ecological compensation states that Cantonal compensation measures during the protection and upkeep of important biotopes must give "due consideration" to "agricultural requirements"
- Article 18*c:* Position of landowners and operators states that the protection and upkeep of biotopes should be undertaken in consultation with landowners and farm operators, and that the latter are entitled to compensation if "they restrict existing uses in the interests of the protection objective or provide a service for no financial consideration." However, the Canton retains the power of compulsory purchase
- In addition, Section 3*b* discusses the modalities for establishing nature conservation parks, which may include agricultural land that is then subject to the conservation guidelines for the park

Thus, the articles in the NCHA impact agriculture in that they potentially limit pesticide use and give legislative backing to the (re)introduction of wild predators. The articles also give consideration to farmers, in that they say that biotope conservation must take into account "agricultural requirements" and that financial compensation can be received for participation in the conservation scheme. Only the last provision listed here, Section 3*b,* leaves wide open the regulations that might or might not be applied in a designated conservation area.

The Spatial Planning Act (SPA), discussed above in the section on soils, contains very clear provisions for the preservation of traditional Swiss countryside landscapes. It includes protections for agricultural land as a part of these landscapes, stating in its third article that [177]:

"The countryside must be preserved. In particular:

a. sufficient areas of suitable arable land, in particular crop rotation areas, should be reserved for agriculture [emphasis added]
b. settlements, buildings and installations should integrate well into the landscape
c. lakesides and riverbanks should be kept free and accessible to the public
d. natural landscapes and recreational areas should be conserved
e. forests should be able to fulfil their functions."

Other articles in the Spatial Planning Act define stringent directives for management of agricultural land, saying for instance that agricultural zones "shall be kept largely undeveloped, according to their various functions" and that new building on agricultural land should be kept to a strict minimum.

The SPA also defines what are "protection zones," thereby providing guidance to Cantons, such as the Valais Canton, on what can be considered within a protection zone. As per Article 17 [177]:

"Protection zones shall include:

a. streams, rivers, lakes and their shores and banks
b. landscapes of special beauty, and countryside of natural, cultural or historical value
c. important sites of local character, historic sites, as well as natural or cultural monuments
d. habitats for protected animals and plants"

---

preservation. Federal Act of 1 July 1966 on the Protection of Nature and Cultural Heritage (NCHA), 451 (2025), https://www.fedlex.admin.ch/eli/cc/1966/1637_1694_1679/en.

It is worth noting that the preservationist outlook of Swiss spatial planning directly impacts agricultural activity, as new building construction is strictly regulated, and as natural reserves for protected animals can (like in the case of Federal legislation above) entail the emergence of predators, which are generally not welcome to farmers.

Regulations specific to the Valais Canton

There are in Switzerland 161 landscapes and natural monuments of national importance (BLN). Collectively, they represent around 19% of the territory of Switzerland [203]. As can be seen in the map below of the Valais Canton, numerous protected areas overlap with agricultural zones presented in prior sections. This means that changes to agricultural practices in these zones are restricted by regulations relating to these landscapes, sites, and natural monuments. The same applies to the protected areas discussed in the "Natural context" section.

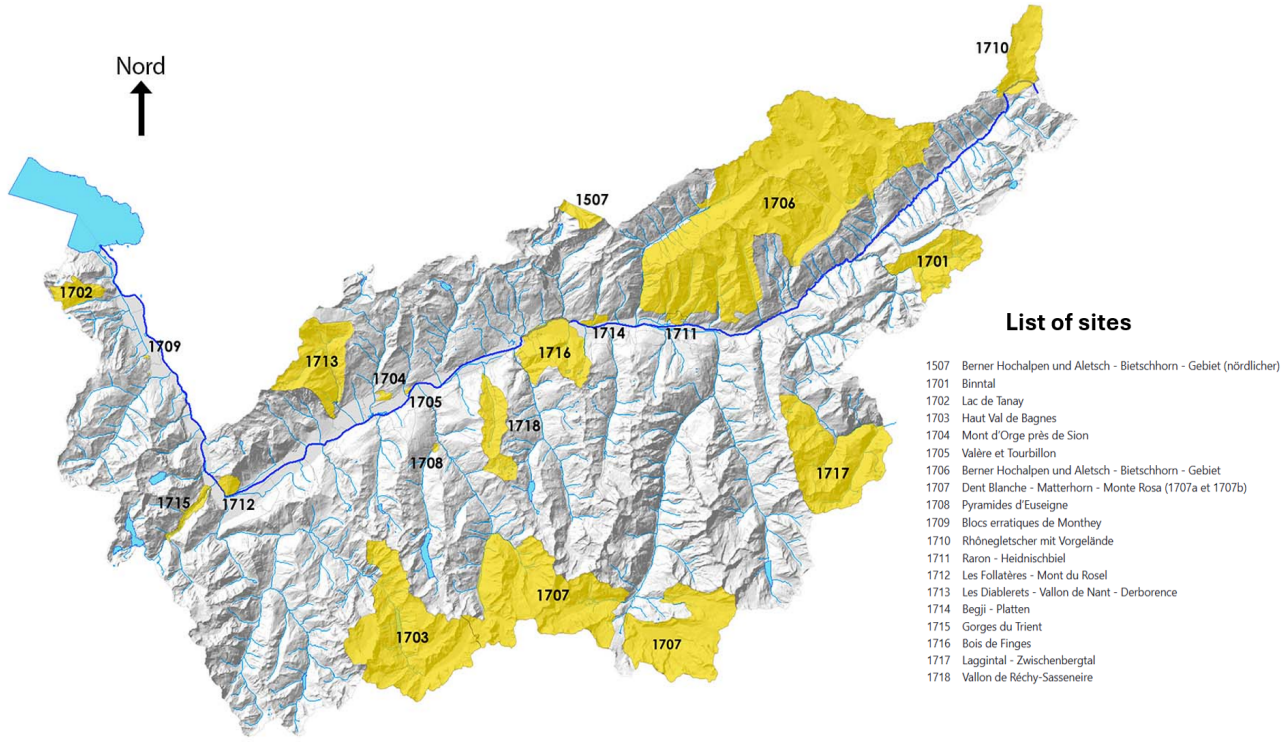


Figure 80 - Landscapes, sites, and natural monuments of importance in the Valais Canton. Source: Canton du Valais, 2025 [204]

Plant protection products

The Swiss Chemicals Act of 2000 (last updated 2024) defines plant protection products as follows [205]:

plant protection products mean active substances and preparations that are designed to:

1) protect plants and plant products against harmful organisms or prevent the action of such organisms
2) influence the life processes of plants other than as a nutrient
3) preserve plant products
4) destroy unwanted plants or parts of plants, or
5) control the undesired growth of plants

The Act tightly controls the procedures for placing new chemicals on the market, for their transport and handling, as well as for the disposal of chemicals. It is relevant to agriculture in the Valais insofar as it regulates access to pesticides that could potentially be used in agriculture.

A further discussion of this theme can be found in the section on "Integrated Pest Management."

5.5 Markets and value chains

The following section is a description of markets and value chains for agricultural products in the Valais Canton. Examples are presented of various market infrastructures, market outlets, farmer selling practices, supply chains, consumer interest in local foods, and consumer cooperatives.

The main outlets for valorization of Valais agricultural products are the following:

- Milk is primarily valorized in two ways: industrial (as drinking milk and derived products) and artisanal (on-farm processing into cheese, yogurt, cream).
- Cheeses, such as raclette, are processed both industrially (cooperatives, large affineurs) and on a small scale in alpine pastures and family farms [206].
- Wine follows the same logic: it can be sold directly at the estate, through cooperatives, or processed and distributed on a large scale (supermarkets, export) [206].
- Fruits and vegetables generate an estimated gross annual revenue of CHF 80 million. Key outlets include:
  - Large retailers (Coop and Migros account for nearly 70% of the market)
  - Processing into juices, compotes, and spirits
  - Direct sales, which are encouraged but not precisely quantified [146].

Regarding producers' selling and contracting practices, the following stands out:

- On-farm sales are growing strongly but remain minor: less than 5% of the market according to national data, though fruits, vegetables, and wine are more involved [207].
- Advertising is done through Cantonal campaigns, labels (e.g., "Marque Valais," "AOC," "IGP"), and initiatives by cooperatives and associations. Cheese marketing follows a seasonal pattern (more in summer in the mountains, continuous production in the lowlands) [208]; for wine, production follows the annual vine cycle, with marketing after vinification, often in autumn-winter [209].
- Added value depends on the sales method: the cost of the raw product represents 65-85% of the total selling price, the remainder covering labor, logistics, overhead, and profit. Margins are higher for direct sales, but this requires more investment in time and infrastructure [210].
- Advance sales contracts exist, often with cooperatives or industrial buyers for cheese and sometimes wine; however, some winemakers prefer direct sales at the estate or through short supply chains [206]. In fruits and vegetables, annual or multi-year written contracts are recommended to share risk, particularly for perennial crops [146].
- Short supply chains are increasingly developed: in Switzerland, 12,676 producers engage in direct sales (2020), with a significant share in the Valais Canton. Fruits, vegetables, eggs, and wine are particularly involved, though importance varies by sector [211].

Producers' and marketers' associations, including agricultural cooperatives, promote local foods, such as the following organizations:

- Valais/Wallis Promotion: This intersectoral organization promotes Valais local products, emphasizing quality and authenticity [212].
- RegioFoodVS: A digital platform connecting local producers with restaurants, strengthening short supply chains [213].
- The fruit and vegetable sector comprises about twenty SMEs active in trading and processing. Some businesses act as wholesalers/dispatchers, storing, packaging, and supplying the Swiss retail sector. National commissions set indicative prices for each fruit and vegetable group, and marketing concepts like Fruit-Union Suisse structure the market [146].
- The *Migros Valais* cooperative is one of the main consumer cooperatives, playing a role in governance, representation, and support of local consumption.

- *The Fédération Romande des Consommateurs* (FRC) also promotes local initiatives and sustainable consumption through activities and networks in the Canton [210].
- Partnerships with collective catering (schools, canteens) are encouraged to increase local fruit and vegetable consumption [146].
- The Valais Canton's Climate Plan includes "Supporting regional agricultural products and short supply chains in the food sector." [214]

Demand for local and responsibly produced products is strong in the Valais Canton, supported by territorial marketing, labels, and awareness campaigns. Valais products have a good reputation among Swiss and European consumers, especially for wine and specialty cheeses [215].

The specific case study & issues of *Raclette cheese* (PDO) is introduced in Appendix 12.4; relying in part on the work of Lhamo et al. (2025).

5.6 Cross-cutting themes - enabling or disabling factors

5.6.1 Environmental challenges

Natural disaster risks

The main natural disaster risks in the Valais Canton are the following:

- avalanches
- landslides
- possible flood events in the Rhône River plain
- forest fires

In what immediately follows, we present four maps corresponding to each of the natural disasters laid out above. (Drought is discussed in the section on climate change). Note that a large part of the danger zones overlap with the agricultural land identified in the maps provided in previous sections.

Avalanches: The following map of the Valais Canton, published by the Cantonal Geoinformation Service in collaboration with the Natural Dangers Service (Service des dangers naturels (SDANA)), identifies that there are many zones with avalanche risks. Red zones have a "high" avalanche risk, and orange zones have "indicative" risk, meaning that the risk is present but has not been specifically measured.

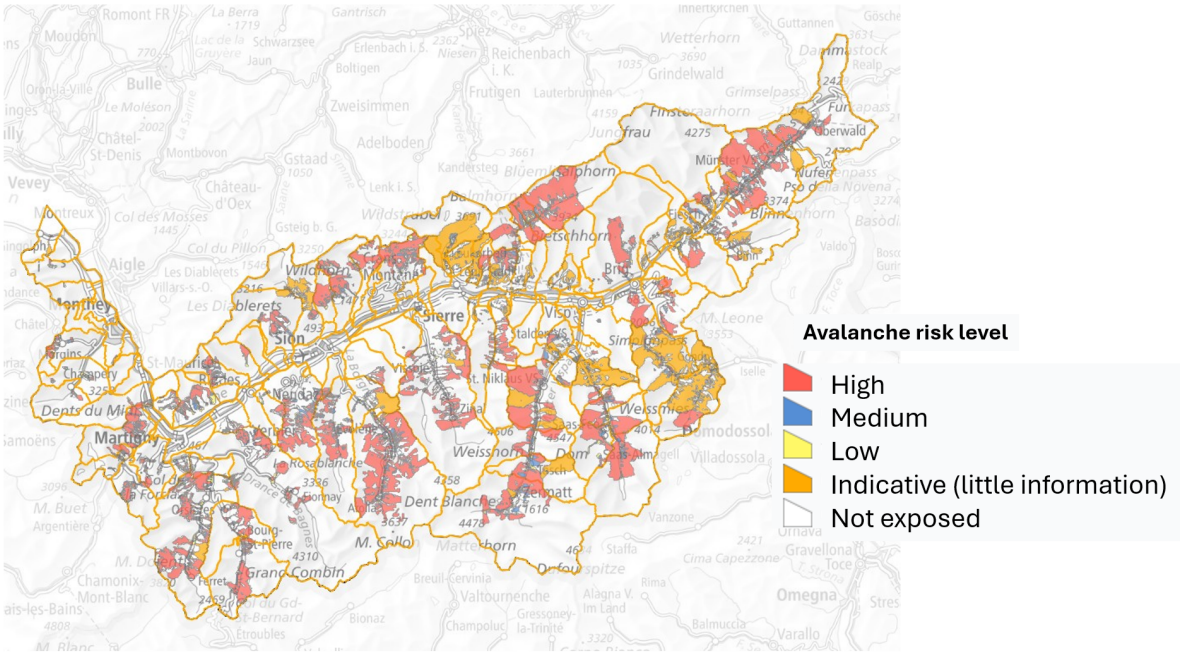


Figure 81 - Map of avalanche risk in the Valais Canton. Source: Canton du Valais [218]

Flood risk: The map below illustrates flood risk in the Rhône River plain. Although the map resolution and superposition of colours make it difficult to see, the map (online at https://tinyurl.com/26a5952z) shows that there is above-low risk all along the river's course. There is also a flood risk for the rivers that lead into the Rhône River itself [219].

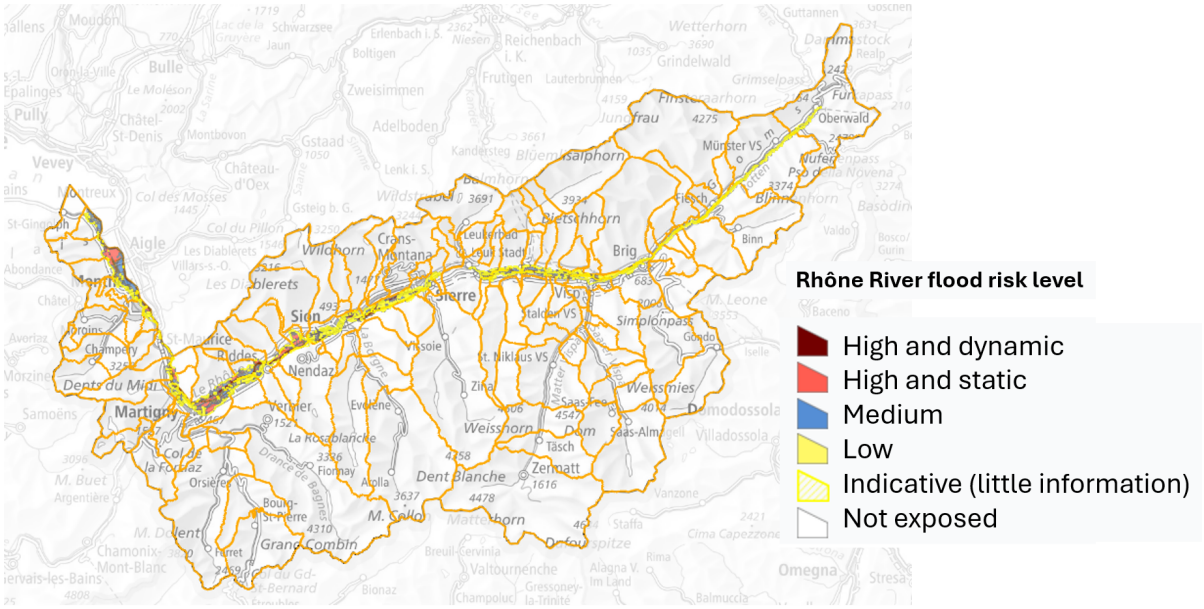


Figure 82 - Map of flood risk in the Rhône River plain. Source: Canton du Valais [220]

Geological risks: the map below shows the extent to which the Valais Canton is exposed to geological risks. Geological risks mean include large and small rockfall; permanent and context-specific landslides; mudslides; and land collapse. Because the number of layers in the map is too great, we have not included a legend/key. The map is given merely as an indication - based on the abundance of colour - of just how present geological risks are in the Canton.

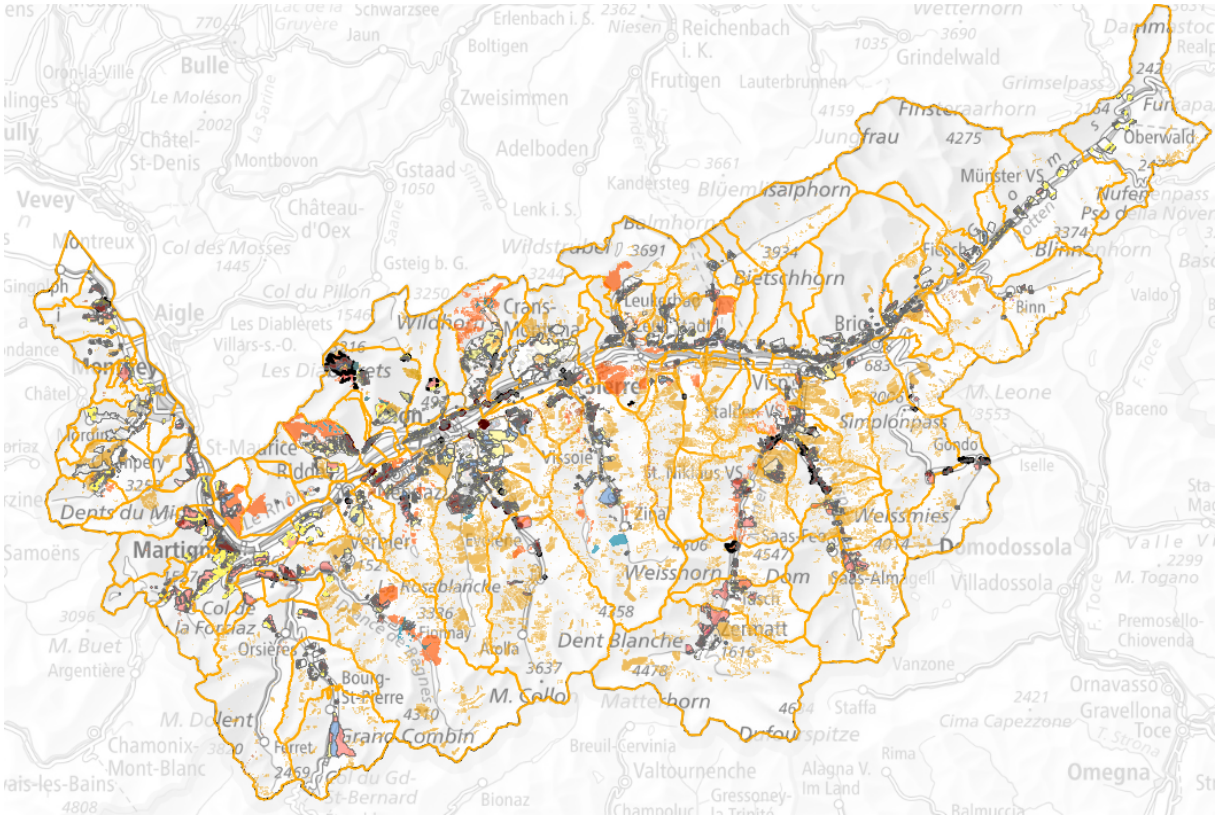


Figure 83 - Geological natural disaster risks in the Valais Canton. Source: Canton du Valais [221]

Forest fires: as of the end of the 2025 summer season, the Valais Canton was by far Switzerland's highest-risk Canton for forest fires, as can be appreciated in the map below, where the gradient ranges from low danger (in green) all the way to very high danger (in dark red).

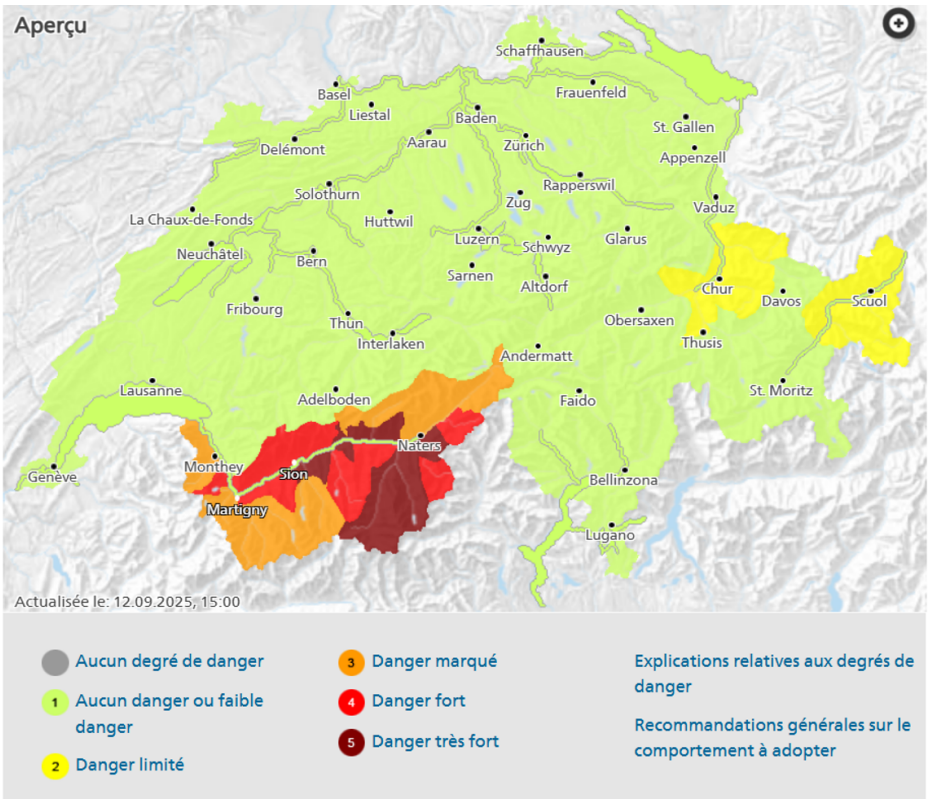


Figure 84 - Map of forest fire risk in the Valais Canton relative to the rest of Switzerland. Source: Portail des dangers naturels [222]

Pollutants

The main pollutant risk in water and soils is pesticides and nitrates. The Canton is implementing specific action plans to reduce these risks, especially near water bodies and roadsides.

Pesticides in the Valais Canton are less of a problem than they are in the north of the country where more intensive agriculture is practiced, as can be seen in the map below:

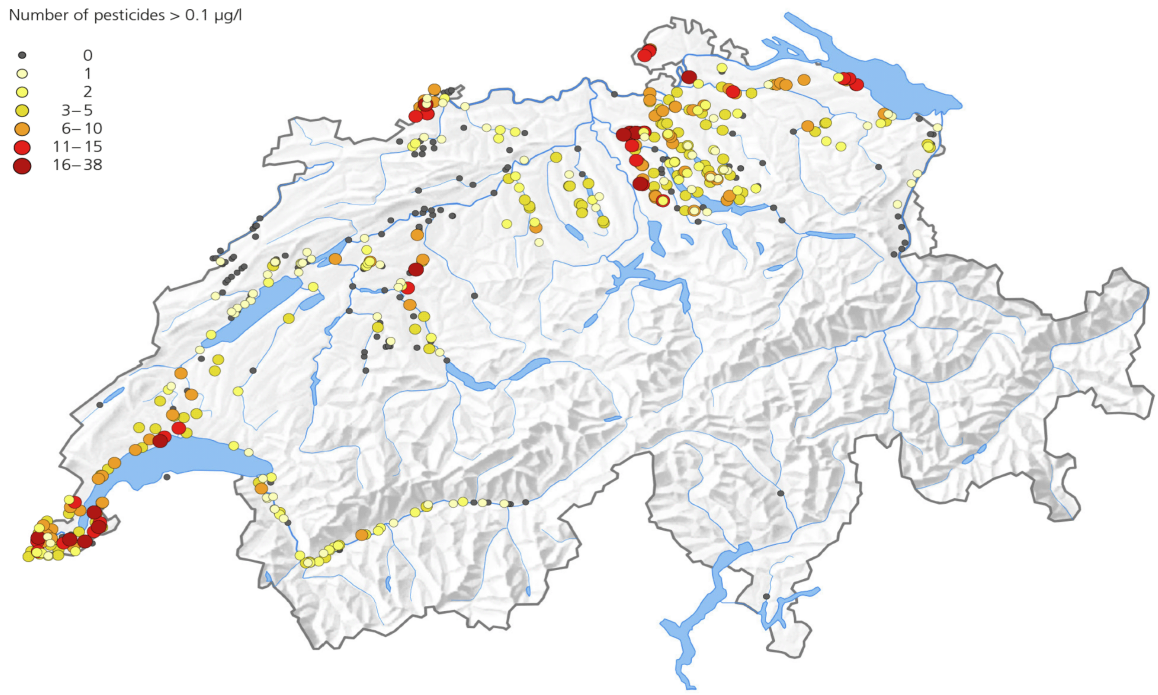


Figure 85 - Number of different pesticides in watercourses recorded in excess of 0.1 µg/l (565 sites with measurements from 2005 to 2012). Source: Station ornithologique suisse [223]

Nitrates are not as much of a challenge in the Valais Canton, at least not in comparison to the situation in the Plateau in the northern half of the country, as can be seen here:

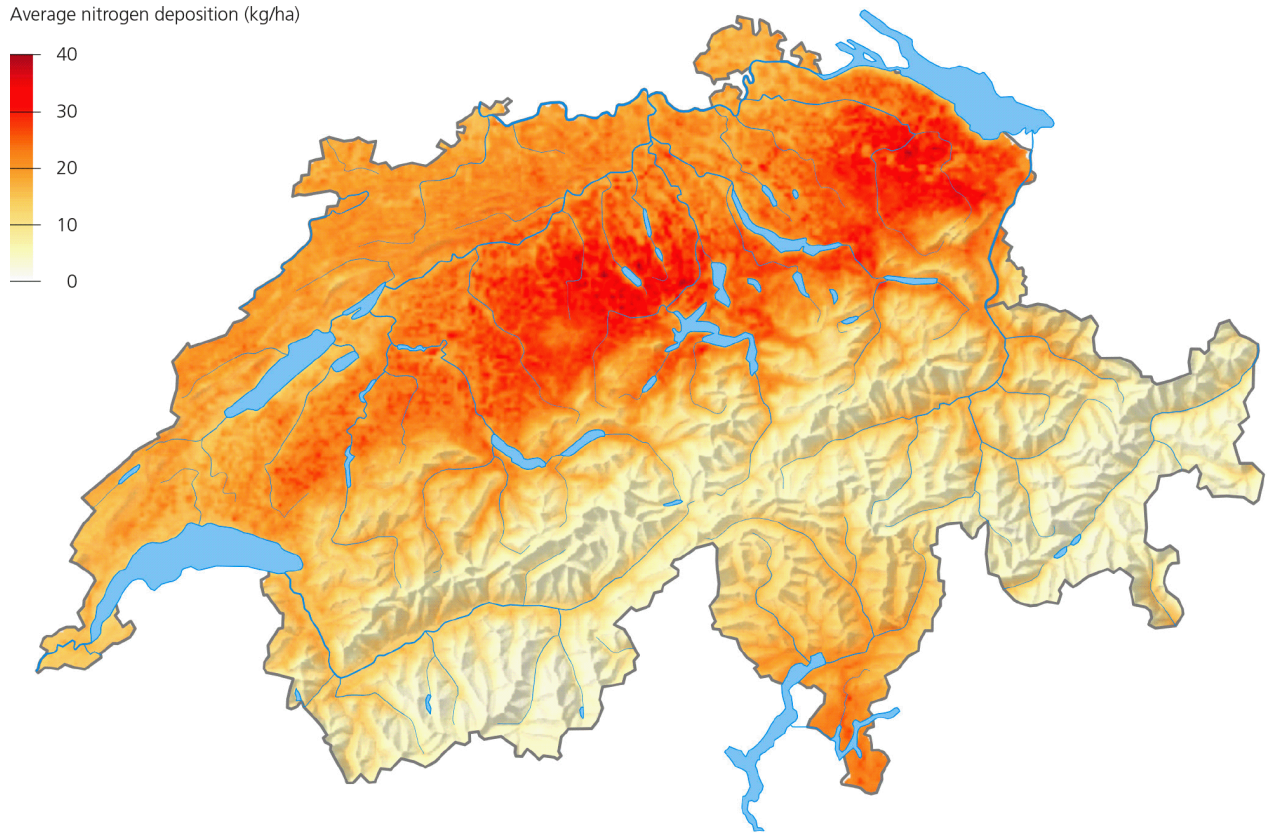


Figure 86 - Average nitrogen deposition per ha and year in 2010. Source: Station ornithologique suisse [223]

Climate change impact and adaptation

Climate change poses a threat to agriculture in the Valais Canton in a number of ways. According to the National Centre for Climate Services [224],

Since the year 1864, the temperature in the Canton of Valais has increased by 2 °C, based on the cantonal fact sheet from 2021. If global greenhouse gas emissions continue to rise in the future, the warming will continue and will amount to further 3 °C by 2060 with respect to the mean of the period 1981-2010.

Human-made climate change will lead to a further increase of both winter and summer temperature in the Canton of Valais. Mean precipitation amounts will tend to decrease in summer and to increase in winter. The magnitude of these changes will depend on the future greenhouse gas emissions. Two different emission scenarios are considered here: Stringent future emission cuts (RCP2.6) and a continued increase of emissions (RCP8.5).

The following figures illustrate the changes in temperature and precipitation, in the Valais Canton, in summer and winter, under two scenarios at the 2035, 2050 and 2085 horizon:

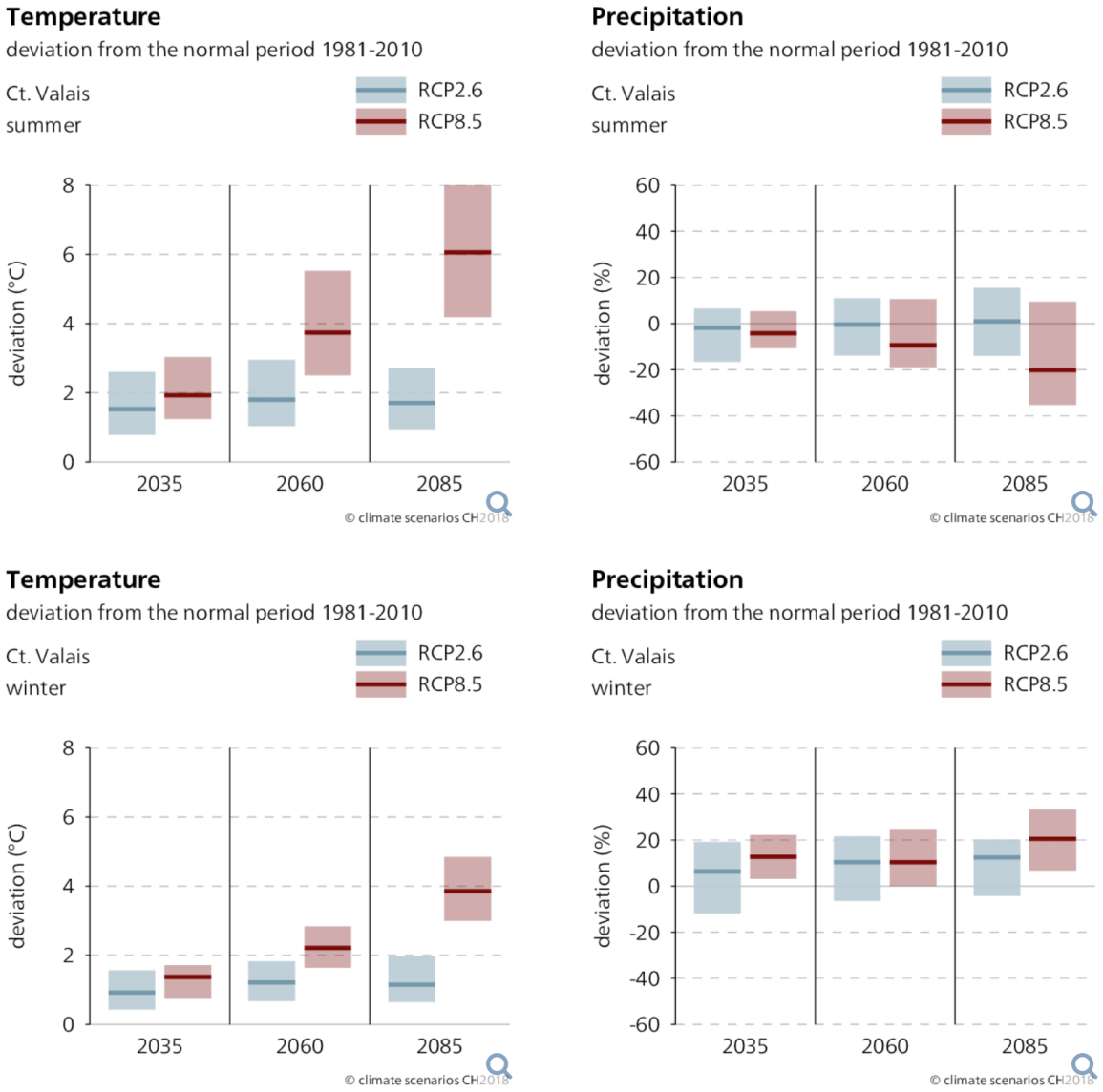


Figure 87 - changes in temperature and precipitation, in the Valais Canton, in summer and winter, under two scenarios at the 2035, 2050 and 2085 horizon. Source: National Centre for Climate Services [224]

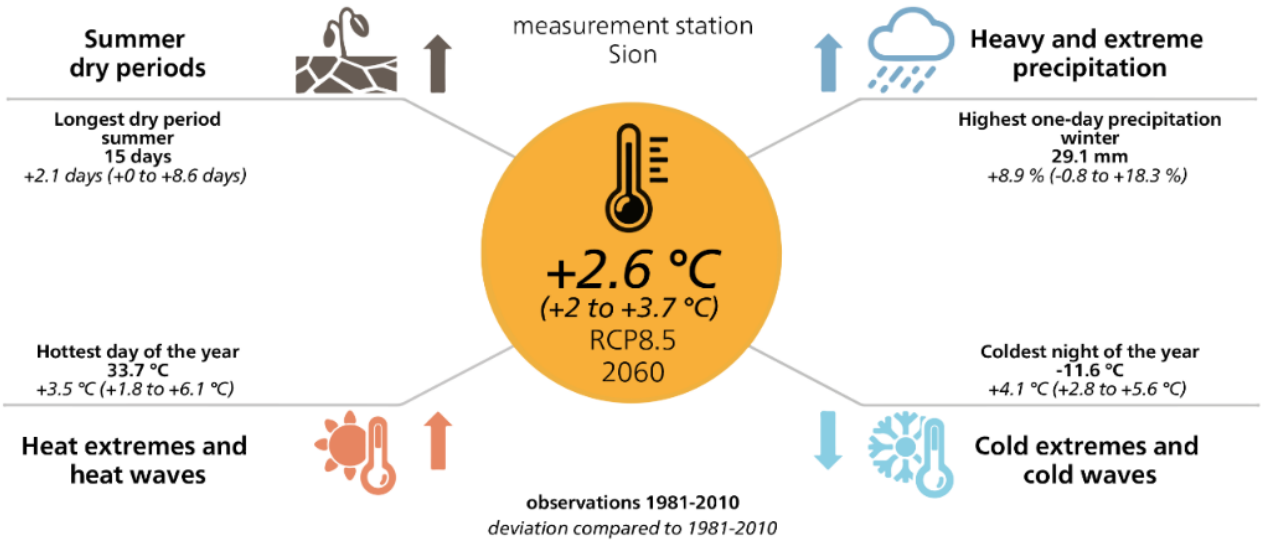


Figure 88 - Overview of the expected changes in extreme values for the measuring station Sion for the period around 2060 compared to the normal period 1981-2010 (assumption: emission scenario RCP8.5). Source: National Centre for Climate Services [224]

The risks posed to agriculture are as follows:

- More hot days and longer growing seasons
- Increased frequency of summer droughts
- More extreme weather events, such as heavy rainfall and sudden floods, mudflows, frequent landslides

These factors place stress on crops, livestock, and infrastructure.

Another challenge linked to climate change in the Canton is water availability. Indeed, the Valais relies heavily on glacial and snowmelt water, especially in summer. As glaciers retreat and snow cover shrinks, rivers and groundwater levels are declining, posing risks for both vineyards and other crops. Some villages already experience acute water shortages in summer, which raises demand for irrigation, either through innovative technologies, drip irrigation, or by collecting small amounts of water from hydroelectric dams [225]. The traditional “bisses” irrigation channels, while iconic, are maladapted to the need for rationing of water and require maintenance and improvement. A paper from the Foundation for the Sustainable Development of Mountain Regions spells out the main challenges [216]:

- “The management of water and its quality: increasing danger of shortage during droughts in particular in touristic resorts during the high season; difficulty to handle and clean the new pollutants such as micropollutants; management of pollutions due to industries in the second half of 20th century; risk of insufficient dilution of cleaned water in the rivers in case of reduced streamflow; need of investment to improve and maintain the water treatment infrastructures.
- “The water management for agriculture and tourism: increasing needs of irrigation (more drought and evaporation) and importance to maintain the “bisses” network; increasing needs for artificial snowing in the touristic resorts.
- “The preservation of lakes and rivers as habitats: increasing pollution by micropollutants; overuse of natural mountain lakes for artificial snowing with impacts on flora and fauna
- “The protection against water-related natural hazards: increasing risks of flood and avalanche due to climate change (more frequent extreme events)
- “The use and development of renewable energy: reduction of electricity production due to the reduction of available water.”

Further, melting glaciers, thawing permafrost, and the increased risk of floods and avalanches threaten both agricultural land and rural infrastructure.

5.6.2 Other key issues

Gender

According to Lhamo et al. (2025), "Gender roles in farming also remain uneven. Livestock farming is still dominated by men. However, women are actively involved in most farms, even if they are not always formally recognized. Some women are employed in their husband's businesses, while others have recently gained legal recognition as joint farm managers. Regardless of their official status, women often participate in decision-making and have access to financial resources." The authors note that the TAPE questionnaire has some limitations in terms of assessing gendered contribution to agricultural activities and that "While women are active in decision-making and daily operations, their contributions often go unrecorded due to informal employment status or legal structures of farm ownership." [109]

Youth

While youth involvement is diverse across the territory, the strong territorial identity in some places - particularly around milk production in summer pastures dedicated to raclette production as opposed to the milk industry - has made this work attractive to youth. Indeed, "In valleys such as Val d'Hérens, strong community ties, collective management of mountain pastures, local culture (e.g. queen fights) and a sense of identity play a central role. These factors encourage young people to stay, facilitate solidarity between farmers and support the transmission of knowledge […] The passion surrounding the Hérens breed and the queen fights helps to maintain a strong motivation for breeding and cultural continuity in the region. Indeed, the younger generations are also passionate about Hérens breeding." [109] Lhamo et al. (2025) remark that the TAPE questionnaire also has its limits in terms of identifying youth engagement: "the presence of young farmers is underrepresented due to the tool's household-based approach, despite qualitative evidence of intergenerational farm transmission in Val d'Hérens and Val d'Illiez." [109]

Ageing of farmer populations

Ageing of farmers is a critical consideration for Swiss agriculture. In this regard, Switzerland is a unique case within the EU: unlike in most European countries, in Switzerland farmers over 65 years of age are no longer entitled to direct payments. Zorn (2025) observes that "this system creates a financial incentive to hand over or give up farms earlier. By contrast, farmers in many EU countries continue to receive subsidies even in old age, which could lead to delayed farm transfers and a higher age structure." [226]

Even without the incentive to hand over farms earlier, however, Switzerland clearly faces a demographic challenge in terms of farm ownership. This can be seen in the figure below, which shows that the age structure of the farmer population has shifted to the right (older) in the years between 2004 and 2020. There is, as would be expected, a sharp drop-off at age 65, when farmers cease to receive direct payments. Data on farm handover suggest agriculture remains overall an unattractive line of work [226].

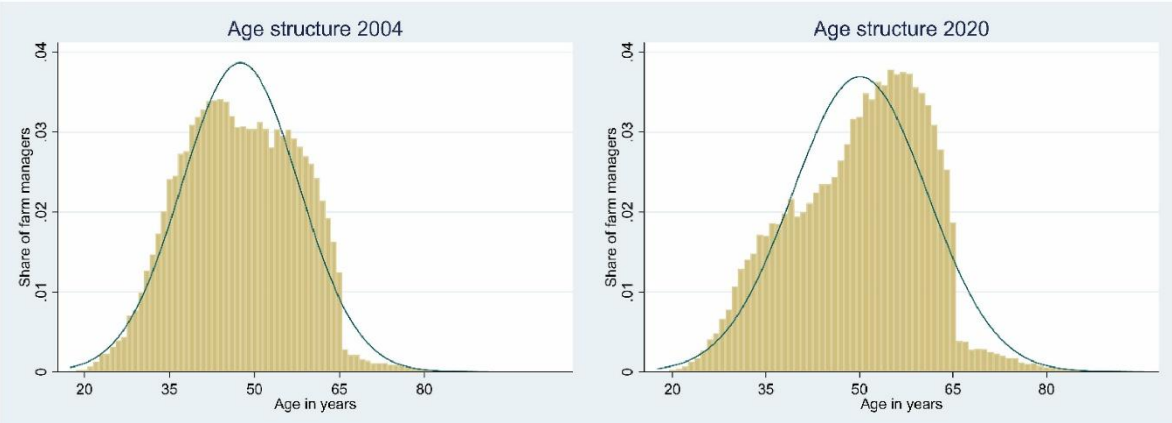


Figure 89 - Age distribution of farm managers in 2004 versus 2020. Source: Zorn (2025) [226]

6 AGROECOLOGY IN LAZIO (ITALY)

6.1 TAPELINE in the territory and the study context

6.1.1 Background and rationale for applying TAPE

In the Lazio region, the most relevant objective of the TAPELINE project is the integration of the TAPE tool into territorial planning processes to support the agroecological transition at regional scale.

This is particularly significant due to the presence of project partners and consultants directly involved in regional planning, which creates a concrete opportunity to embed TAPE within existing policy instruments. TAPELINE also received a letter of interest from the regional administration.

A key reference in this context is the Regional Agricultural Plan (PAR), established under Article 52 of Regional Law No. 38/1999. The PAR represents an innovative planning tool with a dual function: on the one hand, it supports territorial and spatial planning; on the other, it provides a sectoral framework for analyzing and guiding the agricultural system.

This dual nature makes it especially suitable for integrating agroecological assessment tools such as TAPE, enabling a more detailed characterization of rural areas, including their potentials, specificities, and criticalities.

The relevance of the TAPELINE project for the Lazio region lies in the need to embed an agroecological approach within both technical planning and socio-economic development strategies at territorial scale.

In Lazio, agricultural policies and territorial planning have traditionally operated in parallel, often addressing environmental, productive and social dimensions separately. However, current challenges: ranging from climate change and resource degradation to the fragility of rural economies: require integrated approaches capable of linking land use, farming practices and local development.

An agroecological perspective offers precisely this integrative framework. It allows moving beyond farm-level interventions and towards a systemic understanding of territories, where ecological processes, production systems and socio-economic dynamics are considered together. This is particularly relevant in a region characterized by strong heterogeneity, where peri-urban pressures coexist with marginal rural areas facing abandonment and loss of economic viability.

In this context, the implementation of TAPELINE is important not only as a project, but as an opportunity to operationalize agroecology within planning practices: supporting more coherent policy design, strengthening the connection between technical and socio-economic dimensions, and enabling more place-based and participatory strategies for rural development.

Through the implementation of TAPELINE, we aim to demonstrate that an agroecological approach can be effectively integrated into territorial planning and socio-economic development, rather than remaining confined to isolated farm-level practices.

Ultimately, we aim to demonstrate that the agroecological transition is not only a technical shift in agricultural practices, but a governance process that requires coordination across sectors, institutions and local actors: and that this transition can be actively supported through planning instruments and participatory approaches.

What needs to be improved in the Lazio region is the capacity to read and govern agricultural systems in a long-term perspective. Territorial planning in complex systems is often perceived as critical, as it requires careful, context-specific (“tailored”) decisions.

Currently, environmental, landscape, technical and socio-economic dimensions are often addressed separately, and decision-making lacks a structured set of indicators capable of capturing this complexity.

In this context, the main limitation of the institutional enabling environment is not the absence of policies: on the contrary: but the lack of a consistent operational approach and adequate tools to support coherent, evidence-based and integrated decision-making.

Due to the high diversity of farming systems in the Lazio region, it is not possible to provide a generalized assessment of the level of agroecological transition without a dedicated analysis.

Farm structures, production systems and territorial conditions vary significantly, from intensive peri-urban farms to marginal rural areas. This heterogeneity requires a more nuanced and evidence-based understanding, which the implementation of TAPE will help to develop.

Rather than assuming a uniform level of advancement, the project will contribute to identifying different transition pathways and levels of agroecological integration across the territory.

There is a significant opportunity to scale up agroecology in the Lazio region, particularly through the Regional Agricultural Plan (PAR), which is designed to respond to the specific vocations and characteristics of the territory through technical and regulatory provisions.

The integration between the TAPE tool and the PAR represents a strategic opportunity for mutual reinforcement: TAPE can strengthen the analytical and diagnostic capacity of the PAR, while the PAR can provide the institutional framework to translate agroecological principles into concrete planning and regulatory measures.

6.1.2 Specific research and evaluative questions

Which are the main characteristics of agricultural farms in Lazio Region?
The agricultural system in the Lazio region is characterized by a high degree of heterogeneity, both in terms of farm structures and territorial contexts. Farming systems range from intensive and market-oriented peri-urban agriculture to extensive and marginal systems in inner and mountainous areas. This diversity is reflected in farm size, production models, access to infrastructure and integration into value chains. A key feature is the fragmentation of the production structure, combined with the coexistence of highly specialized sectors and more traditional, multifunctional systems. In many areas, agriculture plays not only a productive role but also a territorial and ecological function, contributing to landscape management and the maintenance of rural systems. At the same time, several structural challenges persist, including land fragmentation, uneven access to resources and services, and increasing pressure from urbanization and competing land uses.
How can the 10 Elements of Agroecology be used as a framework to describe and assess the transition of rural areas towards agroecology?

In the Lazio context, the AE framework is particularly useful to move from a descriptive analysis of rural areas towards an interpretative one, identifying different levels of agroecological performance and highlighting both strengths and gaps across territories. The territorial planning with a continuous update of data sets supports a shift from static classifications to dynamic transition analysis.

How can agroecology principles be embedded into land-use planning and territorial strategies, ensuring coherence between agricultural, environmental, and spatial policies?

The Regional Agricultural Plan (PAR) already provides a suitable entry point, as it is conceived as a dual instrument: both territorial/spatial and sectoral: capable of linking agricultural systems with broader land governance processes. Embedding agroecology means translating its principles into planning criteria, such as soil protection, water management, landscape functionality, and support for

local value chains, while ensuring coherence with environmental and spatial policies. This requires moving from sectoral regulation towards integrated and place-based planning approaches.

How can agroecology be monitored within land governance processes, linking biophysical indicators with institutional and socio-economic dimensions?

Agroecology can be monitored by developing integrated indicator systems that connect biophysical, socio-economic and institutional dimensions. The PAR already adopts a methodology based on the use of indicators and composite indices to describe territorial systems and monitor their evolution over time. Building on this approach, agroecological monitoring can combine indicators related to soil, water, biodiversity and landscape with variables such as farm structure, economic performance, and governance arrangements. This allows not only to assess current conditions, but also to track transition processes and support adaptive planning.

How can the TAPE tool be adapted and operationalized to support these goals in a European and regional governance context, particularly through participatory and multi-actor approaches?

The TAPE tool can be adapted to a European and regional governance context by positioning it not only as a farm-level assessment tool, but as a component of territorial planning and decision-making processes. This requires aligning TAPE indicators with existing planning frameworks: such as the PAR: and integrating them into participatory and multi-actor processes involving farmers, institutions and local stakeholders. In this perspective, TAPE becomes a bridge between data collection, stakeholder engagement and policy design, supporting more informed and coherent governance of agroecological transitions. Its operationalization depends on its ability to interact with existing institutional tools, rather than functioning as a standalone instrument.

6.2 Contextual assessment

The following sections are meant to provide information for a comprehensive understanding of the agroecological context and the main factors towards the agroecological transitions.

6.2.1 Country profile and territory boundaries

The agroecosystems under study are located in the Lazio region, in central Italy (11°26′ E - 40°47′ N to 14°01′ E - 42°50′ N). The region borders the Tyrrhenian Sea to the west, while it is bounded by Umbria, Tuscany and Marche to the north, Campania to the south, and Abruzzo and Molise to the east. It covers an area of 17,242 km² and is divided into five provinces: Viterbo, Rieti, Rome, Frosinone and Latina.

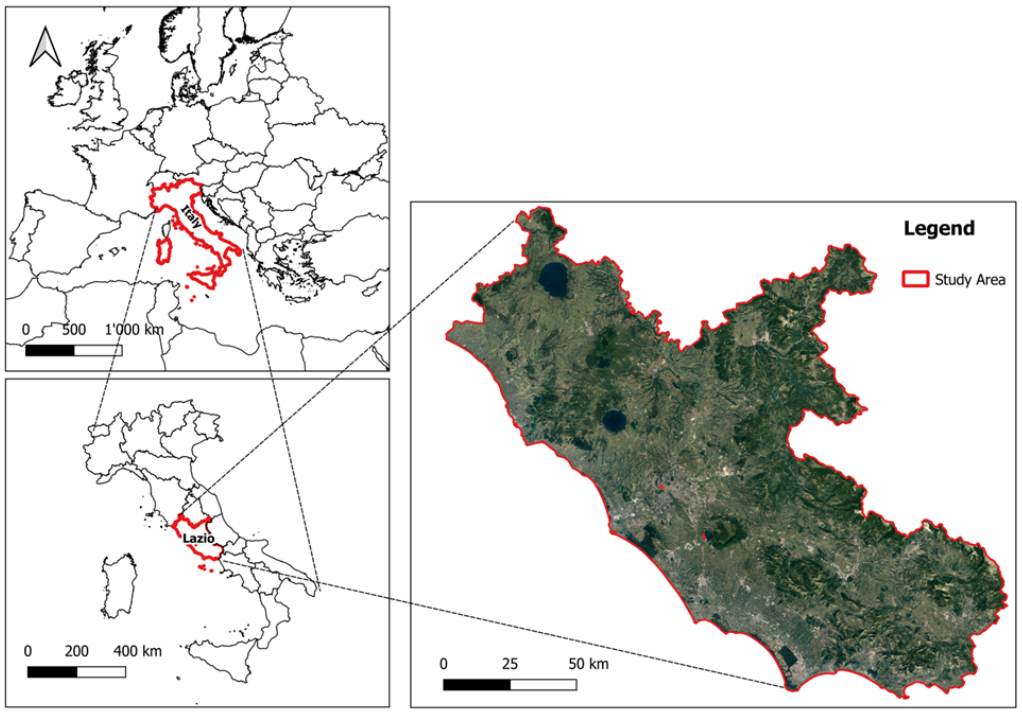


Figure 90 - Study area Lazio Region

Territory Boundaries

In the Lazio region, seven agroecosystems were selected, each characterized by a distinct dominant farming system: the kiwi production agroecosystem; the Castelli Romani agroecosystem; the arable farming agroecosystem of the Maremma Laziale; the olive-growing agroecosystem of the Sabina area; the Roman horticulture agroecosystem; the Val di Comino agroecosystem; and the dairy production agroecosystem.

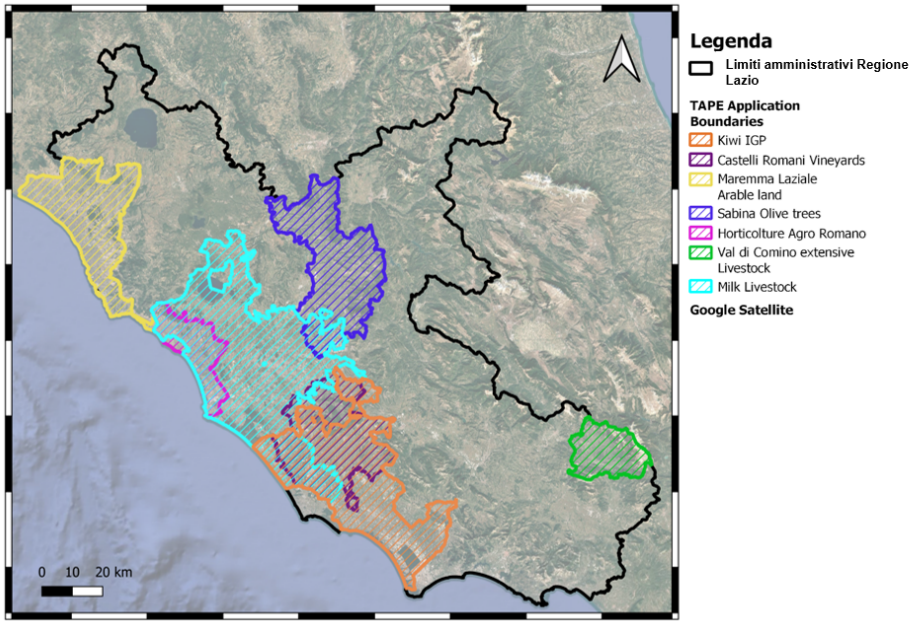


Figure 91 - Agroecosystem selected in Lazio Region

6.2.2 Socio-economic characteristics

Demographic and socio-economic dynamics in the Lazio region have been analyzed using data from ISTAT. The average age of the Italian population is 46.8 years, while in the Lazio region it is slightly lower, at 46 years [260]. With a total population of 5,709,198 inhabitants [260], Lazio is the second most populous region in Italy. The most populated province is Rome, with 4,222,648 inhabitants, while the least populated is Rieti, with only 149,766 inhabitants.

The average population density in the region is 331.8 inhabitants per km², reaching a maximum of 788.1 inhabitants per km² in the province of Rome, and a minimum of 54.7 inhabitants per km² in the province of Rieti.

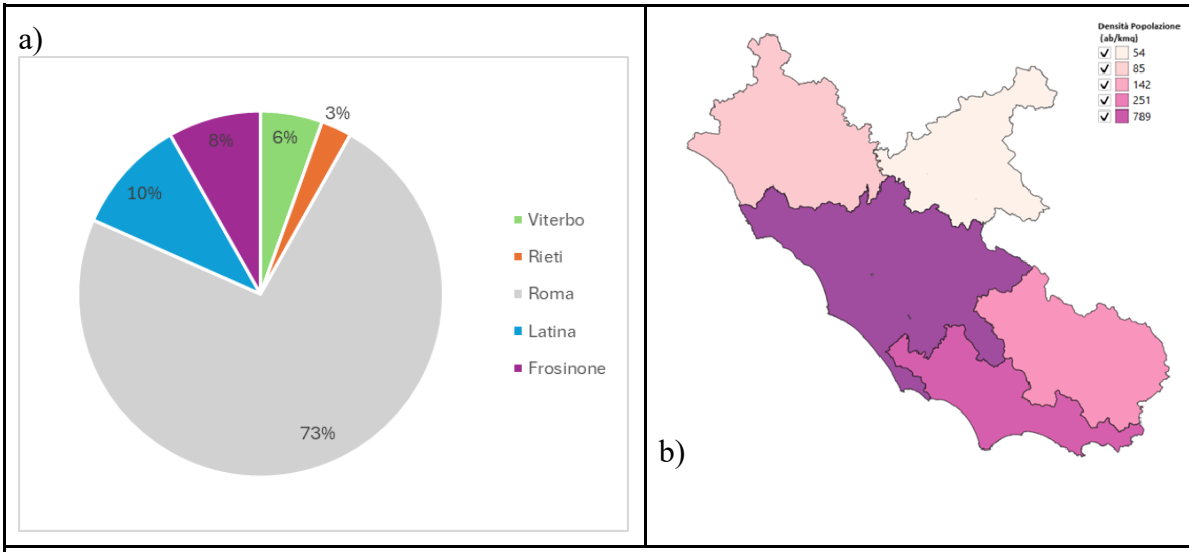


Figure 92 - a) Distribution and b) density of Lazio Region inhabitants

Population by employment sector

ISTAT data show a structural change in employment in Lazio between 1971 and 2011. Agriculture steadily declined over the long term: from more than 153,000 workers in 1971, the figure fell to about 64,000 in 2011. After the sharp decreases recorded up to 2001, the value in the last interval (2001-2011) remained essentially stable, with only a minimal change. Industry, by contrast, followed a much less linear path. After a slow contraction between 1971 and 1991, a very marked surge can be observed in 2001, followed by a sharp decline in 2011. A fluctuation of this magnitude suggests caution in interpretation: in addition to economic dynamics, it is plausible that changes in classification criteria or in the way sectors were recorded across different censuses also played a role. Overall, the most consistent growth was in the "other sectors," which increased significantly throughout the entire period, rising from about 886,000 in 1971 to more than 1.75 million in 2011. The overall picture therefore shows a strengthening of the tertiary sector and a progressive loss of weight of the primary sector, consistent with the transformation of the regional economy toward predominantly service-based activities.

6.2.3 Natural context and ecosystemic services

From the perspective of the natural context, the following aspects were assessed: geology, soils, climate, and hydrography. In addition, the distribution of protected areas within the study area is presented.

Geology

The first environmental aspect examined was geology. The interest underlying the assessment of the geology and lithology of the study area is linked to their relationship with agricultural land use and to the identification of distinct zones according to the prevailing volcanic, carbonate, or alluvial origin of the formations. To provide an overview of the geological characteristics of the regional territory, the National Geological Map at a scale of 1:250,000 was used, applying a thematic classification based on the main geological formations: calcareous, volcanic, and alluvial (Figure 93). Alongside the geological map, the National Geolithological Map at a scale of 1:250,000 was also used, and it is likewise shown in Figure 93.

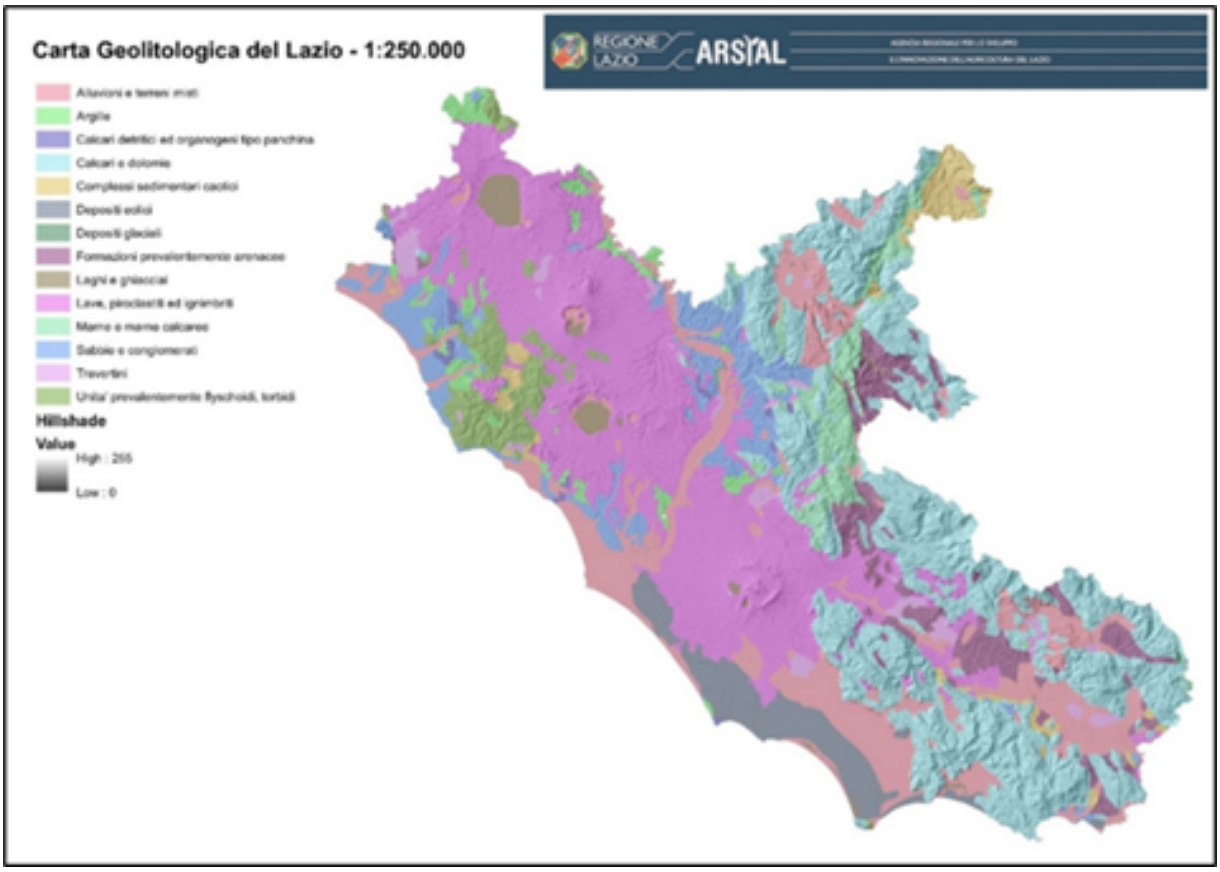


Figure 93 - Data sources: Official cartographic base suitable for printed output at a scale of 1:250,000, identified through screening of RNDT AgID, the MATTM National Geoportal, the ISPRA Geological Survey Portal, the regional SITR Urban Planning Geoportal, and Lazio Open Data; digitized Geological Map of Lazio at a scale of 1:250,000, usable in a GIS environment, from the MATTM National Geoportal

The synthetic representation of the many variants of the current geolithological organization of the Lazio subsoil shown in the thematic analysis maps highlights the main features of the geological structure that characterizes the region. According to the predominance of calcareous and calcarenitic substrates, those resulting from volcanic phenomena, or those derived from marine or fluvial alluvial sediments, it is possible to distinguish three broad groups of formations of similar origin that shape and define the geological structure of Lazio.

Lazio displays a geological diversity that is reflected in three main areas: calcareous, volcanic, and alluvial.

- The calcareous Lazio includes geological formations from different periods. The oldest calcareous formations, dating back to the Triassic-Cretaceous, include the Reatini, Simbruini, and Ernici Mountains, as well as the Meta and Mainarde groups, characterized by marked ruggedness, exposed bare rock, karst cavities, and a limited presence of surface water. The Paleogene formations, outcropping in the Sabini and Carseolani Mountains and in the Aniene Valley, are more eroded and less rugged, with greater agricultural activity due to more favorable conditions. The more recent Pliocene formations, made up of marine clays and sands, characterize the coastal belt of northern Lazio and the Roman Tuscia, featuring land more suitable for cultivation, except in areas affected by badlands.
- The volcanic Lazio extends across the central-southern Anti-Apennines and is characterized by various extinct volcanic complexes, including Vulsineo, Cimino, Sabatino, and the Alban

Hills. These reliefs, predominantly gentle and flat, consist of lava flows and pyroclastic deposits. The morphology and fertility of volcanic soils have favored human settlement and agriculture. The Vulsineo complex, formed between the Pleistocene and the Quaternary, includes Lake Bolsena. The Cimino area includes Lake Vico and a historically cultivated landscape, now dominated by hazelnut cultivation. The Sabatino district is characterized by Lake Bracciano, while the Alban Hills include Lakes Albano and Nemi, surrounded by fertile agricultural land. Finally, the Pontine Islands archipelago is characterized by varied landforms and a predominance of Mediterranean scrub.

- The alluvial Lazio includes the coastal plains and inland areas formed by Quaternary alluvial deposits, such as the valleys of the Tiber and Sacco rivers. The coastal plains, rich in gravel, sand, and volcanic minerals, contrast with the inland areas, which feature fluvio-lacustrine deposits, especially in the Pontine Plain and the Roman area. The Maremma Laziale is characterized by dunes and low-lying areas, transformed through extensive land reclamation during the twentieth century to support agricultural settlement. Similarly, the Agro Pontino was transformed from a marshland into productive agricultural land through drainage works and infrastructure, also improving other areas such as the Plain of Fondi and the Roman Campagna, making them more suitable for agriculture.

Pedology

The Lazio Region has developed a soil database for Lazio and a soil map at a scale of 1:250,000 (Figure 94). The Soil Map of Lazio was prepared by ARSIAL, in collaboration with the CREA Agriculture and Environment Research Centre, the national reference body for the management of the Italian Soil Database and its related cartography [264].

The regional soil map identifies homogeneous geographical units, the so-called pedo-landscapes, defined by geological substrates, climate, physiography, and morphometric aspects linked to the factors of pedogenesis. These landscapes are associated with different soil types, homogeneous in terms of physico-chemical characteristics, quality, and soil formation processes.

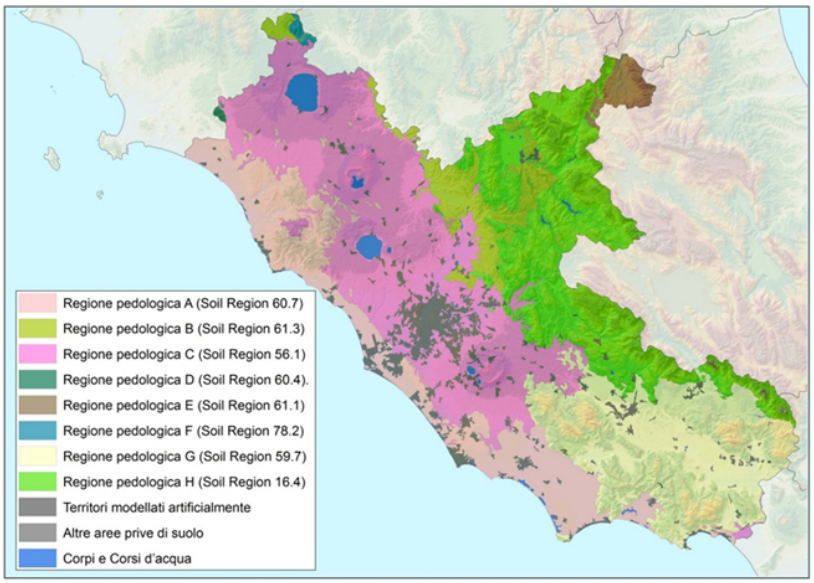


Figure 94 - Soil Region

Each cartographic unit is characterized by a specific combination of soil types, referred to as soil typological sub-units, which group together the soils stored in the database.

The soil types are organized into:

- Soil Typological Units (UTS): a set of soil sites sharing common geographical attributes and similar genetic characteristics, with a certain variability in management issues or applied characteristics.
- Soil Typological Sub-units (STS): a set of observations with similar management issues identified within a given UTS.
- Geographical attributes refer to the different combinations of climate, morphology, lithology, and land use at the reference geographical level.
- Genetic characteristics refer to pedogenetic processes, genetic horizons, and diagnostic properties and materials.
- Applied characteristics refer to management issues, soil conservation concerns, and crop suitability.

The following criteria were selected for the development of the Soil Typological Sub-units (STS): substrate, physiography and morphometry, land use, classification (IUSS Working Group WRB, 2015), internal drainage, rootable depth, total soil depth, texture of surface horizons, soil reaction and degree of base saturation, surface stoniness, coarse fragments, and Land Capability class.

Climate and meteorology

Data relating to climate and meteorology in the territory of the Lazio Region can be obtained from the records of the Integrated Agrometeorological System of the Lazio Region (SIARL). The SIARL dataset provides information on daily maximum, minimum, and mean temperature, as well as daily precipitation. The temporal coverage of the data is limited to only 16 years and therefore does not allow for proper climatic statistics, for which observations over a thirty-year period are required. However, since the stations are located within the Lazio region, the dataset still represents a valid indicator of regional weather patterns.

Annual and seasonal temperature and precipitation values, spatialized across the territory of Lazio, were represented following the scheme adopted in the cartography of the Italian Atlas of Climate and Climate Change (formerly CRA-CMA). Figure 95 presents the maps of annual precipitation and temperature (minimum, maximum, and mean).

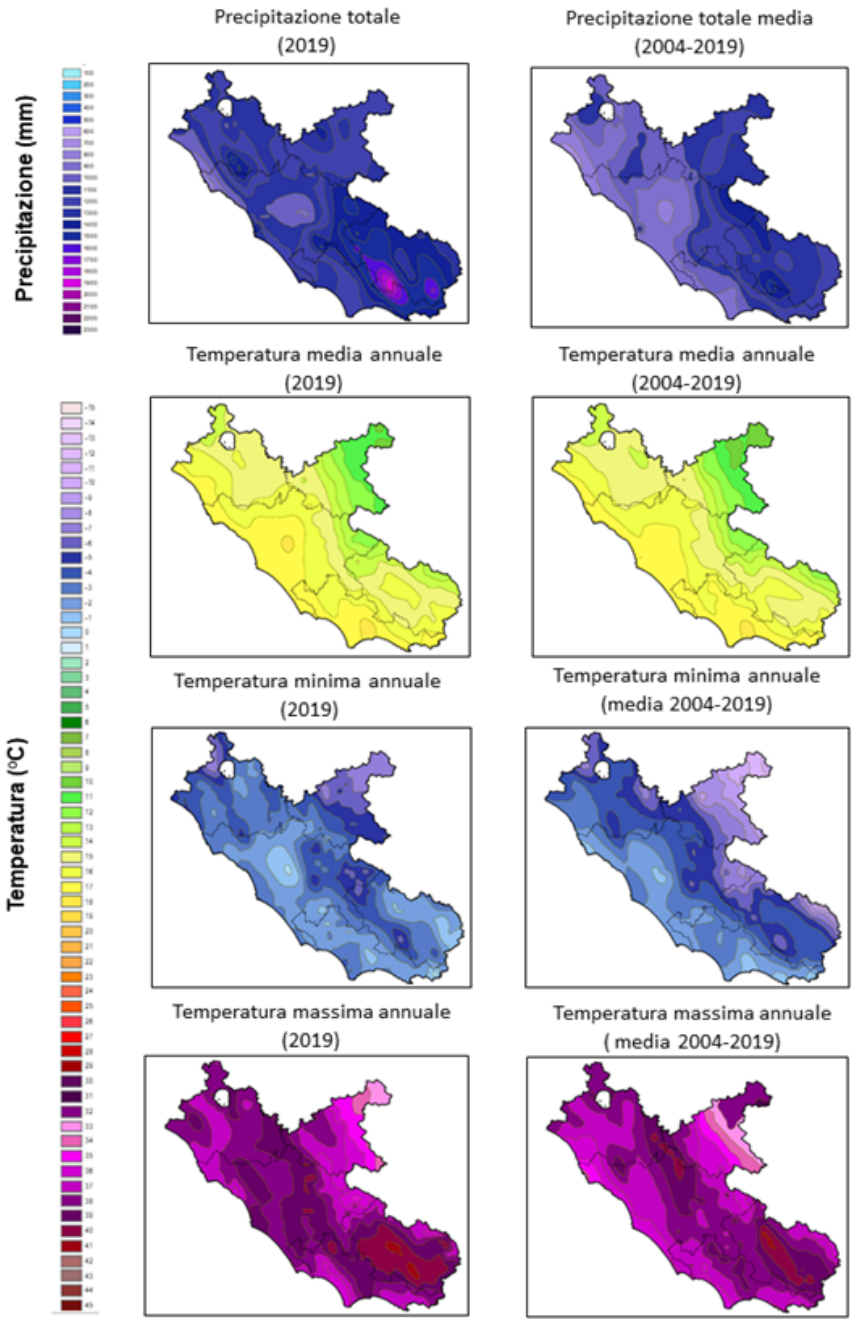
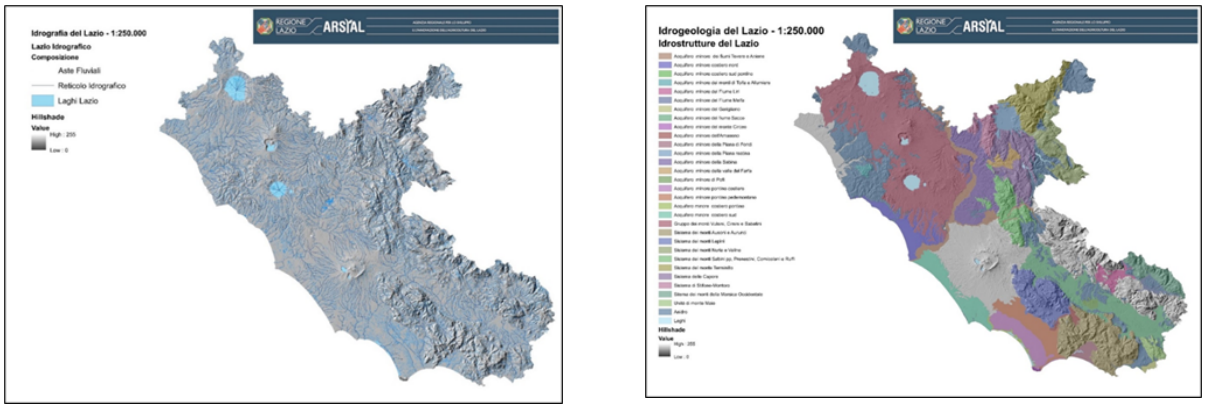


Figure 95 - Summary of annual and average thermopluviometric variables for the 2004-2019 time series.

Hydrology and hydrography

The cartography relating to the representation of the hydrographic network, catchment basins, lakes, and water bodies was derived from the national hydrographic network of the National Geoportal at a scale of 1:250,000, including the hydrographic network and river channels (Figure 96a). For the purpose of providing a proper knowledge framework of the geological and geolithological characteristics of the region, useful for rural planning phases, the map of the main regional hydrostructures is also presented, classified as hydrogeological systems and minor aquifers, the latter being subject to withdrawals and groundwater contributions by the agricultural sector (Figure 96b).



(a) (b)

Figure 96 - a) shows the water bodies within the study area. b) indicates the hydrostructures.

Protected areas

The protected natural areas of Lazio cover approximately 13.5% of the regional territory. The Lazio Region has established a Regional System of Protected Natural Areas (Regional Law no. 46/1977 and Regional Law no. 29/1997), a framework that is constantly evolving as a result of new designations. The system includes a diverse set of parks, reserves, and natural monuments, alongside state protected areas, including national parks, state reserves, and marine protected areas. Taken together, these areas contribute to the protection of regional biodiversity and geodiversity, enhance the historical and cultural heritage, and promote sustainable development models, particularly by supporting compatible agricultural and forestry activities, the preservation of traditional artisanal practices, and forms of responsible tourism. Overall, the regional territory includes 110 protected natural areas, divided as follows: 3 national parks, 2 marine protected natural areas, and 4 state nature reserves established pursuant to Law no. 394 of 6 December 1991 (Framework Law on Protected Areas); 16 regional natural parks and 31 regional nature reserves established pursuant to Article 5 of Regional Law no. 29/1997; and 54 natural monuments established pursuant to Article 6 of the same regional law.

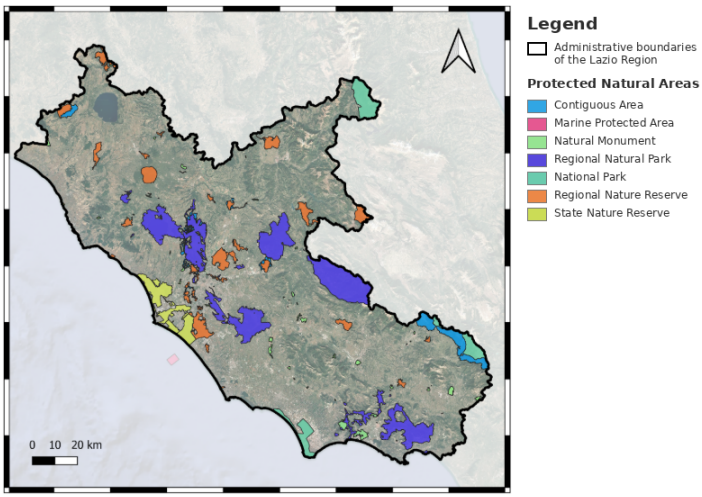


Figure 97 - Protected Natural Areas of Lazio Region

6.3 Agricultural systems in the studied territory

6.3.1 Overview of agriculture in Lazio Region

According to the CREA report [261], portray agriculture in Lazio as a sector undergoing transformation, marked by a decline in the number of farms but, at the same time, by a substantial stability in cultivated land. In 2020, there were 66,328 active farms in the region, compared with 98,216 recorded in 2010, corresponding to a decrease of 32.5%. Over the same period, however, the UAA followed the opposite trend: it increased from about 639,000 hectares in 2010 to about 675,000 hectares in 2020, a rise of 5.7%. This trend points to a process of structural reorganization in the sector, whereby the reduction in the number of farms is accompanied by a greater concentration of land in fewer, on average larger, production units.

Alongside this trend, organic farming has also become increasingly significant. In 2022, organically cultivated land in Lazio reached 173,950 hectares, marking an increase of 5.6% compared with the previous year, while the number of operators in the sector amounted to 5,663. From an economic perspective, although it does not represent a dominant share of the regional economy, the primary sector still plays a meaningful role: in 2022, agriculture, forestry and fishing together accounted for about 1% of Lazio's GDP.

Overall, the picture that emerges is that of an agricultural system that is less fragmented than in the past, in which the numerical decline in farms does not correspond to a proportional reduction in cultivated area. On the contrary, the stability of UAA and the expansion of organic farming suggest ongoing processes of adaptation and consolidation. In addition, livestock farming continues to play a relevant role, particularly in the sheep and cattle sectors, with buffalo farming also maintaining a significant presence.

Legal status and structure of agricultural holdings

An analysis of the legal status of agricultural holdings highlights a productive structure still strongly centered on individual and family farming. In Lazio, as in the rest of Italy, this type of holding is by far the most widespread and accounts for more than two thirds of the UAA. These farms are, however, relatively small on average: their mean size is around 7.5 hectares, a figure that is also below the national average of 8.6 hectares.

This structure confirms the historical and organizational importance of the family farm, which continues to form the core of the regional agricultural system. The result is an agricultural landscape made up of a large number of small holdings, often characterized by direct management and by a strong continuity between the farm and the family. More structured corporate forms, such as limited liability companies and cooperatives, are much less common, while partnerships occupy an intermediate position, although they remain clearly minoritarian compared with individually run farms.

The picture changes, however, when average farm size is taken into account. Holdings organized as companies, although less widespread, manage much larger areas on average than family-run farms. Partnerships exceed 30 hectares on average, limited liability companies are around 45 hectares, and cooperatives around 28 hectares. This points to a dual structure: on the one hand, a widespread network of small individual holdings; on the other, a limited number of larger and more highly structured enterprises, which concentrate a disproportionate share of total productive capacity and operate with markedly higher levels of organization and competitiveness.

Diversity of farm types and characteristics of the agricultural system in Lazio

The agricultural system of Lazio is distinguished by considerable internal diversity, linked both to the strong pull exerted by the Rome metropolitan area and to the presence of extensive hilly and

mountainous zones in the inland areas. This territorial articulation is reflected in a highly heterogeneous productive fabric, largely composed of small and medium-sized family farms, often affected by land fragmentation and oriented toward different types of production depending on environmental conditions and proximity to markets.

An important feature of this diversity is the presence, especially in hilly and mountainous areas, of landowners or farm operators who do not reside permanently in rural territories but continue to maintain land and agricultural activities in their municipality of origin. This situation is linked to the depopulation and migration processes that affected many inland areas in the post-war period and in the following decades. Although the level of productive intensity of these farms may vary widely, they often play an important role in limiting agricultural abandonment and preserving the rural landscape, while maintaining social and patrimonial ties with the territory.

A second relevant aspect concerns the age composition of the agricultural population. In Lazio, as in many other Italian regions, the ageing of farm operators and the difficulty of ensuring generational renewal represent major issues. This dynamic affects both the capacity for innovation and the continuity of farm activities, especially in more marginal contexts, where production conditions are more difficult and profitability tends to be lower.

A further aspect concerns the economic sustainability of farms. In many parts of the region, particularly in inland areas, numerous holdings do not generate sufficient income from farming alone. As a result, diversification strategies are widespread, ranging from off-farm employment to agritourism, direct sales, and other ancillary services. These strategies make it possible, on the one hand, to keep agricultural land in use and, on the other, to support the continued presence of families in rural areas. It is also not uncommon for land to be effectively managed through family-based or informal arrangements: plots that are formally separate may in practice be operated as a single production unit, while in other cases a single farm may appear fragmented for administrative or patrimonial reasons.

In light of these elements, the agricultural system of Lazio can be interpreted, in functional terms, through three broad farm profiles. The first consists of professional farms, which are more structured and market-oriented and are more common in lowland areas or along consolidated supply chains. The second includes pluriactive farms, in which agricultural income is combined with other sources of earnings and where the degree of specialization may vary considerably. The third concerns subsistence-oriented farms or holdings aimed at preserving tradition, often linked to permanent crops such as olives, vines, and orchards, which, although economically limited in scale, play an important role in preserving the agricultural landscape. This group also often includes holdings managed by non-resident operators, generally associated with less intensive forms of farming but still relevant for territorial stewardship.

Overall, the plurality of farm types present in Lazio highlights the need for differentiated policies capable of supporting both the strengthening of professional farms and generational renewal, while also recognizing the role of pluriactive farms and those that provide territorial stewardship. The latter, especially in inland areas, are essential for landscape management, the prevention of land abandonment, the containment of erosion and wildfires, and, more broadly, for the socio-economic resilience of rural communities.

Labor in agriculture

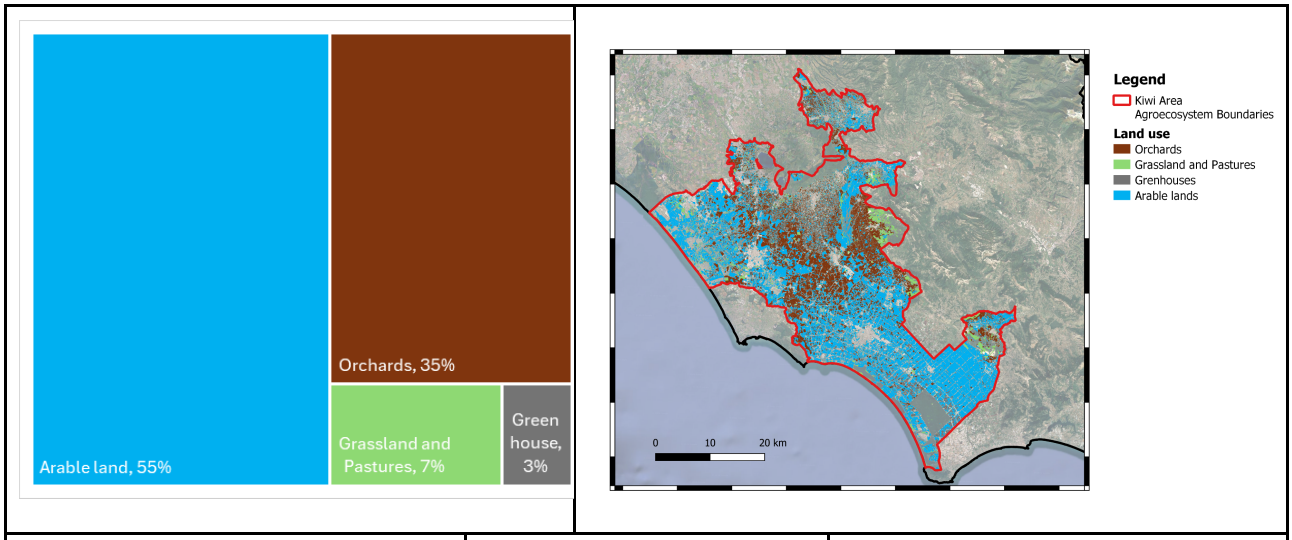
From an employment perspective as well, agriculture in Lazio retains a strongly family-based character. In 2020, the total number of working days recorded on agricultural holdings in the region amounted to approximately 11.2 million. Of these, 7.7 million were attributable to family labor, while the remaining 3.5 million came from other forms of employment, including permanent workers, casual labor, and other arrangements not directly hired by the farm.

Within family labor, the role of the farm holder or operator is especially prominent, contributing alone about 6.3 million working days. This corresponds to about 57% of total farm working days and to more than four fifths of total family labor, an incidence even higher than the national average. The remaining share of family labor is more distributed among spouses, other relatives of the farm holder, and family members, confirming a model in which operational management remains strongly concentrated in the hands of the main operator.

Looking at employment, family labor accounts for more than half of the regional agricultural workforce. At the same time, the presence of foreign workers is also significant, with an incidence above the Italian average. However, in this case too, the picture shows important territorial differences. In the provinces of Frosinone and Rieti, family farming is particularly dominant, and the share of labor provided within the farm is especially high. Latina, by contrast, shows a different profile, characterized by a greater reliance on non-family labor. In this province, moreover, the employment of foreign workers is particularly significant, confirming a labor organization that is more open to the market and linked to productive specializations requiring external labor.

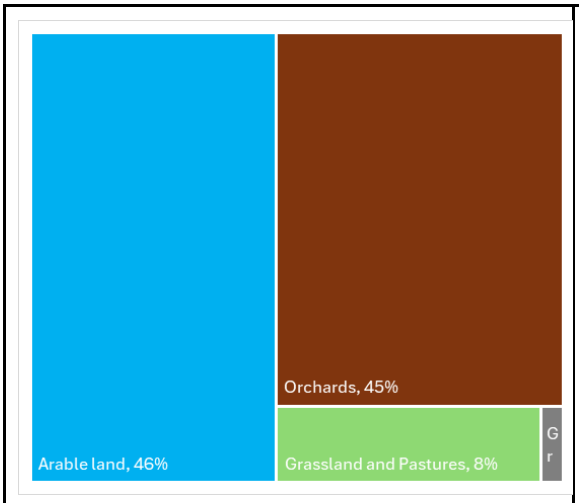
6.3.2 Analysis of the use of agricultural land

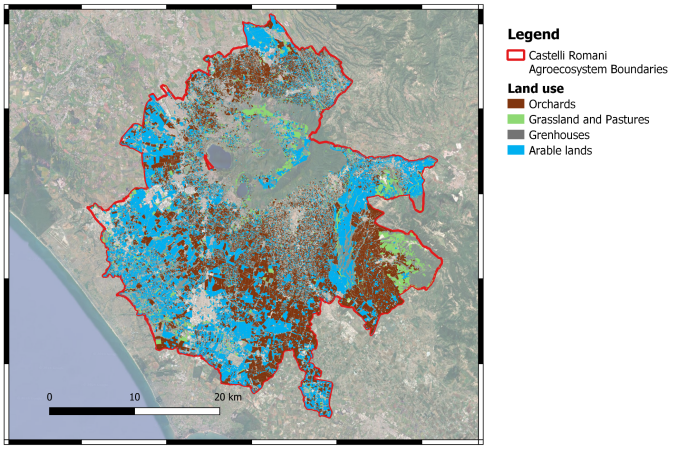
The analysis was based on the use of the graphic crop plan of the Lazio Region and the Land Parcels Identification System (LPIS) land-use data.



UAA (ha)	Number of Farms	Mean size of farms (ha)
103093	5716	10.5

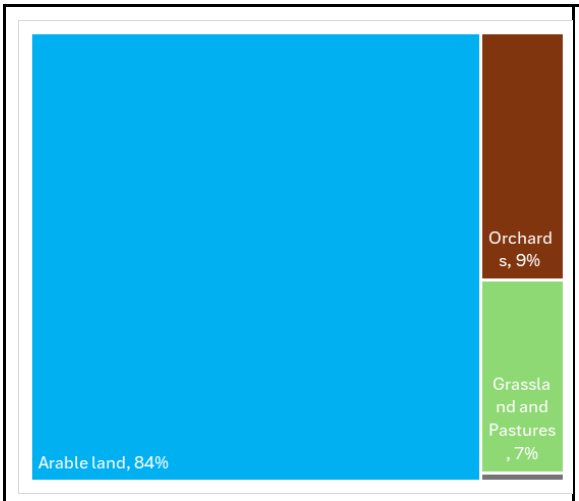
Figure 98 – Lazio - Kiwi production agroecosystem

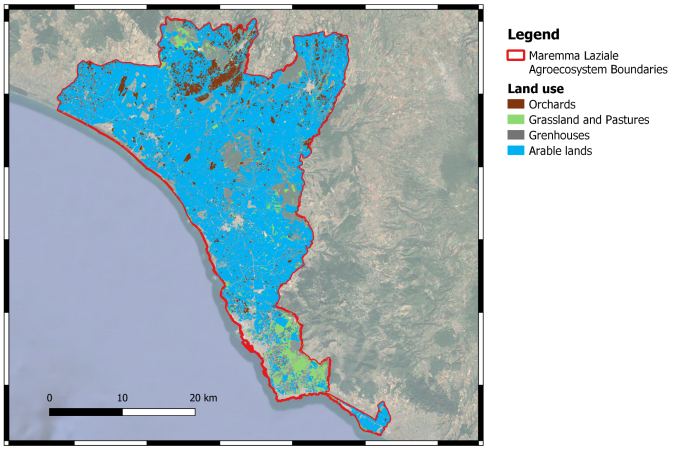




UAA (ha)	Number of Farms	Mean size of farms (ha)
75421	2685	12.3

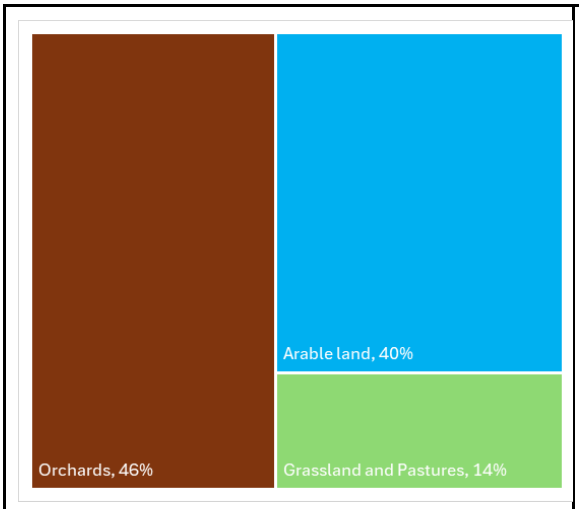
Figure 99 – Lazio - Castelli Romani agroecosystem

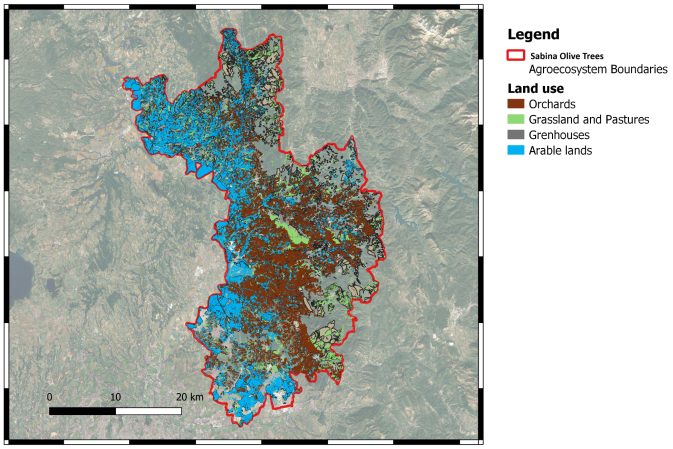




UAA (ha)	Number of Farms	Mean size of farms (ha)
83320	3783	21.9

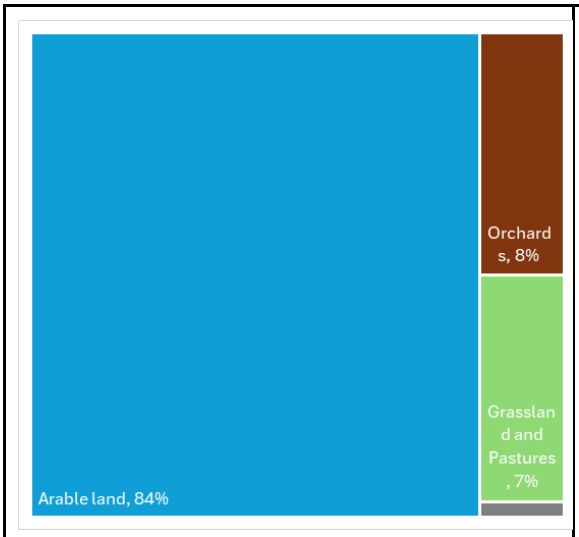
Figure 100 – Lazio - Arable farming agroecosystem of the Maremma Laziale

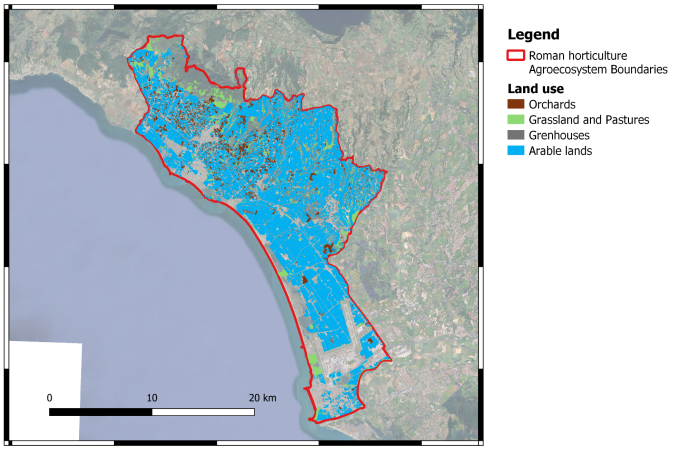




UAA (ha)	Number of Farms	Mean size of farms (ha)
99556	4818	9.8

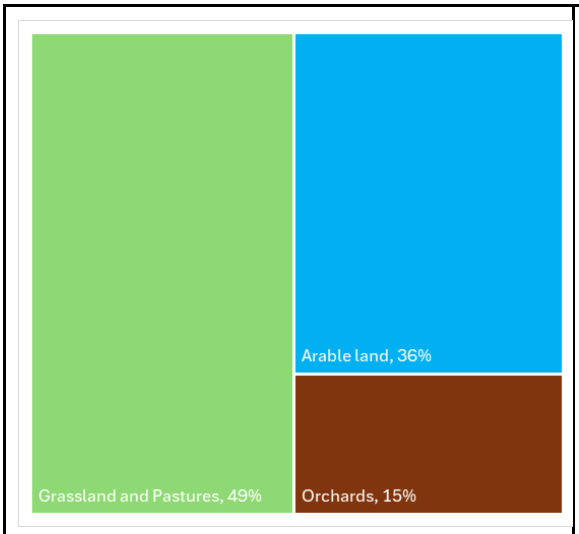
Figure 101 – Lazio- Olive-growing agroecosystem of the Sabina Hills

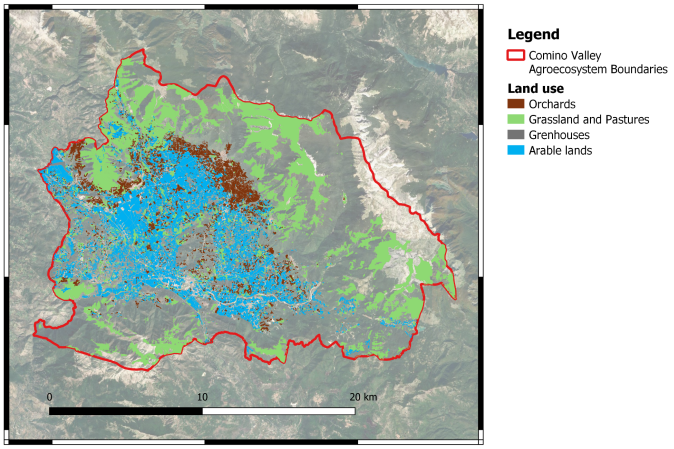




UAA (ha)	Number of Farms	Mean size of farms (ha)
28281	862	22.9

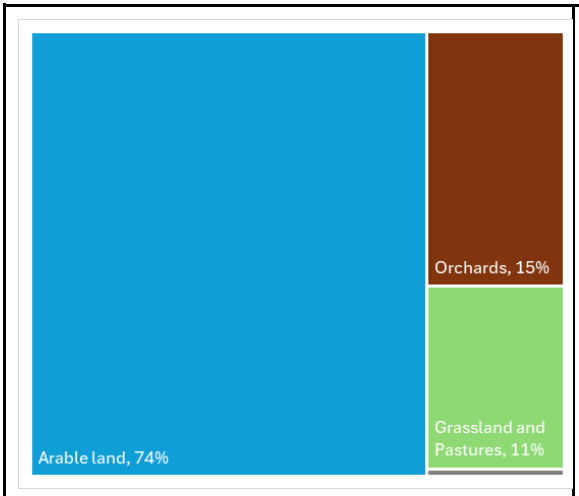
Figure 102 – Lazio - Roman horticulture agroecosystem

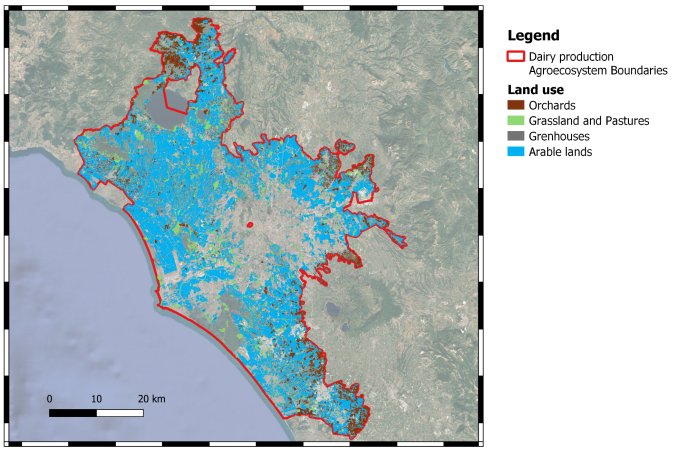




UAA (ha)	Number of Farms	Mean size of farms (ha)
34559	696	32.3

Figure 103 - Lazio - Val di Comino agroecosystem.





UAA (ha)	Number of Farms	Mean size of farms (ha)
163665	3955	27.8

Figure 104 – Lazio - Dairy production agroecosystem

6.3.3 Overall presentation of the farming sectors

In Lazio, agricultural systems show an articulated production structure, characterized by the combined presence of arable crops, specialized tree crops, and a diversified livestock sector. This configuration outlines a framework in which market-oriented production, crops supporting livestock farming, and supply chains of relevance also at the national level coexist.

With regard to arable crops, Istat data for 2023 indicate that cereals cover more than 85,000 hectares in Lazio. This figure corresponds to just over 3% of the national cereal area, pointing to a significant, although not predominant, presence within the Italian context. Alongside cereals, temporary forage crops also play an important role, with the regional area accounting for 7.5% of the national total.

This highlights the importance of crops destined for animal feed and confirms the close integration between crop production and the livestock sector.

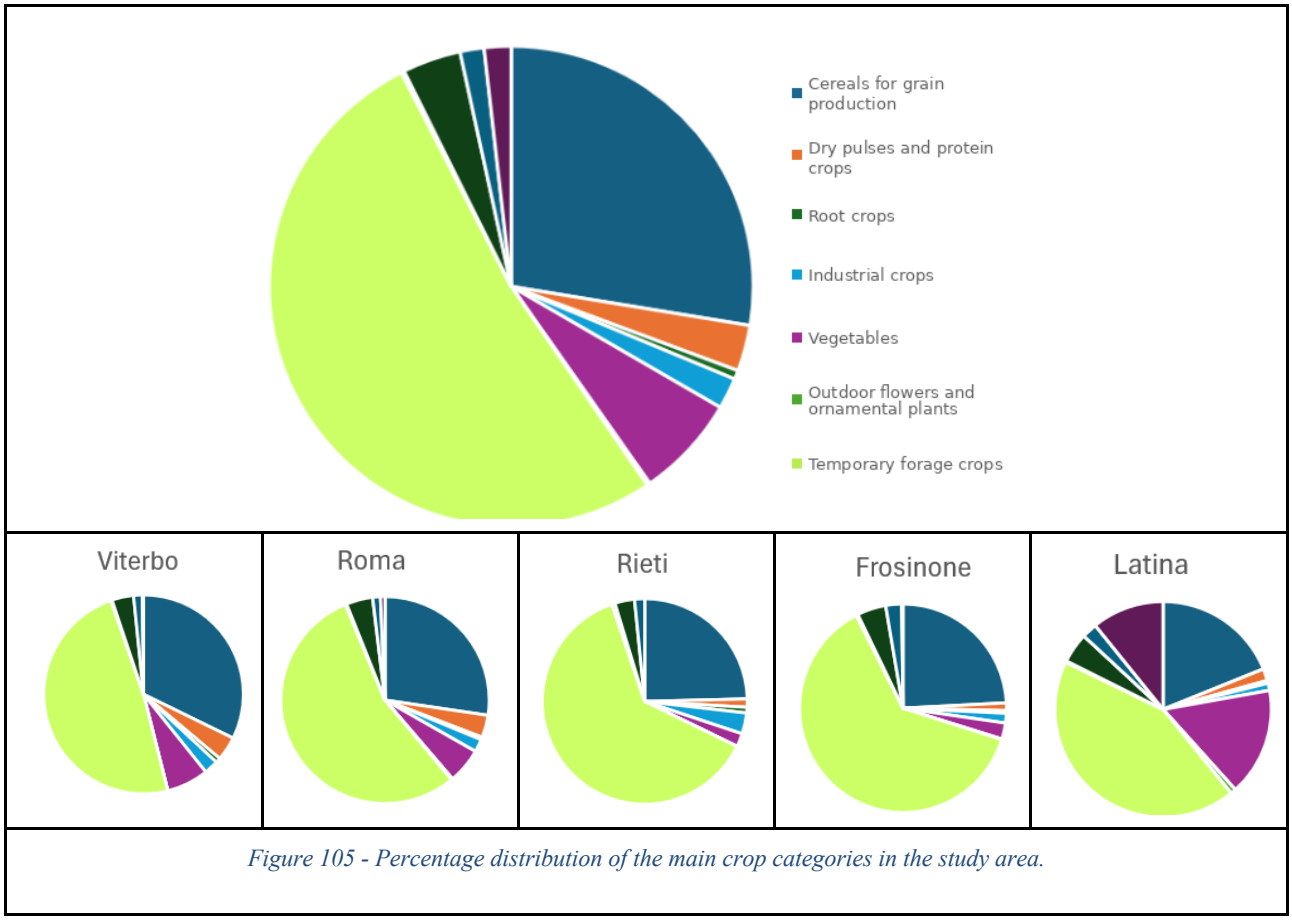


Figure 105 - Percentage distribution of the main crop categories in the study area.

With regard to tree crops, Lazio shows a strongly specialized production profile. Olive growing is the dominant component, accounting for 55.8% of the region's total tree crop area. It is followed by hazelnut with 16.9%, vineyards with 14.4%, kiwifruit with 6.4%, and chestnut with about 3%. Some of these crops are also particularly significant at the national level: kiwifruit and hazelnut, in particular, account for 37.6% and 26.3% of the respective Italian cultivated areas, highlighting both a high degree of specialization and the competitive importance of Lazio in these supply chains.

The fruit-growing sector also contributes to the diversification of the regional agricultural system, although it remains smaller in scale than the main tree crops. Among stone fruits, peach occupies the largest area, with 1,631 hectares, followed by cherry with 854 hectares and plum with 692 hectares. These are complemented by apple, covering 408 hectares, pear with 207 hectares, and apricot with 160 hectares. Overall, these figures confirm the presence of a diversified fruit sector, which complements the region's more economically and territorially important tree-crop supply chains.

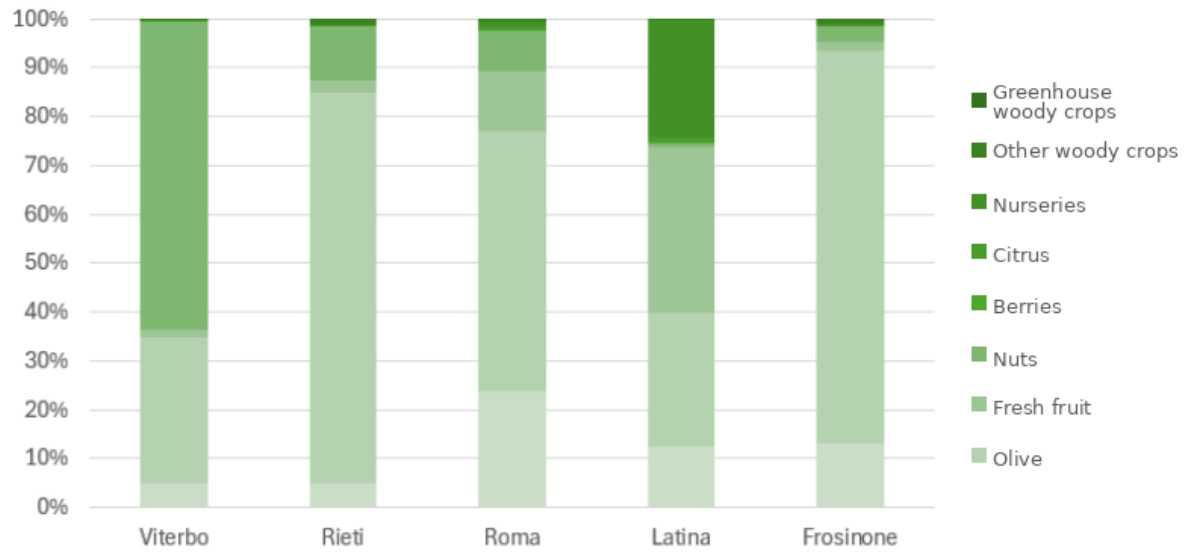


Figure 106 - Percentage composition of the main woody crop categories across the provinces of Lazio.

In 2023, the livestock sector in Lazio was characterized by the presence of a variety of farmed species and by an overall stock of 1,070,859 heads, corresponding to about 4.6% of the national livestock population, equal to 23,088,050 heads. Within this framework, the region plays a specific role in the buffalo supply chain, as it falls within the production areas included in the Mozzarella di Bufala Campana PDO specification. Consistent with this specialization, buffalo stock in Lazio accounts for about 18.5% of the national total. After the buffalo sector, the highest shares of the national total are recorded for horses, at 11.5%, and sheep, at 10.2%. By contrast, cattle and goats play a more limited role, accounting for 3.3% and 4.5% of the Italian total, respectively. The pig sector is comparatively marginal at the national level, with a share of around 0.5%.

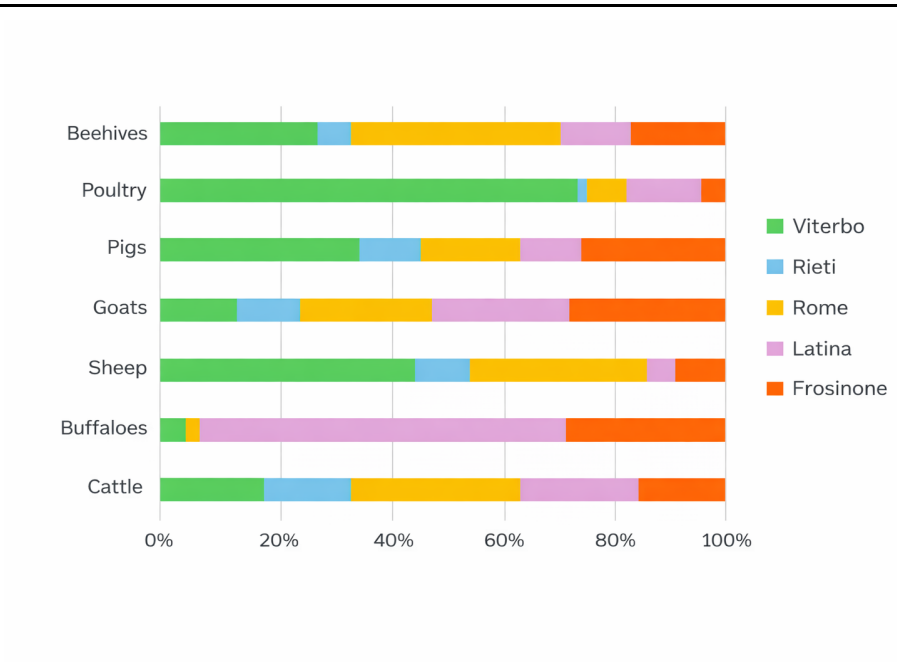


Figure 107 - Percentage distribution of the main livestock farming types across the provinces of Lazio.

An analysis of livestock composition at the regional level shows that about 83% of total heads consist of sheep, goats, and cattle, confirming the importance of farming systems traditionally associated with grazing and semi-extensive livestock production. Buffalo accounts for 7.2% of the total, while pigs represent 4.7%. Recent developments in the sector reveal differentiated trends across species.

Over the 2021-2023 period, the overall livestock population increased by 4.3%, a rise entirely driven by buffalo, whose numbers grew by 19.2%. All other sectors, by contrast, recorded declines, most notably cattle, which decreased by 5.6%, followed by sheep, which fell by about 1%, while pigs and goats showed more limited reductions of less than 1%. Looking only at the 2022-2023 period, total livestock numbers increased by about 2%. Within this overall trend, buffalo remained broadly stable, cattle recorded a slight decline (-0.5%), whereas goats, sheep, and pigs showed positive changes, equal to 5.3%, 3.0%, and 2.4%, respectively.

6.3.4 Importance of organic farming

In Lazio, in 2022, the area under organic farming reached 173,950 hectares, marking a 5.6% increase compared to the previous year. The region thus accounts for 7.4% of the national organic UAA, confirming its leading role within the Italian context.

In terms of crop distribution, approximately 41% of the organic area is devoted to forage crops. Among arable land, cereals remain the dominant specialization, covering 17% of the organic UAA. Other significant crops include olives (11%) and fruit and vegetables. Additional relevant productions are nuts (11%), vineyards (3%), as well as vegetables and protein crops, which account for 5% and 3% respectively.

Regarding operators, in 2022 Lazio recorded 5,663 entities active in the organic sector, showing a slight decrease compared to 2021 (-0.2%). Specifically, there were 4,419 primary producers and 1,243 processors, with both categories representing 5.2% of the national total.

6.4 Policies and Institutional Environment

The Lazio Region has developed a context analysis aimed at describing the main characteristics of the regional agricultural system and identifying priority needs. The approach is consistent with the European Commission’s guidelines for a results- and performance-oriented agricultural policy, designed to promote a sustainable and competitive sector capable of ensuring fair farm income, increasing environmental and climate ambition, and strengthening the role of agriculture within European society.

The analysis, developed in continuity with national policy briefs and structured around the CAP specific objectives, assesses the positioning of the Lazio agricultural system across ten domains: income support (SO1), competitiveness (SO2), rebalancing power within the value chain (SO3), climate change (SO4), protection of environment and natural resources (SO5), landscape and biodiversity (SO6), generational renewal (SO7), rural vitality (SO8), food quality and health (SO9), alongside the cross-cutting objective on knowledge and innovation (AKIS).

- Farm income and resilience (SO1)
  The Lazio agricultural system faces challenges related to profitability and income stability. Net farm income per worker is below the national average and, although increasing over time, grows more slowly than in Italy and the European Union. The gap between agricultural labor income and the average labor cost in the regional economy remains significant, potentially weakening the sector’s attractiveness. Income volatility is also higher than national and EU benchmarks. Public support plays a relatively smaller role in income formation, with direct payments accounting for a lower share, while risk management tools remain underutilized despite the presence of more widespread preventive measures (e.g. structural investments supported by programming).
- Competitiveness and market orientation (SO2)
  The analysis highlights a dual pattern. While productivity has improved in some areas, recent years show a slowdown, particularly in land productivity. At sector level, fruit and vegetables perform relatively well, whereas arable crops and dairy farming face greater difficulties. Olive growing and viticulture, although important for the regional economy, show signs of weaker competitiveness compared to more advanced regions. A further critical issue concerns fixed

investments, which have declined both in value and in investment propensity. Conversely, agri-food exports show positive dynamics, with strong performance in some flagship products. However, structural constraints persist in terms of infrastructure, logistics and access to credit, which remains below the national average.

- Position in the value chain and product valorization (SO3)
  Agriculture in Lazio shows overall economic resilience, but the agri-industrial processing phase appears weaker, with signs of decline. Market conditions are potentially favorable, driven by growing demand for quality, sustainability and local products, yet the regional system does not always translate these opportunities into solid economic outcomes. Organic farming is widespread but concentrated mainly in inland areas, with room for expansion in lowland areas and strategic sectors. Geographical indication products are present but often have limited economic weight. The capacity for aggregation (producer organizations and cooperatives) exists but is sometimes insufficient in scale to support modern positioning and marketing strategies.
- Climate change, risk and energy (SO4)
  Climate change in Lazio is reflected in increasing water deficits, more frequent droughts and heatwaves, episodes of intense rainfall, and shifts in crop phenology (e.g. earlier flowering). Key risks for agriculture and forestry include rising irrigation demand, soil fertility degradation, increased pest pressure, reduced animal welfare, and higher wildfire risk. Damage from natural disasters: particularly droughts and frost: remains significant and is often not compensated due to low uptake of insurance schemes. The mismatch between demand and supply of insurance represents a major constraint, making the development of mutual funds and preventive tools particularly important. On the energy side, renewable energy production is significant but shows signs of slowing growth; solid biomass and Picturevoltaics are key components of the regional energy mix.
- Natural resources: water, soil and air (SO5)
  The region is characterized by a large share of agricultural land but also a high level of land artificialization, especially in the metropolitan area of Rome. In the medium to long term, utilized agricultural area (UAA) has declined, with more variable recent trends. Water indicators reveal conditions of stress, with high irrigation demand and significant losses in distribution networks. Water quality shows critical issues related to nutrients (nitrates and phosphorus), particularly in vulnerable zones. Soil management faces challenges related to erosion and organic matter depletion, requiring the continuation and strengthening of conservation practices. Regarding air quality, reductions in ammonia emissions are a positive trend, although further efforts are needed in manure management and fertilization practices.
- Biodiversity and landscape (SO6)
  Lazio host a wide network of Natura 2000 areas and a strong interaction between agricultural activities and protected territories. However, agricultural land with high-diversity landscape features remains limited, while biodiversity indicators (such as the Farmland Bird Index) show a declining trend, signaling a gradual loss of environmental quality in farming systems. Land take and fragmentation exert structural pressure on ecological connectivity and ecosystem resilience. At the same time, the protection of regional agrobiodiversity represents a strength, supported by dedicated regulatory tools and registers.
- Generational renewal (SO7)
  Lazio shows a slightly higher share of young farm managers compared to the national average, and young-led farms tend to concentrate both land and production value, with a stronger presence in high value-added sectors such as horticulture, viticulture and livestock. However, challenges remain in terms of agricultural education levels, which are below national standards, and in access to land and capital. These factors make start-up support, advisory services and tailored accompaniment measures particularly strategic.
- Rural areas, employment and local development (SO8)
  The regional classification by degree of rurality highlights a strong imbalance between population and territory: more fragile rural areas host a small share of residents but cover a large portion of the regional surface. These areas face demographic decline, ageing populations and weaker socio-economic indicators. Key challenges include access to services,

entrepreneurial capacity and local governance. Investments in digital connectivity (ultra-fast broadband) are an enabling factor, but strengthening local development instruments: such as LEADER, SNAI and participatory approaches: remains essential, particularly by expanding their coverage and improving coordination across policies and funding sources.

- Food, health and animal welfare (SO9)
  The CAP 2023-2027 places increasing emphasis on food safety and sustainability, addressing issues such as pesticide use, food quality and safety, waste reduction and animal welfare. In this area, both first pillar conditionalities and payments, as well as voluntary measures and investments under rural development, play a relevant role.

6.4.1 Agricultural policy in the territory

Land use and land reform policies in the Lazio Region (as well as at the national level with local impacts) are structured along three main directions: the enhancement of public land assets, the sale of agricultural land to promote generational renewal, and support for youth entrepreneurship. The Municipality of Rome has implemented a policy for managing public agricultural land aimed at preventing abandonment and degradation while fostering economic and social development, known as “Enhancement and Recovery of Public Land” (Roma Capitale). The objective is to create new farms by allocating land plots to young farmers (up to 40 years old). Through the “Public Land Call”, the administration makes available plots: such as those in Borghetto di Malafede, Castel di Guido, and Tenuta del Cavaliere: for projects that integrate multifunctional agriculture, including organic production, biodiversity conservation, urban gardens, and educational or social services.

A further initiative is led by ARSIAL, which manages the sale of regionally owned land to rationalize land use. The mechanism is based on public auctions or targeted calls (such as those concerning land in Costaroni, in the municipality of Riano), allowing the transfer of ownership of small and large plots to private actors. These operations often aim to consolidate existing farms or enable the establishment of new productive activities on land previously managed by public authorities.

At the national level, but with a strong presence in Lazio, a key initiative is the Agricultural Land Bank managed by ISMEA. This consists of a comprehensive inventory of agricultural land made available due to abandonment, lack of cultivation, or land consolidation processes. Land is sold through transparent procedures, mainly auctions. ISMEA policies provide significant incentives for applicants under 41, including instalment-based payments for land acquisition and access to subsidized loans. This approach aims to address land fragmentation: typical of many areas in Lazio: and to facilitate access to land for individuals with entrepreneurial projects but limited initial capital.

Overall, current regional and municipal strategies in Lazio indicate a shift from passive land management to a more proactive and strategic approach. Priority is given to projects linked to organic agriculture and landscape conservation, while land use is increasingly framed not only as productive but also as educational and socially inclusive, particularly through social farming initiatives. Across all instruments, a strong emphasis is placed on supporting young people, ensuring the continuity of the agricultural sector while promoting its modernization through innovation and environmental sustainability.

Productivity improvement strategies

This section can be used to highlight some more info about specific strategies for improving the productivity (e.g. Soil health; Water management; Crop selection, etc.)

Non applicable

Sustainability and climate resilience measures

The Lazio region is affected by the salt wedge phenomenon, which involves the inland intrusion of seawater through riverbeds and coastal aquifers. This issue is primarily driven by a combination of reduced river flows (exacerbated by prolonged droughts) and the over-extraction of groundwater, as the agricultural sector accounts for a significant portion of regional water consumption.

The phenomenon primarily affects the coastal areas of the Lazio Region, where the interaction between surface water and groundwater systems makes aquifers particularly vulnerable to

salinization. The most exposed zones include the Roman coastal strip, especially around the mouth of the Tiber River, encompassing areas such as Fiumicino, Maccarese, and Ostia, where intensive agricultural activities rely heavily on groundwater resources. Additional critical areas are represented by the reclaimed coastal plains, characterized by low elevation and extensive drainage systems, and by coastal wetlands and low-lying zones, where the balance between freshwater and seawater is naturally fragile. More broadly, all river mouths and coastal aquifers in the region are subject to saltwater intrusion, particularly during periods of reduced river discharge and prolonged drought.
Lazio Region's measures against saltwater intrusion focus on monitoring, infrastructure, and regulatory actions outlined in the Regional Water Protection Plan (PTAR) and coastal defense plans. The PTAR includes infrastructure interventions like maintaining flows, aquifer recharge, and remediation of water bodies to protect groundwater from salinization; prioritizes coastal basins with pressure analyses.
Regulatory actions enforce quality standards, vulnerable zones, and 6-year management cycles with effectiveness checks [265].

Input subsidies

There are no public subsidies available or specifically dedicated for input purchases.

Credit access

Throughout 2024 and the opening months of 2025, the credit market in Lazio was defined by a series of contrasting dynamics. While the region saw a general contraction in bank credit to the non-financial private sector, which dipped by 0.8% as of December 2024, this trend was primarily driven by a decline in demand from companies that opted to rely on their own high levels of internal liquidity. In contrast, the national food, beverage, and tobacco industry showed more resilience, recording a slight 0.4% increase in loans during the same period.

Lazio's agricultural sector experienced a notable productive recovery in 2024, with value added increasing by 2.5% after a severe 8.4% drop the previous year. However, this rebound was only partially reflected in credit activity. By the end of 2024, the total stock of loans for "Agriculture, Forestry, and Fishing" in Lazio amounted to 1,733 million euros, a 2.8% decrease compared to 2023. Investment-focused lending beyond the short term saw an even steeper decline of 7.1%, with funding for machinery falling by 8.2% and property purchases by 13.8%. Conversely, rural construction emerged as a positive outlier, showing a growth of 5.8%.

The food processing segment in Lazio exhibited much more vitality than primary production. Credit stock for this industry reached 1,002 million euros by late 2024, marking a significant 13.3% increase year-over-year. This financial momentum was mirrored by a booming export market, as the regional food sector led trade growth with a nominal increase of 21.5% in 2024.

Despite these pockets of growth, credit quality and risk remain critical issues. The deterioration rate for agricultural credit in Lazio reached 2.11% in 2024, remaining significantly higher than the national average of 1.56%. This concern extends to the broader Food & Beverage industry in Central Italy, where the deterioration rate hit 3.59%, the highest in the country.

Looking at support tools in 2025, public guarantees continue to play a pivotal role for SMEs. Nationally, approved operations for farming and livestock production through the Guarantee Fund grew by 18.7%, with total financing exceeding 1.6 billion euros. Furthermore, the "Nuova Sabatini" program: essential for purchasing modern machinery: saw a 26.3% increase in funded amounts. There was also positive news for new entrepreneurship, as credit operations for start-ups established for less than three years rose by 10.2%.

Investment opportunities

In the Lazio Region, support for investments in the agri-food sector is primarily structured through European funds managed at the regional level under the Rural Development Complement (CSR 2023-2027), alongside national schemes implemented by bodies such as ISMEA and INAIL. The CSR 2023-2027 represents the main regional instrument (formerly PSR) supporting farm modernization. Calls active or expected for 2026 include support for investments in processing and marketing, providing non-repayable grants: often up to 50%: for SMEs investing in facilities, machinery, digital tools and e-commerce infrastructure. Agri-environmental commitments such as Integrated Production (SRA01) offer annual payments to farmers adopting low-impact practices, with application deadlines typically set around May 2026. Specific support is also available for the wine sector through vineyard restructuring schemes, financing the conversion and modernization of vineyards under the 2026-2027 campaign.

At the national level, additional instruments: often complementary to regional funds: are available. These include financial tools managed by ISMEA, such as "ISMEA Investe", which provides subsidized loans (with interest rate reductions of up to 70%) and equity participation for large-scale agri-food investment projects. Further support is offered through the ISI INAIL Agriculture call, which provides non-repayable grants for the purchase of safer and more environmentally friendly machinery and tractors; for 2026, support may reach up to 80% for young farmers and 65% for other beneficiaries. Young and new farmers can also access the "First Installation Grant", a lump-sum start-up payment that in Lazio can reach €70,000 for applicants under 41 establishing a farm in disadvantaged areas (€50,000 in standard areas). Finally, the regional agency ARSIAL periodically publishes calls to support promotion activities, including participation in fairs and events, projects linked to local gastronomic heritage, and initiatives enhancing quality labels such as "Tuscia Viterbese" and "Rea - Qualità Reatina".

Investments in rural development (CAP II pillar) are primarily on strengthening farm structures, which absorb the largest share of resources through interventions aimed at modernization, mechanisation and production efficiency (SRD01). These are complemented by investments in agri-food processing, particularly in dairy value chains, which enhance added value and market competitiveness (SRD13). A growing role is played by the diversification of farm activities, such as agritourism and multifunctional services, which contribute to income integration and strengthen the link with local territories (SRD03). At the same time, agri-environmental measures support the transition towards more sustainable practices, although through funding schemes that differ from those for material investments (SRA01, SRA29). Resources allocated to innovation, while more limited, are strategic in fostering the adoption of new tools and organizational models, especially within the AKIS framework (SRG01). Finally, investments in rural infrastructure and support for young farmers complete the picture, contributing respectively to improving framework conditions and promoting generational renewal (SRD07, SRE01). Overall, the system remains strongly oriented towards material assets but shows emerging signs of a gradual shift towards more integrated and place-based approaches.

6.5 Markets and value chains

6.5.1 Main characteristics of the agricultural value chains

The agri-food supply chains of Lazio represent a heritage of fundamental strategic, economic, and cultural importance for the region. The Lazio production system is characterized by a marked diversity, with centers of excellence supported by a widespread network of small-scale agricultural enterprises and by a growing level of industrial integration.

The Dairy chain

The dairy supply chain plays a central role in terms of image and quality, boasting 6 PDO products, 2 TSG products, and 53 Traditional Agri-food Products (PAT).

The supply chain includes approximately 213 enterprises, mainly concentrated in the provinces of Rome, Latina, and Frosinone. The structure is predominantly composed of micro-enterprises (179

out of 213), with 53 industrial dairies representing the core of regional processing. The three main sectors are:

- Sheep and goat milk: oriented towards the production of aged cheeses and Ricotta Romana PDO, with production aimed at both domestic consumption and export.
- Cow milk: characterized by declining production also due to drastic price fluctuations influenced by international trade.
- Buffalo supply chain represents a key area of excellence, particularly in the provinces of Latina and Frosinone. A significant share of production (around 20%) flows into the Campania supply chain and is marketed as fresh milk. However, the sector shows strong potential for development, especially through innovative, high value-added supply chains.

Vegetables and Fresh Fruit

The fruit and vegetable supply chain is the most relevant in terms of resources captured through the Integrated Supply Chain Projects (PIF), accounting for 46.4% of the projects financed in the region.

The province of Latina is the main hub for high-quality production, especially for kiwi (Hayward variety), where it benefits from modern facilities that help contain production costs.

- Market dynamics: There is an increase in the consumption of "traditional fresh products" and organic products. However, the supply chain suffers from a structural decline in domestic consumption and excessive bargaining power of Large-Scale Retail Distribution (GDO).

The wine supply chain

Lazio has a millennia-old winemaking tradition, now characterized by a profound transition towards quality.

- Wine heritage: The region hosts 3 DOCG, 27 DOC, and 6 IGT denominations. The most relevant historical areas include the Castelli Romani (Frascati DOCG, Marino DOC), the province of Viterbo (Est! Est!! Est!!! di Montefiascone), and the Frosinone area (Cesanese del Piglio DOCG).
- Grape varieties and territory: The landscape is dominated by white grape varieties (Malvasia and Trebbiano), but with a significant rediscovery of native red varieties such as Cesanese. The volcanic soils and the sea-moderated climate give Lazio wines their characteristic sapidity and minerality.

Future challenges

Lazio's supply chains share several structural features and systemic challenges highlighted by recent ARSIAL and CSR reports. These are outlined below as future challenges for the regional system.

- Consumption polarization: The market is increasingly divided between "premium" products (PDO, organic, identity-based), which show growth in both volume and value, and standardized or UHT products, which are experiencing a structural decline.
- Integration and aggregation: Thanks to integrated planning (POF/PIF), participating companies are better structured, more oriented towards multifunctionality, and show higher labor productivity compared to non-participating ones.
- Costs and margins: Many companies, especially in the buffalo sector, operate with reduced margins due to input cost inflation (feed, energy) and price volatility. Technical efficiency remains a key factor: Lazio farms are on average less efficient than those in Campania, partly due to younger and less structured supply chains.

- Generational turnover: Although new enterprises are emerging, many represent generational succession supported by CSR funding, which does not always correspond to the creation of businesses oriented toward sustainable competitive development.

In conclusion, the competitiveness of agri-food supply chains in Lazio will depend on the ability to interpret the systemic functions of the territory and respond with coherent planning strategies. Capitalizing on consolidated and shared knowledge, strengthening producer aggregation in innovative or innovation-consolidation projects, focusing on territorial distinctiveness, branding, and supply chains capable of generating higher margins, as well as improving managerial efficiency, are key elements that the PAR can enhance through its implementing technical measures, highlighting an agroecological perspective based on technical and relational expertise, circularity, and a strong link with the territory.

6.6 Cross-cutting themes - enabling or disabling factors

6.6.1 Environmental challenges

This section can be used to highlight environmental challenges (e.g. Natural disaster risks; Pollutants; Climate change impact and adaptation, etc.)

6.6.2 Water pollution

In Lazio, one of the main environmental issues linked to agriculture concerns the risk of water pollution from nitrates of agricultural origin, regulated at EU level by the Nitrates Directive 91/676/EEC. In Nitrate Vulnerable Zones - NVZs, farms can distribute a maximum of 170 kg of nitrogen/ha/year from livestock effluents (DM 5046 of 25/02/2016).

The regulatory framework is strengthened by the Water Framework Directive 2000/60/EC, implemented in Italy by Legislative Decree 152/2006. The NVZs in Lazio were designated in 2004 and confirmed in 2019.

Analysis by the Regional Agency for Environmental Protection (ARPA) led the Lazio Region to formalize a significant expansion of vulnerable areas: the total extent of NVZs covers approximately 238,298 ha of territorial surface and 146,028 ha of agricultural surface, with a significant increase compared to the previous situation. Monitoring results in the 2016-2019 period confirmed eutrophic conditions attributable to agricultural pressure, leading to the recognition of additional NVZs in 2023. (Figure 108)

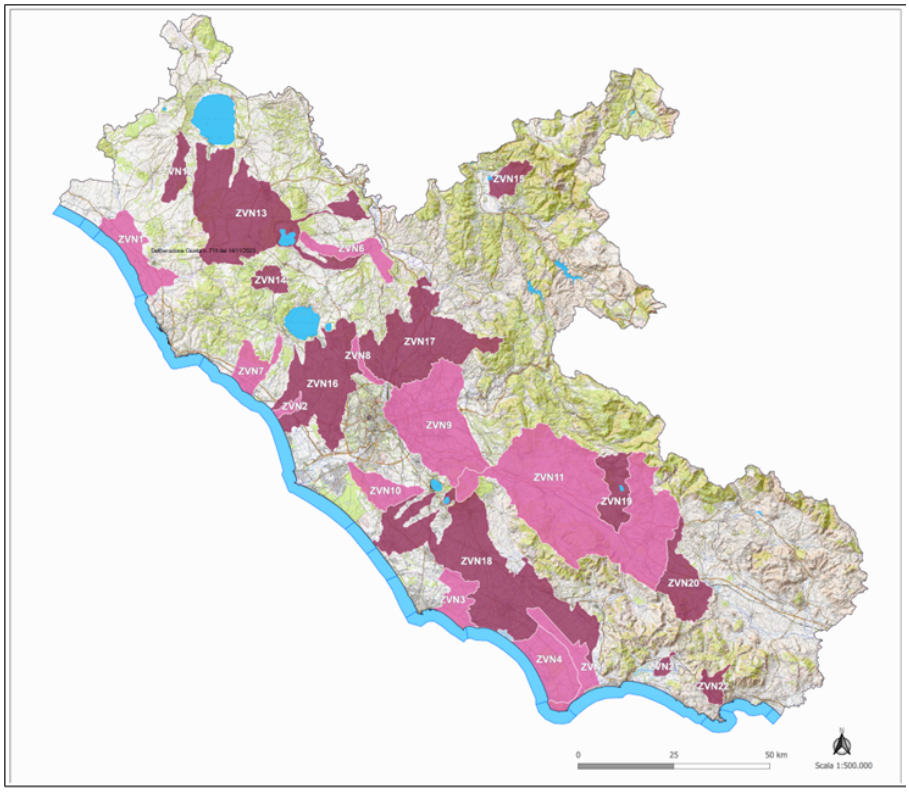


Figure 108 - The previous and the newly designated Nitrate Vulnerable Zones (NVZs)

6.6.3 Contaminated sites

In Lazio, an additional environmental issue with potential impacts on the agricultural sector is represented by contaminated sites, recorded in the regional archive established pursuant to Article 251 of Legislative Decree 152/2006 and managed by ARPA Lazio (updated in 2018). The archive lists 1,221 sites: remediation has been completed for 155, while procedures (standard under ex Article 242 or simplified under Article 249 and DM 31/2015) are still ongoing for 1,066 of them. The most frequent type of contaminated sites is fuel sales points (437 sites, about 36%), confirming the significant role of hydrocarbon and solvent contamination in urbanized and peri-urban areas. There are also 170 former landfills recorded, concentrated mainly in the province of Frosinone (115, about 68% of former landfills).

The territorial distribution shows a strong concentration in the province of Rome (614 sites, about 50% of the total), followed by Frosinone (260, 21%). Rieti is the least affected province (49 sites, about 4%). ARPA Lazio also reports specific provincial criticalities, largely linked to active or disused production facilities, waste management, and energy infrastructure.
In particular, the province of Frosinone is critical due to the presence of numerous former landfills activated by mayoral ordinances and, in the SIN Sacco area, active and disused industrial sites, waste treatment plants, and a former landfill. The Sacco Valley falls within the National Interest contaminated sites (SIN) named "Sacco River Basin". In this area ARPA has detected the presence of "marker" contaminants such as hexachlorocyclohexane (α, β, γ), DDT, DDD, DDE, and other phytopharmaceuticals.

6.6.4 Other key issues

This section can be used to highlight other relevant aspects related to the territory (e.g. Gender distribution; Role of young generations; Ageing of farmer populations; the migration trends; Any knowledge about existing, well known agroecological innovations such as collective farming or time-sharing groups; etc.)
Renewable energies

One of cross-cutting themes we focused on is the renewable energy sector, in particular the agrivoltaic systems, solution not compromising agricultural production. They can be considered a key enabling factor of agroecology allowing the reduction of energy costs at farm level. Agrivoltaics also claims to serve resilience and adaptation to extreme weather events such as heavy rains, hail, and drought. However controversial issues related to the most effective technical solutions are still debated [270]. The national legal framework responds to the EU aim of bringing renewable energy production up to 42.5% of overall energy needs by 2030 [273].

The regional regulatory framework delegates to provincial administrations the issuing of the Single Authorization for FER facilities according to standardized authorization processes (Regional Law No. 18/2006, DGR 517/2008). Municipalities have the competence to identify areas unsuitable for the installation of wind and Picturevoltaic plants [266].

At least three planning tools interfere on the matter: the Regional Energy Plan (PER), the Regional Agricultural Plan (PAR), the Plan for the Ecological Transition (PET).
So far, agrivoltaics are interpreted as a lever for reducing variable company costs and increasing the competitiveness of agricultural enterprises. Unsuitable land areas to install FER facilities include HNVF (areas with high agricultural value), environmentally vulnerable areas, and landscape assets (PER).

Generational renewal

Generational turnover and female entrepreneurship represent two structural, cross-cutting challenges for the Lazio agricultural system, closely linked to the long-term sustainability of the sector and the vitality of rural areas. As highlighted in the 2024 ISMEA Report on Young People and Agriculture, the Italian primary sector is still strongly characterized by the aging of entrepreneurship. As of 2020, farm managers under 41 totaled 104,886, or 9.3% of the total, down 43% from ten years earlier.

National data highlight that the average value created by a youth-led enterprise is 65% higher than the average across the entire agricultural business universe. This dynamism is essential for driving the transition toward Agriculture 4.0 and agrivoltaics, sectors toward which young people show greater investment propensity [257].

Access to land and credit remain the main obstacles for young farmers as emphasized by the Strategy on generational renewal [274].

Moreover, the retention of young people in Lazio's rural areas is hindered by negative contextual factors, such as the incomplete development of digital infrastructure (with delays in coverage of "white areas") and the shortage of early childhood services, which directly impact birth rates and the stability of farming families.

Female presence constitutes a structural, albeit still fragile, component of the national agricultural system. According to CREA, based on data from the 7th General Census of Agriculture, women manage about one-third of total agricultural enterprises (31.5%), with an average farm size smaller than those under male management (on average 4 hectares less) and contributing less to national standard output (17.5%) [257].

On the policy instruments front, the “Più Impresa” ISMEA measure provides financial support for young (18-under-41) and female entrepreneurs in agriculture, allowing them to sub-enter into existing farms or expand and modernize their own enterprises through a mix of grants and low-cost (often interest-free) loans, typically up to 1.5 million euro. The measure targets micro, small, and medium-sized agricultural enterprises in both startup and operational phases, promoting innovation, sustainability, and generational turnover.

In combination with “Generazione Terra” ISMEA instruments, which support young farmers’ access to land (purchase or long-term leases), these tools align with the CAP 2023-2027, helping to modernize farms, consolidate young and female-led businesses, and strengthen the competitiveness of the national agri-food system.

7 AGROECOLOGY IN TROODOS (CYPRUS)

7.1 TAPELINE in the territory and the study context

7.1.1 Background and rationale for applying TAPE

TAPELINE's main objective is to catalyze a large-scale transition towards agrifood systems rooted in agroecological principles. Applying agroecological methods at *large scale* in Troodos is important because:

- Landscape-level soil protection is only effective at scale: extended coverage of terraces, ground cover, and sustainable practices is needed to stop erosion and prevent desertification across the wider mountain ecosystem.
- Wildfire prevention depends on continuous, large-area land management, where active farming and controlled grazing reduce fuel loads across whole valleys, not isolated plots.
- Water resilience requires coordinated action, as individual farms cannot address declining groundwater, inefficient networks, and semi-arid conditions without collective, territory-wide measures.
- Biodiversity restoration works best at ecosystem scale, enabling connected habitats for pollinators, natural vegetation, and wildlife to thrive.
- A strong, resilient rural economy needs a critical mass of agroecological producers to support value chains, local processing, branding, and agro-tourism.
- Climate adaptation requires integrated territorial planning, not fragmented actions, to build resilience against droughts and extreme weather.
- Participatory evaluation of the agroecological transition becomes more robust and representative when it includes all territories and social groups.

a) Through the implementation of TAPELINE project what would you like to demonstrate in your territory?

Specific Activities in Troodos, Cyprus:

- Establishing a pilot Territorial Living Lab at the territorial level to test and refine agroecological practices, serving as an innovation hub.
- Empower local farmers through capacity-building workshops, training sessions, hands-on mentoring and on-site technical support for adopting agroecological practices rooted in AE elements at the local level.
- Conduct targeted agroecological assessments adapted to the unique mountainous landscape of Troodos.
- Develop localized strategies and roadmaps for agroecological implementation in mountain-specific environments.
- Facilitate stakeholder engagement to ensure long-term agroecological sustainability and knowledge transfer.
- Share findings and insights from the Troodos site across the broader TAPELINE network.

b) In your opinion what needs to be improved in your territory and what are the limitations of the respective institutional enabling environments to achieve wider transitions to agroecology that TAPE tool should help to understand/highlight?

Table 8 - Institutional limitations hindering territorial needs in Troodos

Territorial Need	Institutional Limitations
Farmer support, advisory services, and diversification - Improve consulting for production and multifunctionality - Field-based advisory units with territorial focus	- Farmers are not organized; weak or absent cooperatives - Lack of structured on-the-ground advisory services
Coordinated water management - Restore irrigation networks - Collective water management and coordinated action	- Broken irrigation networks - Inactive irrigation associations - Weak coordination between authorities and users
Wildfire prevention and post-fire management - Integrated wildfire strategies - Manage abandoned lands - Consultation with landowners and incentives for land recovery	- Lack of electronic monitoring/early warning systems - Poor coordination among environment, forestry, agriculture, and communities - Unclear or fragmented land ownership
Biodiversity restoration and landscape-level management - Integrated restoration across the landscape - Unified management of environment, forest, and agriculture	- Key agencies do not collaborate effectively - Limited on-the-ground institutional presence - Fragmented responsibilities prevent holistic management
Participatory and integrated territorial governance - Multi-actor platforms (MAPs) to coordinate actions - Participatory evaluation and innovation pathways	- Lack of structured mechanisms for participation and co-decision - Absence of MAPs to coordinate and evaluate the agroecological transition

Overall, farmers in Troodos can be considered in a low or early stage of agroecological transition. While very few farms explicitly identify themselves as "agroecological," many practices that resemble agroecology are better understood as outcomes of organic farming rather than deliberate agroecological strategies. Most farms operate under organic standards but remain embedded in an intensive farming logic, rather a transition toward agroecology. Although the mountainous, terraced environment could support agroecological approaches, current farming systems are more accurately characterized as organic production adapted to landscape constraints. The transition is therefore partially underway: but uneven, fragmented, and not yet consolidated.

It is crucial to highlight that while European subsidies formally support agroecological practices, there are no specific local or national schemes to effectively encourage such a transition adapted to the specific conditions of Troodos area, even though it is a high value nature preservation area. There is a potential to scale up agroecology, but real progress depends on reshaping public policies and participatory governance at the local level, so they better match the realities of mountain farming systems. Several opportunities exist, but so do structural constraints. The key is to align policies with the region's ecological, cultural, and socio-economic characteristics through a territorial, integrated, and socially inclusive approach that brings together:

- Biodiversity conservation
- Local food systems
- Cultural heritage
- Fire prevention
- Rural revitalization
- Agro-tourism
- Climate adaptation

Agroecological transition is promoted in Troodos territory in a complementary manner to existing and ongoing programs and initiatives, such as regenerative agriculture and agroecology actions, interventions in fire-affected areas, and the ERASMUS+ 'Back to The Land" program that promote

rural revitalization and rebirths, as well as efforts by local authorities and stakeholders to adopt sustainable practices at both farm and territorial levels.

7.1.2 Specific research and evaluative questions

The Troodos region is characterized by interconnected environmental and socio-economic challenges, including land abandonment, depopulation and aging, declining agricultural viability, and increasing exposure to climate-related risks such as water scarcity and wildfires. At the same time, the territory retains significant agroecological potential, particularly through traditional farming systems, terraced landscapes, and diversified low-input production practices.
In this context, agroecology is not limited to farm-level practices but can be understood as a territorial approach that links agricultural production with landscape management, environmental resilience, and local development. It contributes to soil improvement, reduced production costs, and enhanced product quality, while also strengthening territorial identity and the added value of local products. Importantly, agroecology may also support the emergence of collective forms of organization and coordination, which are increasingly relevant under changing economic conditions.
Moreover, by increasing the value of both agricultural activity and previously abandoned land as forms of territorial capital, agroecology opens pathways for the maintenance of existing and reactivation of abandoned land without requiring high external capital investments. Instead, it relies on knowledge, local practices, and collective governance. This enables the development of multifunctional and mosaic landscapes that combine production, environmental protection, and wildfire risk reduction.
Despite these potentials, there is still limited empirical understanding of how agroecology operates at territorial level in relation to land abandonment dynamics, environmental resilience, and governance structures. This creates the need for an integrated analytical framework that can capture these interrelated dimensions.

Therefore, the research questions formulated here under are structured around three key pillars:

1. *Land abandonment and farming system dynamics, focusing on drivers and pathways of land maintenance, reactivation or recovery;*
2. *Environmental resilience, focusing on water, fire risk, and landscape management;*
3. *Territorial value and governance, focusing on identity, value creation, and collective action.*

<u>Main Research questions</u>

How can agroecology function as a territorial approach to reduce land abandonment, create added value in mountain agricultural systems and enhance environmental resilience in the Troodos region?

RQ1 - Land abandonment and farming systems

What are the characteristics of existing farming systems and territorial conditions that influence the risk of land abandonment, and how can agroecological practices contribute to the maintenance, recovery, or reactivation of agricultural land and traditional farming systems?
This question investigates how different farming system types are linked to abandonment dynamics, which systems persist or why are abandoned (e.g. ageing, labor, loss or maintenance of traditional systems etc.), and what conditions support their recovery, strengthening the viability and attractiveness of farming systems. So, what is interesting to investigate is system viability, transition potential and resilience of active farms.
Step 0 contextual analysis and the TAPE questionnaire (Steps 1-2) together allow the identification of local drivers of land abandonment and the characterization of existing farming systems. The combination of stakeholder input from the MAP and farm-level data enables an understanding of how different farming system types are linked to abandonment dynamics.

RQ2 - Environmental resilience

How do agroecological practices influence water use efficiency, fire risk, and landscape management in mountain agroecosystems?
This question is operationalized through the TAPE assessment (Step 2-3), which evaluates agroecological practices and their environmental performance. Indicators related to resource efficiency, biodiversity, water management, and landscape functions are used to assess how farming systems contribute to environmental resilience in the territory.

RQ3 - Territorial value, collective action and governance

How does agroecology contribute to territorial identity, product valorization, and the development of collective action and governance dynamics among local actors?
This question is explored through the Step 0 contextual analysis and the participatory dimension of TAPE, complemented by MAP discussions. These tools allow the examination of how agroecology influences territorial identity, collective action, and governance dynamics, and how these processes support coordinated territorial responses to shared challenges.

General Objective: from farm-level TAPE results to territorial-level action

The general objective of the TAPELINE project in Troodos is to find ways to engage local actors (farmers, residents, local authorities, and researchers) in a Territorial Living Lab process that applies the TAPE framework to co-develop and evaluate agroecological pathways, strengthening the links between agriculture, food systems, landscapes, and social cohesion while addressing land abandonment and improving environmental resilience in the Troodos region.

The proposed approach builds on the results that will be generated through the application of the TAPE tool (Steps 0-3) at the farm level, based on fieldwork conducted with farmers and initial exchanges within the Multi-Actor Platform (MAP). The aim is to move beyond farm-scale assessment by systematically linking these findings to a Territorial Living Lab process in the Troodos region. In this perspective, TAPE provides a robust evidence base on farming systems, agroecological performance, and transition pathways, while the Living Lab and MAP create the institutional and participatory space needed to collectively interpret these results, align stakeholder perspectives, and co-design strategies. This articulation enables the translation of farm-level insights into coordinated territorial actions, thereby supporting the upscaling of agroecological transitions from individual practices to landscape-level, collective and participatory processes that address land abandonment, enhance environmental resilience, and strengthen territorial governance.

The 10 Elements of Agroecology (*Diversity, Synergies, Recycling, Efficiency, Resilience, Culture and food tradition, Co-creation and sharing of knowledge, Human and social values, Circular and solidarity economy, Responsible governance*), integrated within the TAPE survey, will provide a bridge between farm-level assessment and territorial transition. They support the evaluation of practices at farm scale while enabling the aggregation of results at the territorial level. Within the Territorial Living Lab in the Troodos region, they serve as a common framework for stakeholder dialogue, helping identify strengths and gaps and guiding the co-design of agroecological strategies, thereby facilitating the upscaling of transitions beyond individual farms.

The 10 Elements of Agroecology act as a transversal analytical framework linking the research questions by connecting farming system viability (RQ1), environmental performance (RQ2), and territorial governance and value creation (RQ3), thereby enabling the integration of farm-level assessments into broader territorial transition pathways.

7.2 Contextual assessment

The following sections provide information for a comprehensive understanding of the agroecological context and the main factors towards the agroecological transitions.

7.2.1 Country profile and territory boundaries

The study area in this research is the mountainous region of Troodos in Cyprus which is classified as CY000*LAU 2, according to the European statistical system, is part of free Cyprus.
Geographically, the Troodos region is located in the center of the island and covers 25% of free Cyprus. According to the Statistical Service of Cyprus *(CYSTAT*), the area comprises 127 communities with a total area of 164,239 ha (see Figure 109), is inhabited by just 30,528 permanent residents (3.3% of the Cypriot population - *CYSTAT* 2021), while maintaining connections with over 70,000 expatriates.



Figure 109 - Location of Troodos area in Cyprus

Administratively, it is divided into three districts: Nicosia, Limassol, and Larnaca. Troodos consists of eleven sub-regions (historical areas, see Figure 110) including 127 communities with distinct geographical and cultural characteristics. The most populated historical area is Krasochoria, with over 7,000 inhabitants, followed by Solea (4,877) and South Pitsilia (4,307). However, a characteristic feature of the settlement pattern is its polycentricity, with a few larger settlements forming a network that accommodates a significant share of the population. There are two development agencies, a district agricultural office, and a district tourist office operating in Troodos.

Troodos is a mountainous area with a diverse landscape of valleys, terraces, and steep slopes, rich in natural resources (forests, rivers, streams, etc.). It is a reservoir of very important natural resources for the island, with water being the most prominent. It is also considered the center of Cyprus' cultural heritage due to its rich cultural assets (monuments of rural and religious heritage, UNESCO-listed sites).



Figure 110 - Administrative Boundaries of Communities and Historical Areas

Table 9 - Main Geographical Characteristics by Historical sub-regions of the Study Area. Source: Population statistics, CYSTAT, 2011-2021

Sub-areas /Historical areas	Number of Communities	Administrative area	Population 2021	Population 2011	Area (km2)
Krasochoria - Ampelochoria	28	Limassol	8,886	7,553	311.4
Solea	16	Nicosia	4,877	4,983	165.4
South Pitsilia	11	Limassol	4,307	4,571	98.8
Oreini Morfou - Assinou	9	Nicosia	2,561	2,709	156.7
Oreinis	1 (Ag. Epifaneios Oreinis)	Nicosia	449	412	17.36
North Pitsilia	17	Nicosia	2,473	2,660	202.5
Koumandaria	14	Limassol	2,813	2,536	149.9
Marathassa	14	Nicosia (8) Limassol (6)	1,170	1,523	313.3
Oreina Theretra Lemessou	6	Limassol	1,141	1,160	78.8
Lefkaron	4	Larnaca	462	484	49.44

Kellakiou	7	Limassol	1389	1416	98.79
Total Area	127	-	30,528	30,007	1,642.39

7.2.2 Socio-economic characteristics

Over the past few decades, mountain communities of Troodos have experienced a steady decline in population, which has directly impacted local productive activities, raising concerns about the potential abandonment of large parts of the region. Most settlements have not experienced demographic recovery: around 20% of the communities have no residents under 24 at all, yet approximately 20% of the total population is under the age of 24, while 28% is over the age of 65.
This demographic and productive transformation is linked to long-standing processes, such as migration and urbanization that began in the mid-20th century, combined with the persistent absence of a coherent policy framework for mountainous regions. Consequently, the mountain environment remains fragile and exposed to ecological disturbances, natural hazards and the pressures associated with its integration into the urban system. Weakening the region's ability to manage natural resources or address key challenges such as climate change, water scarcity and biodiversity loss would have significant and potentially irreversible consequences for Cyprus as a whole.
Despite these pressures, there is growing recognition of the multifunctional role of mountain areas and the structural disadvantages affecting production and everyday life. This shift is gradually restoring the region's value, supported by policies that promote the protection of natural and cultural assets, efforts to prevent territorial abandonment, growing consumer interest in heritage and local products, and the opportunities offered by new technologies.

Spatial distribution of population and change in the period 2001-2021

A characteristic feature of the settlement pattern is its polycentricity, with a few larger settlements forming a network that accommodates a significant share of the population.

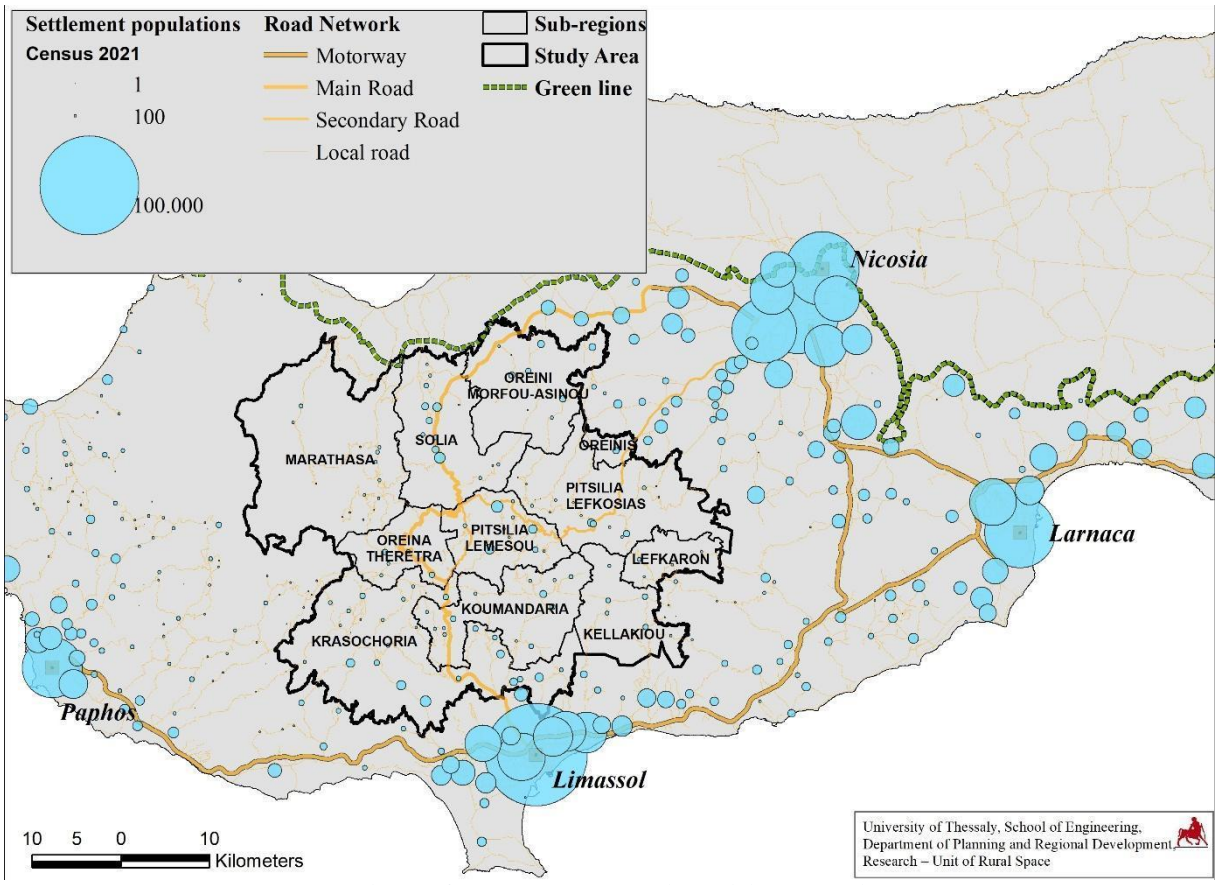


Figure 111 - Population of Communities in Troodos and the surrounding areas in 2021

According to the 2021 census conducted by the Statistical Service of Cyprus, the 127 communities of Troodos Mountain area had a total population of 30,528 (in 2011, 30,007 inhabitants, compared to around 60,000 in 1960: a 53% decrease, see Table 9), representing 3% of the total Cyprus population, while the area covers 30% of the country. Geographically, the population in Troodos (CYSTAT, 2021) is concentrated along three main axes (see Figure 112). The main population axis (1) is the vertical one covering Solia (Eurycho - Kakopetria) and South Pitsilia of Limassol (Kyperounta, Agros, Pelendri) with a total population of 9,554 inhabitants, accounting for 34.5% of the population of Troodos. On the southern edge of the region (axis 2, figure 4.4) we find the suburban zone of Limassol (Pachna, Souni-Zanakia, Paramytha, Fasoula), which is clearly influenced by the dynamism of this large city, while to the northeast and east is the area) adjacent to Nicosia (without being considered its immediate suburban area) and includes settlements such as Potami, Orounta, Agia Marina Xyliatou, Palaihori, and Farmakas (axis 3, figure 4.4). The Marathassa area and the western part of Oreina constitute the most remote zone, characterized by long travel times, lack of services, and severe population decline and aging.

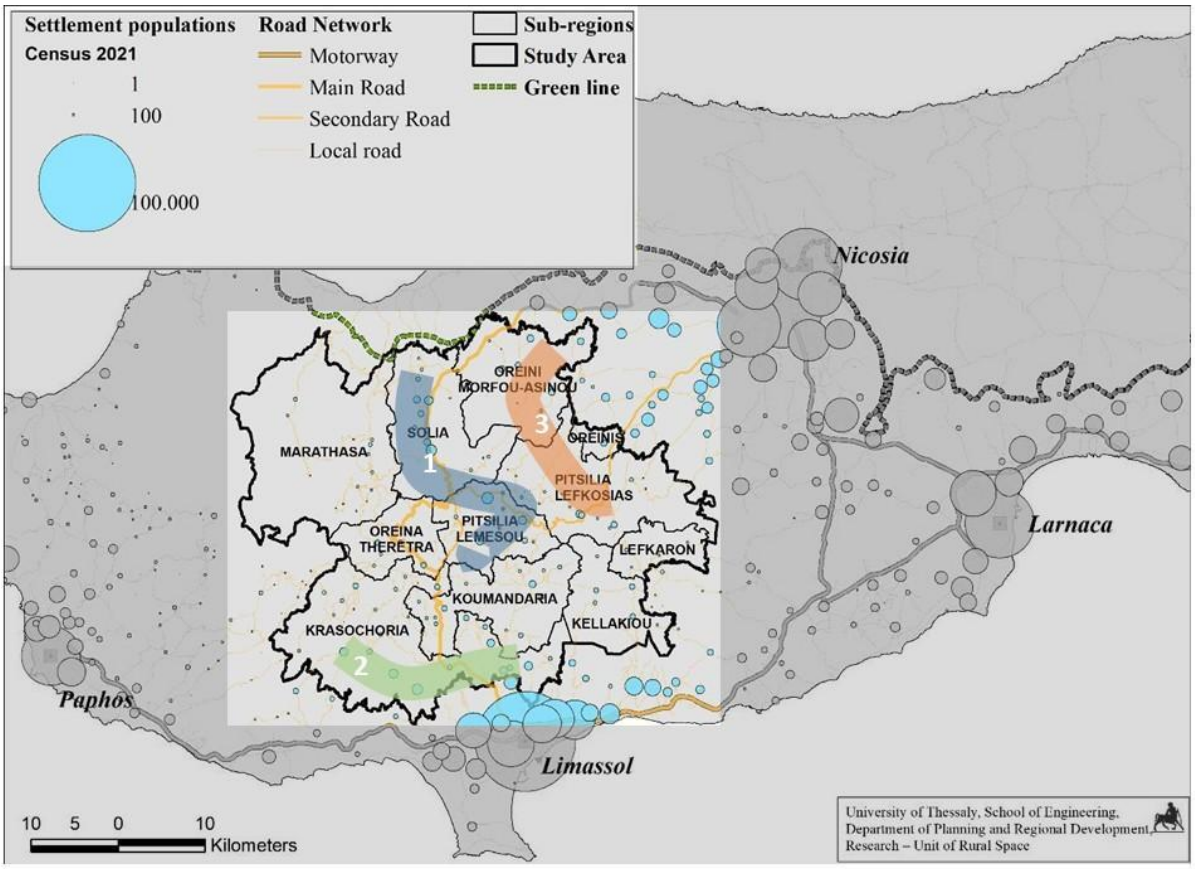


Figure 112 - Main population concentration axis

A considerable number of communities continue to experience notable population decline in the period 1960-2021 (see Table 9), with some recording losses of more than 25% between 2001 and 2011. Most of the larger centers mentioned above (along the central and north-eastern axis) show little population change between 2011 and 2021. In contrast, the communities of Krasochoria, especially those located closer to Limassol: both small and large: are showing signs of population increase (see Figure 113).

Table 10 - Evolution of permanent Population per subregion 1960-2021. Source: Population statistics, CYSTAT 1960-2021

Sub-areas (historical area)	2021	2011	2001	1992	1982	1960

Solea	4877	4983	5246	5843	7174	7206
Marathassa	1170	1523	2145	2,871	4,341	7948
Oreini Morfou-Asinou	2561	2709	2804	2851	3047	2654
Oreina Theretra	1141	1160	1085	1395	1748	2274
Pitsilia of Limassol	4307	4571	4866	5242	6917	9423
PItsilia of Nicosia	2473	2660	3178	3657	4529	6293
Koumandaria	2813	2536	2368	2469	2867	4135
Krasochoria	8886	7553	5963	6444	8093	12454
Lefkaron	462	484	475	539	637	1097
Kellakion	1389	1416	1409	1328	1520	2054
Oreinis	449	412	338	352	348	310
Troodos Area	30528	30007	29877	32991	41211	55848
Cyprus[81]	923,381	838,897	689,565	602,025	522,845	573,500

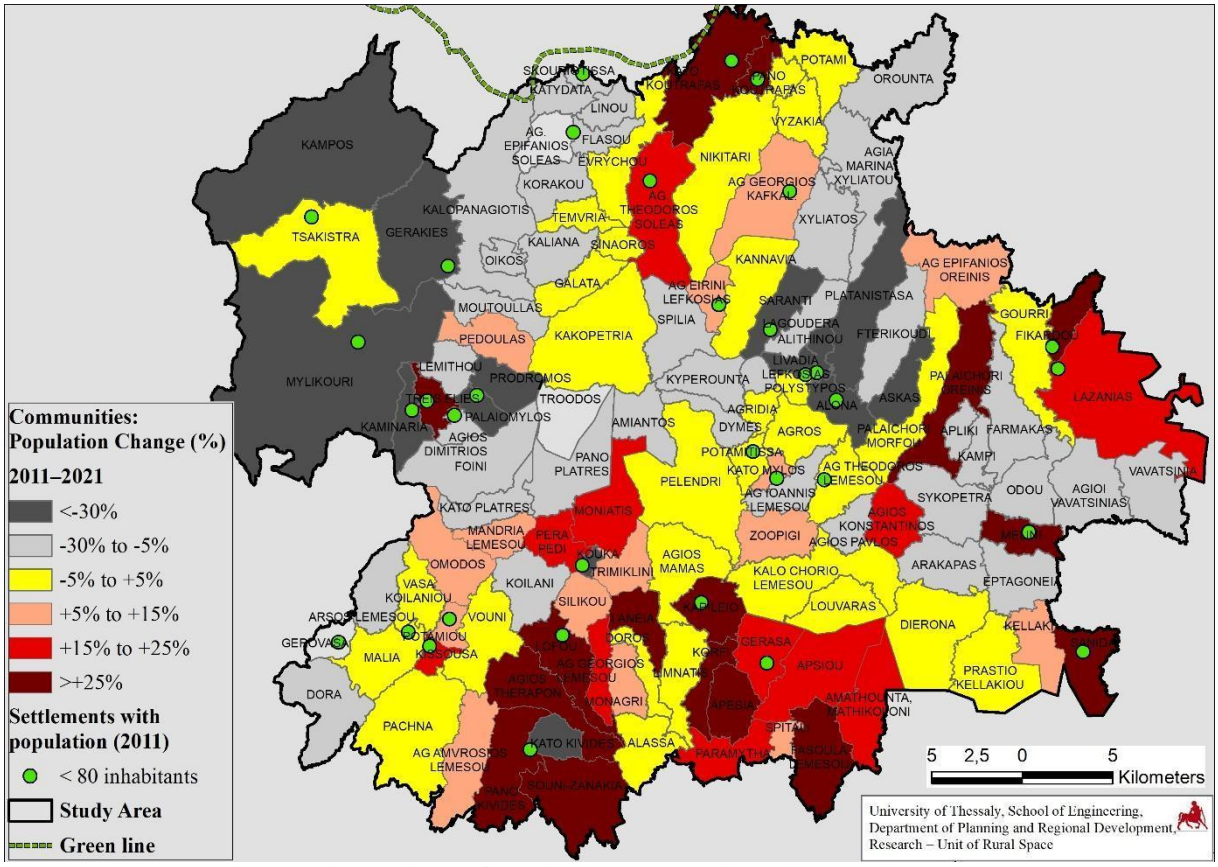


Figure 113 - Percentage Change in the Population of Troodos Communities during the Period 2011-2021, Source: CYSTAT

Population density, urban-rural distribution and migration patterns

The Troodos region is distinctly rural, mountainous, and environmentally sensitive, standing apart from Cyprus's major urban centers (Nicosia, Limassol, Larnaca, and Paphos). It consists exclusively

[81] The reports, which cover the entire country, include the area controlled by the Republic of Cyprus (and not the occupied area).

of small-scale, low-density settlements, and the entire population living within the mountainous area is rural. Out of a total of 127 communities, only eight exceed 800 inhabitants -four of which have more than 1,000- and these are distributed across almost all sub-regions.
This sparse settlement pattern contributes to Troodos's very low population density, particularly in Marathasa, Asinou, and the Nicosia part of Pitsilia, where steep terrain, extensive forest cover, and protected areas further limit inhabitation. Overall, the region has 30,528 residents, with a population density of 18.6 inhabitants/km² compared to the national average of 166.95 inhabitants/km² [82]. While the region's population has stabilized, its share of the national population continues to decline. Migration has brought some rejuvenation: since 2011, 946 families have settled in Troodos, 682 of them under 40, indicating a modest influx of younger residents into an otherwise aging rural workforce (based on a local survey in 2018).
Population distribution within Troodos is uneven. Semi-mountainous and more accessible sub-regions, such as Pitsilia of Limassol, Solea, and Krasochoria, exhibit higher densities, while areas like Koumandaria remain sparsely populated despite proximity to Limassol. A distinctive feature of the region is its polycentric settlement pattern, in which roughly one-third of the Troodos population is concentrated across multiple small centers. This pattern reflects historical migration, urbanization trends, and the long-standing absence of targeted development policies for mountainous areas. Today, population concentration is evident along the Solea-Pitsilia of Limassol axis and the peri-urban zone of Limassol. Southern Troodos (e.g., Krasochoria) shows relative recovery, whereas other sub-regions, such as Marathasa and Pitsilia in Nicosia, continue to experience decline.
The combined effects of rural exodus and depopulation, migration, and the island's division have reshaped Troodos's demographic and land-use patterns. Agricultural abandonment is most pronounced in central and less accessible areas where steep terrain and marginal land limit productivity, contributing to declining population density and the consolidation of settlements in more accessible zones. Remaining agricultural activity is largely confined to terraced slopes and valley bottoms, where it helps sustain both the environment and traditional landscape. In contrast, areas where cultivation has ceased show signs of land degradation and vegetation overgrowth, reflecting the broader impact of demographic shifts on the region's spatial distribution and rural vitality. These trends highlight how population movements, settlement patterns, and declining agricultural engagement are closely intertwined in shaping Troodos's rural landscape.

Table 11 - Evolution of rural-urban population 2001-2011-2021. Source: CYSTAT 2001-2021

Population	Evolution 2001-2011	Evolution 2011-2021
Rural population of Cyprus	+24.7%	+12.4%
Urban population of Cyprus	+20.2%	+8.9%
Rural population in the Limassol area	+30.0%	+15.8%
Rural population in the Nicosia area	+19.5%	+8.6%

Population structure and ageing statistics

The demographic profile of the Troodos region in 2021 shows a predominantly ageing trend, though the extent varies significantly across sub-areas. The 65+ age group represents 28.3% of the total (compared to a national average of 17.2%), while several more remote sub-areas show particularly advanced ageing, including Marathassa, Solea, Koumandaria, Oreina Theretra, and the Pitsilia areas, where older adults account for nearly one-third or more of residents.
The share of children (0-14) is comparatively low across most communities: averaging 11.9%: with only Krasochoria (15.7%) and Oreinís (17.8%) showing relatively higher youth proportions. This indicates sustained low fertility and the out-migration of young families.
Working-age groups (15-64) remain the demographic core, but the limited youth base suggests future declines in the local labour force and school-age population. Krasochoria, Lefkaron and Kellakiou stand out as more balanced areas, showing stronger representation of younger or middle-aged groups.

[82] This density is calculated based on the surface area (5.531 km²) of the free (government-controlled) areas of Cyprus.

Table 12 - Evolution of age distribution of the population by sub-areas (2011 - 2021). Source: CYSTAT 2011, 2021

	Ages 2011										
	0-14		15-29		30-44		45-64		65+		
Sub-areas	**number**	**%**	**number**	**%**	**number**	**%**	**number**	**%**	**number**	**%**	**Sum**
MARATHASSA	87	*5,7%*	198	*13,0%*	208	*13,7%*	379	*24,9%*	651	*42,7%*	**1523**
KRASOCHORIA	1086	*14,4%*	1396	*18,5%*	1349	*17,9%*	1957	*25,9%*	1762	*23,3%*	**7553**
KOUMANDARIA	274	*10,8%*	445	*17,5%*	395	*15,6%*	713	*28,1%*	709	*28,0%*	**2536**
OREINA THERETRA	115	*9,9%*	162	*14,0%*	191	*16,5%*	310	*26,7%*	382	*32,9%*	**1160**
OREINI MORFOU -ASINOU	380	*14,0%*	609	*22,5%*	506	*18,7%*	696	*25,7%*	518	*19,1%*	**2709**
PITSILIA OF LIMASSOL	560	*12,3%*	898	*19,6%*	718	*15,7%*	1061	*23,2%*	1334	*29,2%*	**4571**
PITSILIA OF NICOSIA	298	*11,2%*	544	*20,5%*	355	*13,3%*	725	*27,3%*	738	*27,7%*	**2660**
SOLEA	611	*12,3%*	905	*18,2%*	825	*16,6%*	1262	*25,3%*	1380	*27,7%*	**4983**
KELLAKIOU	160	*11,3%*	342	*24,2%*	210	*14,8%*	388	*27,4%*	316	*22,3%*	**1416**
LEFKARON	57	*11,8%*	168	*34,7%*	65	*13,4%*	113	*23,3%*	81	*16,7%*	**484**
OREINIS	73	*17,7%*	64	*15,5%*	93	*22,6%*	114	*27,7%*	68	*16,5%*	**412**
Total Troodos Area	**3701**	*12,3%*	**5731**	*19,1%*	**4915**	*16,4%*	**7718**	*25,7%*	**7939**	*26,5%*	**30004**

	Ages 2021										
Sub-areas	**0-14**		**15-29**		**30-44**		**45-64**		**65+**		
	number	**%**	**number**	**%**	**number**	**%**	**number**	**%**	**number**	**%**	**Sum**
MARATHASSA	67	*5,7%*	134	*11,5%*	147	*12,6%*	311	*26,6%*	511	*43,7%*	**1170**
KRASOCHORIA	1395	*15,7%*	1378	*15,5%*	1967	*22,1%*	2184	*24,6%*	1962	*22,1%*	**8886**
KOUMANDARIA	319	*11,3%*	412	*14,6%*	476	*16,9%*	765	*27,2%*	841	*29,9%*	**2813**
OREINA THERETRA	97	*8,5%*	176	*15,4%*	187	*16,4%*	320	*28,0%*	361	*31,6%*	**1141**
OREINI MORFOU -ASINOU	281	*11,0%*	473	*18,5%*	462	*18,0%*	651	*25,4%*	694	*27,1%*	**2561**
PITSILIA OF LIMASSOL	456	*10,6%*	760	*17,6%*	709	*16,5%*	1055	*24,5%*	1327	*30,8%*	**4307**
PITSILIA OF NICOSIA	240	*9,7%*	402	*16,3%*	443	*17,9%*	632	*25,6%*	756	*30,6%*	**2473**
SOLEA	515	*10,6%*	817	*16,8%*	805	*16,5%*	1116	*22,9%*	1624	*33,3%*	**4877**
KELLAKIOU	144	*10,4%*	240	*17,3%*	269	*19,4%*	378	*27,2%*	358	*25,8%*	**1389**
LEFKARON	40	*8,7%*	103	*22,3%*	111	*24,0%*	104	*22,5%*	104	*22,5%*	**462**
OREINIS	80	*17,8%*	64	*14,3%*	95	*21,2%*	106	*23,6%*	104	*23,2%*	**449**
Total Troodos Area	**3634**	*11,9%*	**4959**	*16,2%*	**5671**	*18,6%*	**7622**	*25,0%*	**8642**	*28,3%*	**30528**

Comparing the data from 2011 and 2021, the following conclusions emerge:

- The percentage of people over 65 years old increased in most communities, but more sharply in the area of Oreini Morfou-Asinou and Oreinis (with a rise of 7-8%), in Solea, Lefkaron (+5-6%), and to a lesser extent in Pitsilia of Nicosia and Kellakiou. In contrast, in Marathasa, Koumandaria, and Pitsilia of Limassol the increase was relatively contained, while in Krasochoria and Oreina Theretra it actually declined.
- The percentage of children under 14 years old decreased significantly in Oreini Morfou-Asinou, Oreina Theretra, Pitsilia of Limassol, and Solea, whereas an increase was recorded in Krasochoria and Koumandaria.
- The working-age population still forms half the population, but declines in youth suggest future contraction.
- Overall, the Troodos region faces clear demographic pressures driven by ageing, youth decline, and uneven population distribution, with potential implications for service provision, community vitality, and long-term sustainability.

<u>Age pyramids and gender distribution</u>

The age pyramid (Figure 114) indicates a shrinking and ageing population, with a weak base and a concentration in middle and old age groups. There is a small positive indication in the 20-24 age group, but the main reproductive groups (25-44) are limited. In comparison, the Cyprus age pyramid reflects a mature, near zero-growth population, characterized by a narrow base and top but a noticeable bulge in the middle. The base has begun to strengthen after 2006, partly due to improved fertility levels.

Within the Troodos region, there is still notable potential in the 15-24 and 45-54 age groups, which are crucial for future demographic renewal, representing an important source of human capital for regional development.

Spatially, higher shares of youth (15-29) are found mainly in the southern zone and the northeastern part of Troodos, as illustrated in the maps.

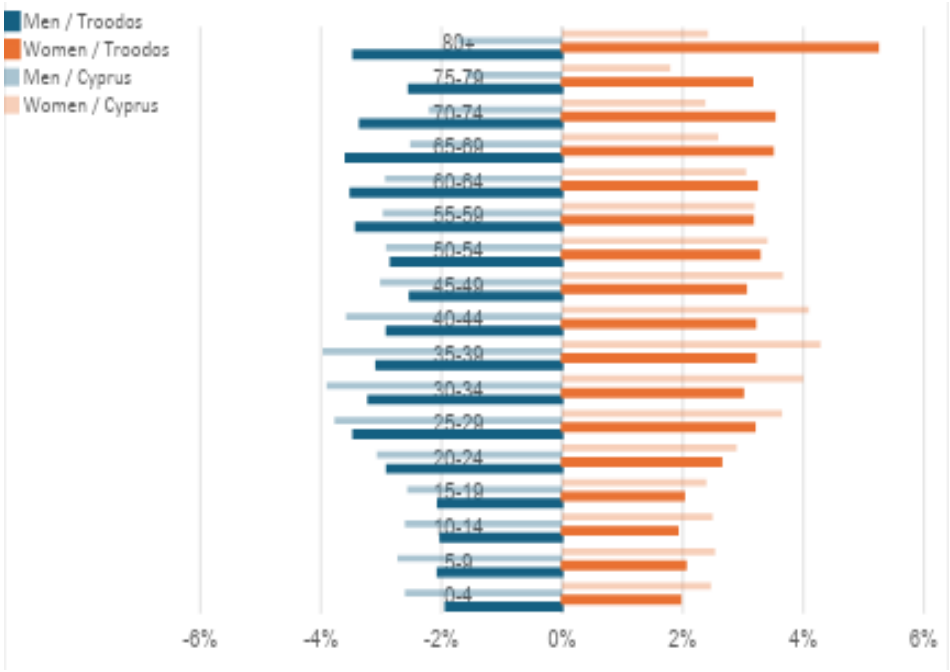


Figure 114 - Age pyramid & gender distribution of total population in Troodos and Cyprus (CYSTAT, 2021)

Settlement Patterns of foreign residents and young/new families

According to the 2011 census, there were approximately 3,500 foreigners registered in Troodos (12.7% of the total population), with about half coming from EU countries. In the 2018 field survey, based on information from community leaders, a total of 704 foreign families were identified, with the largest concentrations in Zouni-Zanakia, Omodos, and Lanis.

One of the factors examined at the time was the settlement of new families in the area. The majority (58%) concerned settlements in Krasochoria and Koumandaria, but new settlements were also recorded in more disadvantaged areas, such as Marathasa and Pitsilia, often by young couples*.

**Note: The data comes from the 2018 field survey and has not been updated since then.*

Spatial distribution of economic activities per sector and the share of agricultural employment

Troodos presents a complex and evolving economic landscape, where traditional and emerging activities coexist in a multifunctional mountain economy. Despite ongoing demographic pressures, the area retains historic communities where agriculture, manufacturing, and tourism coexist around central villages.

Although recent employment data for 2021 are not available, the latest information (2011) shows that the economically active population of Troodos represents a relatively small share of the total population (~40%), reflecting the region's high levels of ageing. While variations between sub-regions are limited, areas such as Krasochoria, Pitsilia, Solea, and Koumandaria concentrate the majority (~80%) of the workforce. Unemployment at the time was generally low, though slightly higher in the southern parts of the region, particularly in Krasochoria and Koumandaria. Overall, the area maintained lower unemployment rates than the sharp increases seen in Cyprus during the subsequent economic crisis. These patterns highlight the limited but regionally concentrated labor force in Troodos and underscore the interplay between demographic structure and local employment conditions.

The area maintains a relatively strong agricultural base (~8% in 2011), alongside notable though uneven development of secondary and tertiary activities[83]. This pattern reflects the region's ongoing agroeconomic transition, where traditional agriculture is increasingly interconnected with processing, tourism, and other services. Compared with other regions of Cyprus, the study area shows a noticeably higher concentration of employment in the primary sector, along with relatively

[83] Economic activity in Troodos varies across its communities. Agriculture plays a bigger role in Oreini Morfou-Asinou, where it employs over a third of the workforce, while in areas like Oreina Theretra, Pitsilia Limassol, and Solea it accounts for roughly one-tenth. Industry is most concentrated in Oreini Morfou and Krasochoria, with Krasochoria, Pitsilia Limassol, and Solea together hosting the majority of manufacturing jobs. Services, on the other hand, thrive in Oreina Theretra, Solea, and Marathasa, with Marathasa benefiting particularly from the boost in tourism.

significant specialization in secondary-sector activities, particularly in agro-food processing and small-scale craft industries.
This structure reflects an ongoing agroeconomic and agroecological transition, in which agriculture is increasingly interconnected with processing and tourism, creating a multifunctional rural economy. The persistence of traditional know-how in agriculture and small-scale processing, combined with emerging links to experiential tourism linkages that are rooted in local products, traditions, and landscape, form a solid foundation for sustainable development. Local products retain strong links to the territory and cultural heritage, can offer opportunities for agroecological innovation, to create added value and foster sustainable rural development. In this sense, the employment structure illustrates both the resilience of traditional sectors and the dynamic adaptation toward a more diversified and multifunctional mountain economy. However, despite the strong cultural identity of local products and services, the distinctiveness of Troodos outputs has not yet been adequately highlighted or promoted in ways that would increase their added value. Equally absent is a coordinated effort to support entrepreneurship, particularly among young people.
The manufacturing sector demonstrates notable potential, particularly in agro-food and artisanal production, where traditional know-how persists. Examples include the production of traditional sweets, grape-based delicacies, and family-run wineries in Krasochoria, alongside small boutique wineries often linked to tourism. Many of these enterprises are visitor-oriented and integrated into the "Wine Routes" network, illustrating the convergence of agriculture, processing, tourism, and environmental stewardship.
Overall, the spatial distribution of economic activities highlights Troodos' potential for sustainable rural development through agroeconomic diversification and agroecological innovation. Strengthening synergies between agriculture, manufacturing, tourism, and ecosystem stewardship, while promoting local products and supporting youth entrepreneurship, will be critical to fully realize the region's economic, social, and environmental potential in the face of demographic and environmental challenges.

Age classes of farm managers, by gender

Based on data from 2010-2020, the total number of agricultural holdings in Troodos fell from 10,831 to 7,813, a decline of 25.8%. The decrease is most pronounced among the 30-54 age groups (-48% to -51%), while the youngest (<30) and oldest (75+) farmers saw increases (+48.8% and +5.7%, respectively). Intermediate age groups (55-74) experienced smaller declines. Within Troodos, reductions are particularly sharp in the middle age groups, whereas the youngest and oldest farmers now constitute a larger share of holdings. Overall, the data indicate an aging agricultural workforce with limited generational renewal.
The data show a general decline in the agricultural population and number of holdings, especially among the productive age groups (30-54). At the same time, there is modest renewal with young farmers under 30 and continued activity among those over 75, who increased their land by 27%, likely due to administrative or tax related land transfers). This creates a paradox: older farmers consolidate and expand their holdings, a small number of young farmers are entering the sector, while the 30-54 age group: the traditional core of the workforce: loses a significant share of land. This trend points to an ageing agricultural workforce and underscores potential challenges for generational renewal in Troodos.

Table 13 - Distribution of holdings by age group of farm holder (2010, 2020). Source: Cyprus Agricultural Payments Organization (CAPO) 2010, 2020

Age categories	Number of farms (2010)	% of total	Number of farms (2020)	% of total	% of age category
< 30	80	0.74	126	1.6	57.5
30 -44	1111	10.3	633	7.9	-43.0
45-54	2620	24.2	1062	13.2	-59.5

55-64	3275	30.2	2342	29.2	-28.5
65-74	2510	23.2	2323	28.9	-7.5
75+	1235	11.4	1546	19.2	25.2
Total	10,831		8,032*		-25.8 (evolution)

* This total number (8,032) does not include 15 companies and 120 holdings for which the age of the farm manager has been declared

Table 14 present the distribution of farm size and the number of holdings across different age groups of farm managers. The data highlight a highly fragmented farm structure, characterized by a large number of very small holdings (under 1 hectare) that collectively account for a limited share of the total agricultural land. In contrast, a significant proportion of land is concentrated in a smaller number of larger operational units, indicating a dual structure of micro-scale and more consolidated farming systems. In addition, there is a strong association between small-scale holdings (< 1ha) and older farmers, suggesting that farm fragmentation is closely linked to generational ageing and succession challenges within the agricultural sector. However, the analysis also indicates a mismatch between declared and actual farm structure, as medium-sized holdings (1-2 ha TEO) may be misleading in practice. In many cases, land is formally declared by multiple owners but effectively managed by a single main farmer, leading to a consolidation of operational control that is not reflected in official classifications. This creates a risk of under-representation of actual medium-sized farms and can distort the interpretation of the real farming structure on the ground.

Table 14 - Farm size (surface) and number of farms per farmers' age. Source: CYSTAT 2020

	Farms								Surface							
categories	No	compagny	<40 yrs	40-54 yrs	55-64 yrs	65-74yrs	75+ yrs	no info	No	compagny	<40 yrs	40-54 yrs	55-64 yrs	65-74yrs	75+ yrs	no info
<1ha	5.058	6	210	820	1.431	1.515	1.034	42	2.567,1	4,3	103,7	426,0	729,4	751,7	532,7	19,4
1-2Ha	1.709	3	105	292	537	454	300	18	2.416,2	3,9	149,4	417,6	755,9	643,9	421,3	24,2
>2Ha	1.400	6	162	232	374	354	212	60	9.213,5	50,2	1.209,3	1.574,0	2.384,3	1.784,7	1.308,2	902,9
total	**8.167**	**15**	**477**	**1.344**	**2.342**	**2.323**	**1.546**	**120**	**14.196,7**	**58,4**	**1.462,3**	**2.417,5**	**3.869,5**	**3.180,3**	**2.262,2**	**946,5**

	Farms (%)								Surface (%)							
categories	No	compagny	<40 yrs	40-54 yrs	55-64 yrs	65-74yrs	75+ yrs	no info	No	compagny	<40 yrs	40-54 yrs	55-64 yrs	65-74yrs	75+ yrs	no info
<1ha	*62*	*40,0*	*44,0*	*61,0*	*61,1*	*65,2*	*66,9*	*35,0*	*18,1*	*7,4*	*7,1*	*17,6*	*18,8*	*23,6*	*23,5*	*2,0*
1-2Ha	*21*	*20,0*	*22,0*	*21,7*	*22,9*	*19,5*	*19,4*	*15,0*	*17,0*	*6,7*	*10,2*	*17,3*	*19,5*	*20,2*	*18,6*	*2,6*
>2Ha	*17*	*40,0*	*34,0*	*17,3*	*16,0*	*15,2*	*13,7*	*50,0*	*64,9*	*85,9*	*82,7*	*65,1*	*61,6*	*56,1*	*57,8*	*95,4*
total	**100**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**

	Farms								Surface (ha)							
categories	No	compagny	<40 yrs	40-54 yrs	55-64 yrs	65-74yrs		75+ yrs	No	compagny	<40 yrs	40-54 yrs	55-64 yrs	65-74yrs		75+ yrs
<1ha	5.058	6	210	820	1.431	1.515	1.034	42	2.567,1	4,3	103,7	426,0	729,4	751,7	532,7	19,4
1-2,5 Ha	2.060	3	134	349	636	545	373	20	3.195,1	3,9	213,8	543,3	976,8	844,9	583,9	28,5
>2,5 Ha	1.049	6	133	175	275	263	139	58	8.434,5	50,2	1.144,8	1.448,3	2.163,4	1.583,8	1.145,6	898,5
total	**8.167**	**15**	**477**	**1.344**	**2.342**	**2.323**	**1.546**	**120**	**14.196,7**	**58,4**	**1.462,3**	**2.417,5**	**3.869,5**	**3.180,3**	**2.262,2**	**946,4**

	Farms (%)								Surface (%)							
categories	No	compagny	<40 yrs	40-54 yrs	55-64 yrs	65-74yrs	75+ yrs	no info	No	compagny	<40 yrs	40-54 yrs	55-64 yrs	65-74yrs	75+ yrs	no info
<1ha	*62*	*40*	*44*	*61*	*61*	*65*	*67*	*35*	*18*	*7*	*7*	*18*	*19*	*24*	*24*	*2*
1-2,5 Ha	*25*	*20*	*28*	*26*	*27*	*23*	*24*	*17*	*23*	*7*	*15*	*22*	*25*	*27*	*26*	*3*
>2,5 Ha	*13*	*40*	*28*	*13*	*12*	*11*	*9*	*48*	*59*	*86*	*78*	*60*	*56*	*50*	*51*	*95*
total	***100***	***100***	***100***	***100***	***100***	***100***	***100***	***100***	***100***	***100***	***100***	***100***	***100***	***100***	***100***	***100***

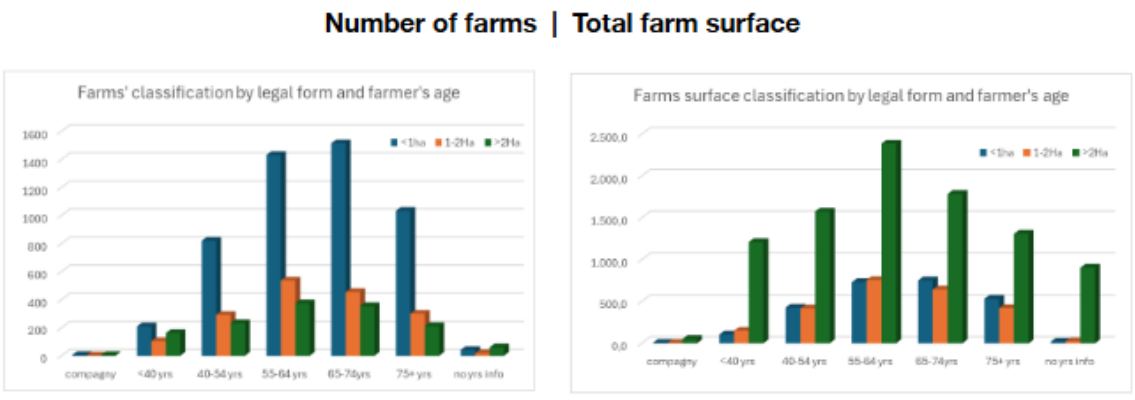


Figure 115 - Distribution of farm holdings (number) and UAA by age group and legal form

Executive Summary - Demographic Assessment of the Troodos Region

The Troodos region shows population stability in absolute numbers but a declining share relative to the total population of Cyprus. The demographic structure is characterized by ageing and shrinkage, reflected in a weak base of children and a concentration in middle and older age groups. Although there is a slight positive signal among youth (20-24), the core reproductive ages (25-44) remain limited.

Spatially, the population is unevenly distributed. The southern Troodos zone (Krasochoria) shows signs of recovery, while Marathassa and Pitsilia of Nicosia continue to lose population. The main demographic and settlement backbone lies along the Solea - Pitsilia of Limassol axis, centered on Kyperounta-Agros-Pelendri and the Solea valley from Evrychou to Kakopetria-Galata.

A substantial seasonal population, driven by both tourism and returning diaspora, places additional pressure on infrastructure (water, wastewater, roads). Many seasonal visitors originate from Troodos households now living in cities or abroad; some may return permanently due to lifestyle changes and cost-of-living differences.

Foreign residents account for 12.7% of the permanent population, with concentrations in the southern Troodos and the peri-urban zone of Limassol. Many are older, contributing little to demographic renewal.

Overall, the region faces a critical demographic risk: low proportions of youth, high levels of ageing, and clear signs of long-term decline in several areas. There are modest indications of some youth and new couples remaining or settling in selected communities, but attracting and retaining younger households remains difficult.

Key Challenges

- Advanced population ageing, leading to unfavorable demographic prospects toward 2030 and undermining social cohesion (reduced critical mass for schools, services, and local production).
- Spatial inequalities and marginalization of remote communities.
- Continued out-migration of young people and limited return migration.
- Difficulty attracting new couples to live permanently in Troodos communities.

7.2.3 Natural context and ecosystemic services

This section presents an overview of the natural context of the Troodos territory, outlining the key environmental characteristics that shape both the landscape and human activity. It provides a synthesis of the region's climate and agroecological zones, topography, soil types and uses, water availability, land-use patterns, and the ongoing loss of agricultural land. The analysis also highlights the extent of protected areas and the existing mapping of ecosystem services.

Climate zones are present on the selected territory

Cyprus has a Mediterranean semi-arid climate, with the Troodos mountain range being a key factor in meteorological conditions. The relief and altitude of the Troodos mountains regulate climatic conditions, particularly rainfall, both locally and nationally. The study area has a typical Mediterranean climate with dry, hot summers and cold, wet winters. The area is divided into two zones according to rainfall: (a) at an altitude of more than 500 meters, rainfall is relatively high, with values exceeding 700 mm per year, while at the summit of Mount Olympus it reaches 1100 mm; (b) at an altitude of 200-500 meters, where the slopes of the Troodos mountain range are located, moderate amounts of rainfall are observed (300-700 mm of rain per year). Snowfall occurs for about 2-3 weeks in areas with altitudes between 700 and 900 meters, while areas with altitudes above 900 meters are covered with snow for a longer period.

The average temperature in the area varies depending on the altitude and micro-topography of the area. The highest temperatures are observed in July and August, while the lowest are in January and February. Average daily temperatures in the summer months range between 29 and 22 degrees Celsius (with highs reaching 36 degrees Celsius), while in the winter months they range from 10 to 3 degrees Celsius, respectively.
Time series for the two climate variables, temperature and precipitation, were analyzed for the Troodos region. The analysis of temperature data shows seasonality in the values, but no significant change in the trend on an annual basis for the period 2000-2021 (Figure 116). A similar analysis was performed for precipitation for the period 1980-2021 (Figure 117). Here too, seasonal variation in values is observed. Finally, the trend analysis shows a slight decrease in rainfall (red line) over a period of approximately forty years.

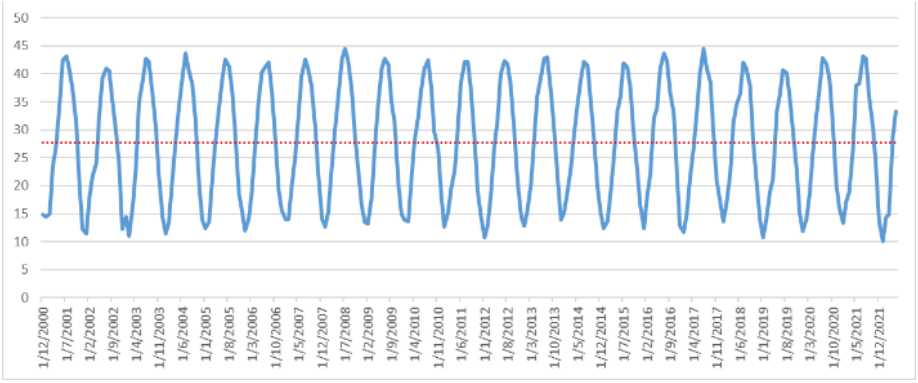


Figure 116 - Temperature variation, 2000-2021 in the Troodos region

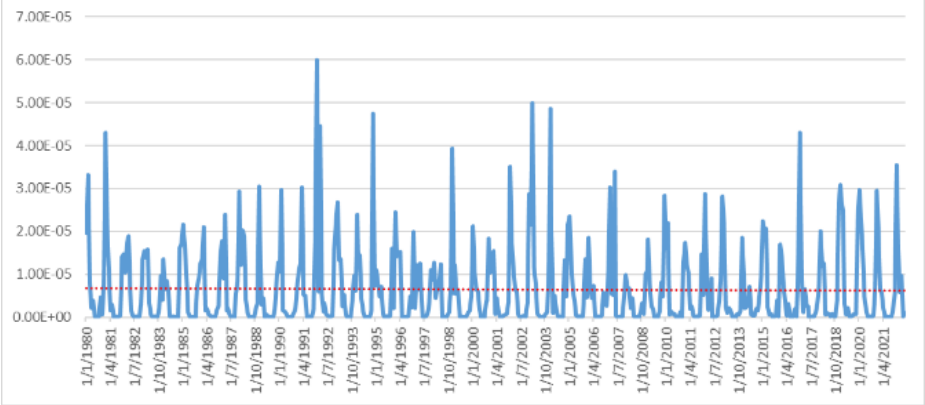


Figure 117 - Rainfall variation 1980-2021 in the Troodos region

Agroecological zones present on the selected territory

In Troodos, based on the FAO classification (Simplified AEZ classification (33 classes), the following agroecological zones are distinguished:

- Sub-tropics, moderately cool; sub-humid
- Sub-tropics, moderately cool; semi-arid
- Dominantly very steep terrain
- Land with severe soil/terrain limitations

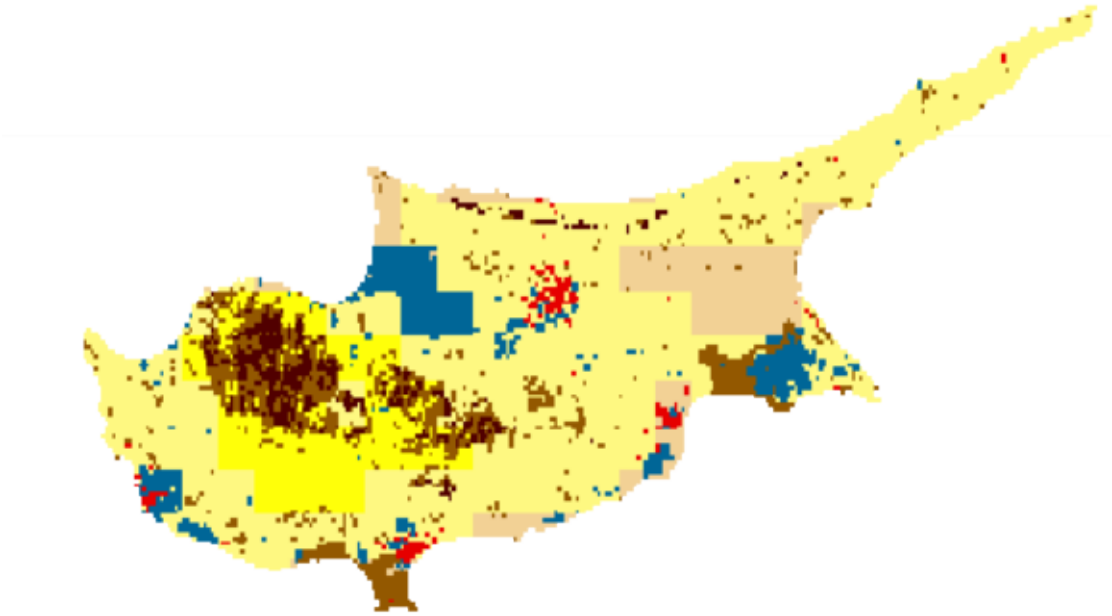


Figure 118 - Agroecological zones in Cyprus, Source: https://gaez.fao.org/pages/data-viewer

Topography, soil types, water availability

Topography

Troodos is distinguished for its diverse relief, while its geology is recognizable and characteristic of the entire Troodos range. The central part of the mountain range is characterized by gentle slopes and rounded peaks, while it is surrounded by a more rugged relief, dominated by steep slopes and valleys with a rich hydrographic network. To the southwest, there are hills with relatively flat surfaces separated by steep valleys. Based on the relief, the following three zones can be distinguished (Figure 118):

- Zone A: the purely mountainous part, with an altitude of 800-1952 m, covering 42% of the study area (662 km^2)
- Zone B: the mountainous-semi-mountainous part with an altitude of 500-800 m, covering 36% of the study area (656km^2)
- Zone C: the semi-mountainous-lowland section with an altitude of 200-500 m, covering 22% of the area (324 km^2).

The entire area belongs to the Troodos Ophiolite Sequence, which was formed by marine volcanic activity between the Eurasian and African tectonic plates. The geological conditions of the area allow for the storage of underground water resources. The topography of the area also allows for the creation of aquifers and springs at various altitudes. In contrast to sedimentary formations (in the Pachna area), relatively little groundwater is developed.

In addition, the ophiolite complex of the mountain is also characterized by the presence of asbestos, chromite, and copper-bearing iron pyrites deposits, as well as concentrations of gold and silver. Within the zone, there are quarrying areas (extraction of diabase, limestone, and stone) with active and inactive/abandoned quarries.

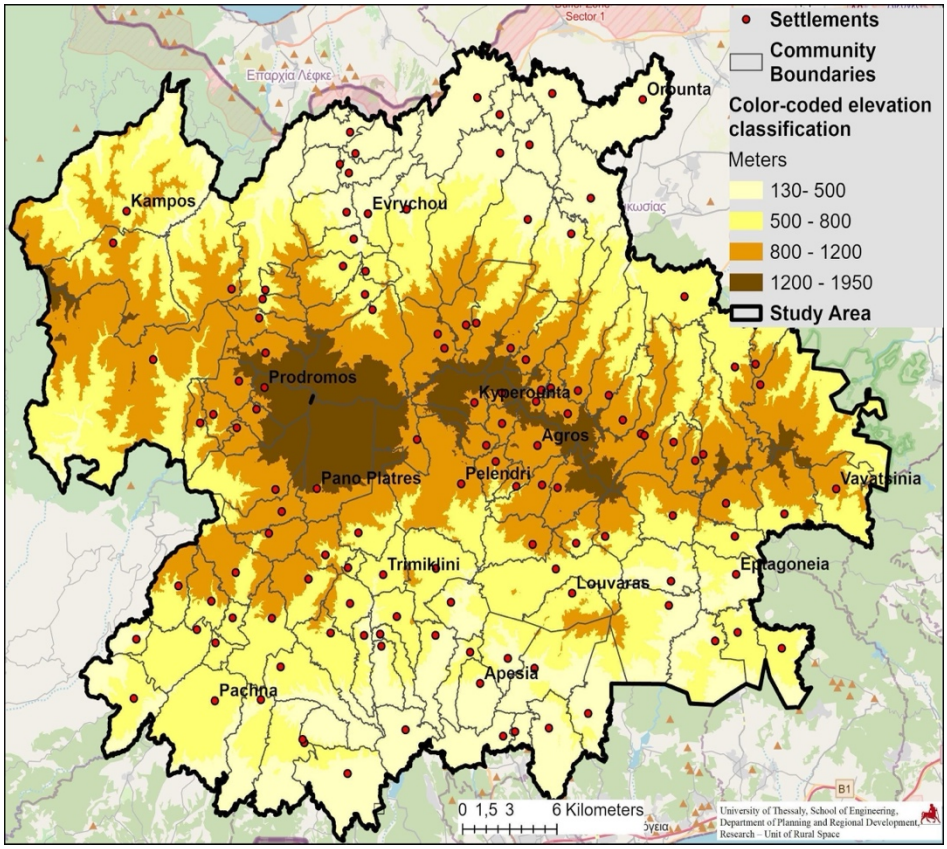


Figure 119 - Topography of Troodos area

Soil types

The soils in the central zone of Troodos are shallow, rocky, eroded, and characterized by large and steep slopes. These soils are dominated by natural vegetation and have a thin horizon with organic matter (<=4%). The soils of the Krasochoria area (southern region) are rich in calcium carbonate and are characterized as shallow to deep gravelly soils. In order to preserve fertile soils over time, interventions were carried out to level agricultural land with steep slopes and terraces were constructed. At the same time, the planting of crops with deep root systems (trees, vines) significantly reduced erosion while also retaining rainwater, effectively enriching the aquifers.

The abandonment of agricultural land, and terraces in particular, has increased the risk of soil erosion and desertification. Their lack of maintenance, beyond the loss of a feature of the landscape, makes these shallow soils vulnerable to further erosion and loss of the natural vegetation and biodiversity that has characterized them until now. This is compounded by climatic conditions and the effects of the climate crisis, which are most noticeable in semi-arid climatic zones, which include the entire study area.

Soil depth: there are three categories of soil in terms of depth:

a. very shallow soils (<10 cm), stony and poorly developed soils[84]. This category predominates
b. young (weakly) developed and shallow to moderately deep (10 cm to 100 cm), calcareous soils. This category is found on the southern side of the Troodos mountain range (Krasochoria area), in the Solea valley and in the Asinou area
c. Well-developed, deep to very deep (>100 cm), fertile soils are found in limited areas in the northern and southern lowland areas of Troodos
Extensive areas of the Troodos are at risk of erosion and, more generally, soil degradation due to shallow depth.

[84] Research to date has not focused on developing a reliable soil map of the Troodos region. The aim is to produce a detailed soil map for the specific area in the near future. (Source: Zomeni M, et al., 2018)

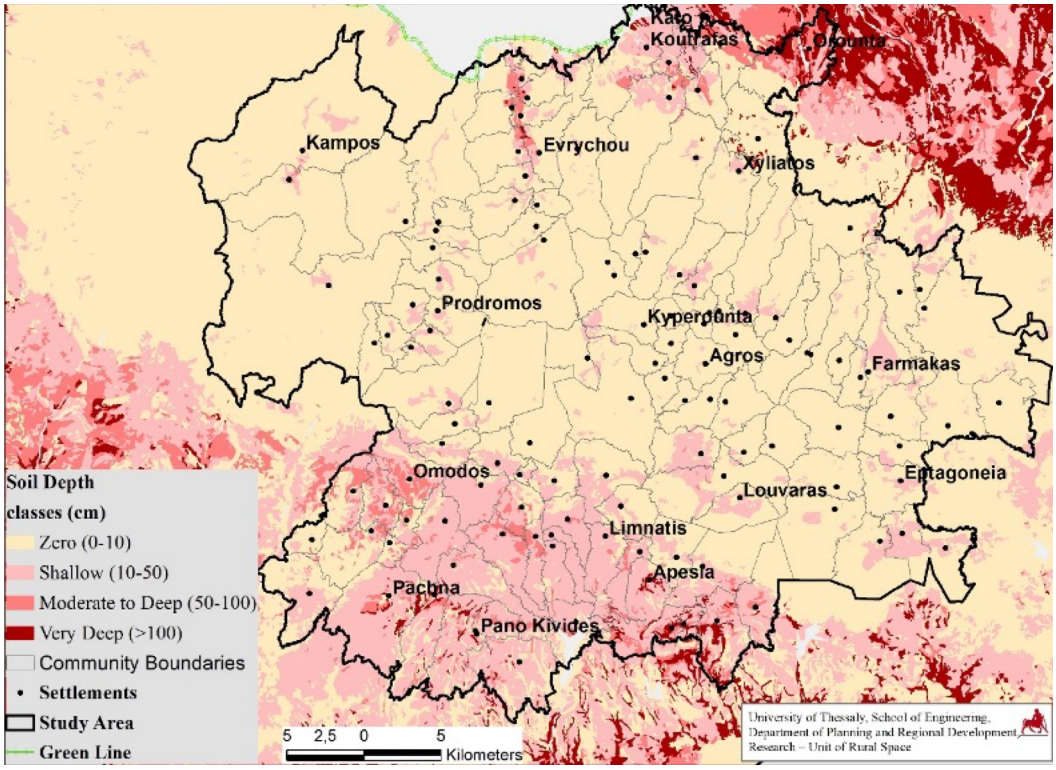


Figure 120 - Soil depth heterogeneity in Troodos

Water availability

Numerous rivers flow from the peaks of the mountain range and run through the valleys of Troodos, contributing to the formation of landscapes, the development of biodiversity, and human activity.

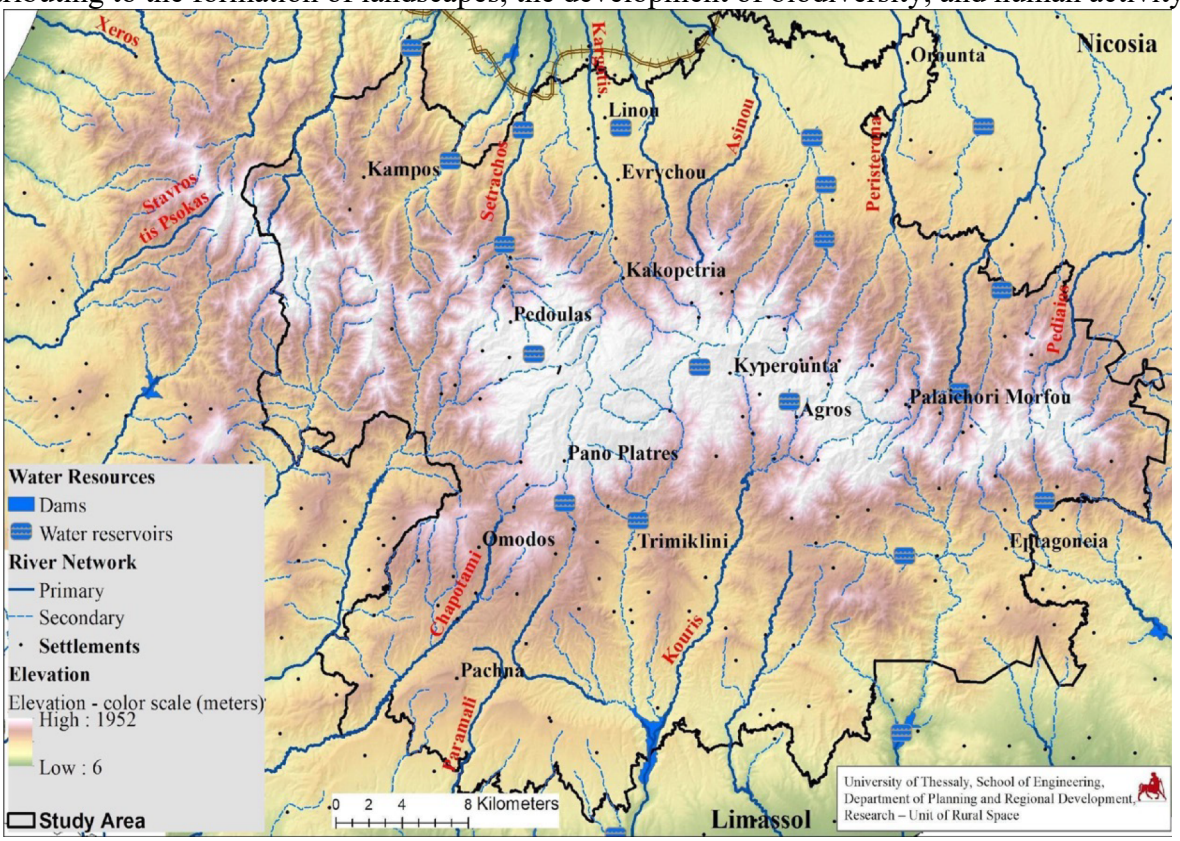


Figure 121 - Rivers, streams, and surface water storage projects

Most watercourses have a rather steep gradient, with most sections located at intermediate altitudes. They are intermittent, flowing for 3 to 4 months of the year and drying up for the rest of the year. Only sections of certain rivers upstream of the Troodos study area have continuous flow (e.g., the Xeros, Diarizos, Karkotis (according to field research, it is the only one with continuous flow

throughout the year), Marathasa, Atsas, Kourris (with several tributaries), Serrachis, Limnati, Ha-Potami, and Germasogeia).
Surface water resources are managed by storing them in reservoirs and dams. There are a large number of reservoirs/dams scattered throughout the area[85] *(23 dams/reservoirs). The reservoirs are used either for water supply or for irrigation of agricultural crops. The amount of water in them depends on rainfall and usage.*

Assessment of the available water situation

The Troodos aquifer[86] comprises three groundwater bodies: (a) the CY_17 water system (Central and Western Mesaoria), (b) CY_18 (Lefkara-Pachna) and (c) CY_19 (Troodos), with CY_19 being the main groundwater body in the area. In Troodos, groundwater is mainly used to meet water supply and irrigation needs. Their quantitative and qualitative status is assessed[87] as follows (see Figure 122):

- Water body CY_19: its status is considered good in terms of both quantity and quality of groundwater. Its quantitative status remains "good" although there are areas with local deterioration for which measures must be taken to remedy the situation.
- Water body CY_17 remains in "good" chemical status with local phenomena of nitrate pollution as a result of intensive local agricultural and livestock activity and salinization as a result of intense local pumping for agricultural purposes. Its quantitative status remains "poor" as a result of long-term over-abstraction for both irrigation and water supply.
- Water Body CY_18: downgraded to "poor" chemical status as a result of intensive pumping, nitrate pollution as a result of extensive agricultural and livestock farming activity and exceeding the upper acceptable value for arsenic for reasons that need to be investigated. Its quantitative status remains "poor" as a result of long-term over-abstraction for irrigation.

[85] "These projects were constructed as part of a) the Pitsilia Integrated Rural Development Plan (Pitsilia irrigation project), b) the Solea Irrigation Project, and c) Arkolachania Water Supply Project" Goussios et al. (2024).

[86] "Report on the assessment, review, revision, and reclassification of groundwater systems" (TAY, 2020)

[87] idem.

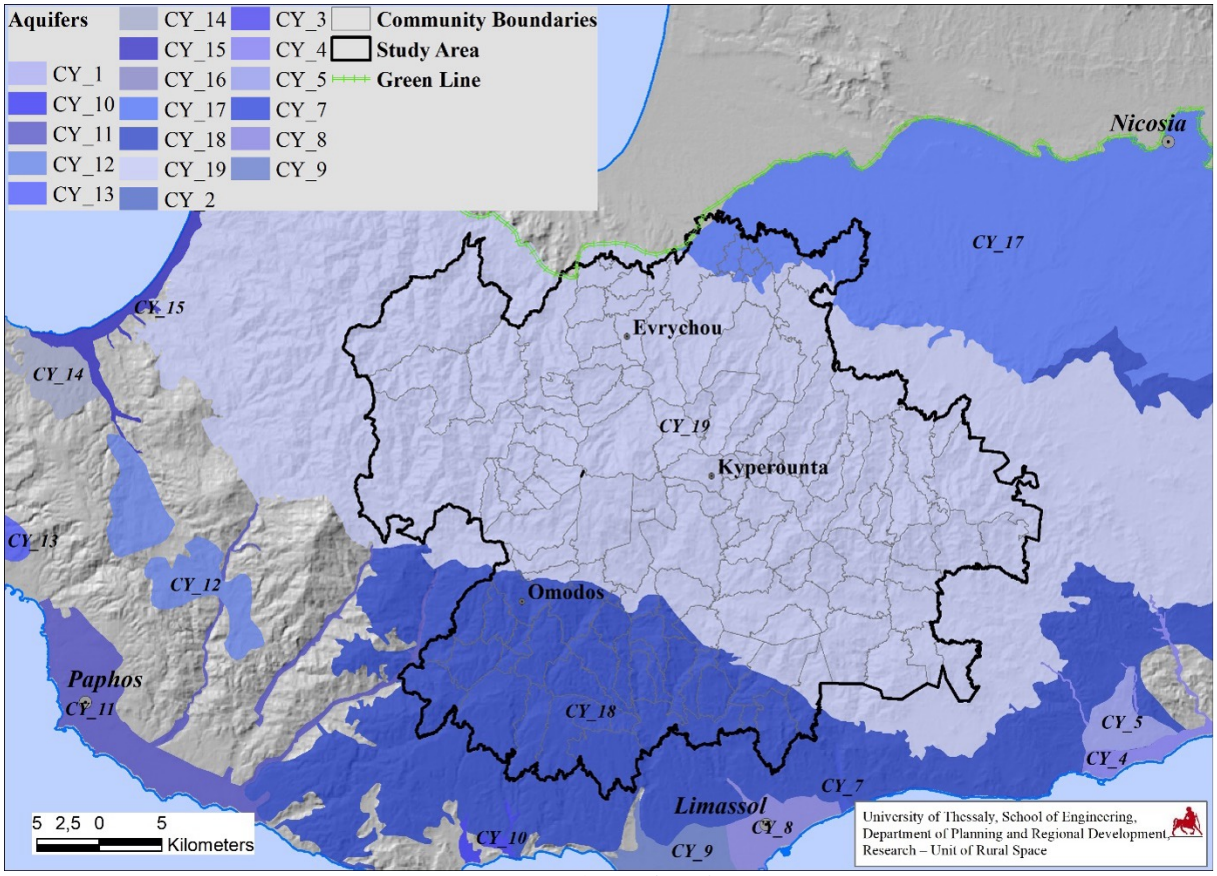


Figure 122 - Groundwaters/Aquifers in Cyprus

However, smaller aquifers located within these bodies face particular problems, mainly due to the lowering of their water levels as a result of overexploitation of groundwater. In this context, interventions are needed at the local level to improve the condition of these aquifers.

In Troodos[88], there are vulnerable areas that are or may be subject to agricultural nitrate pollution: parts of the areas of Solea, Orenina Theretra, Pistilia Limassol, Koumandaria, and Krasochoria-Ampelochoria (see Figure 123).

[88] 2nd River Basin Management Plan for Cyprus, TAY, 2014, Cyprus

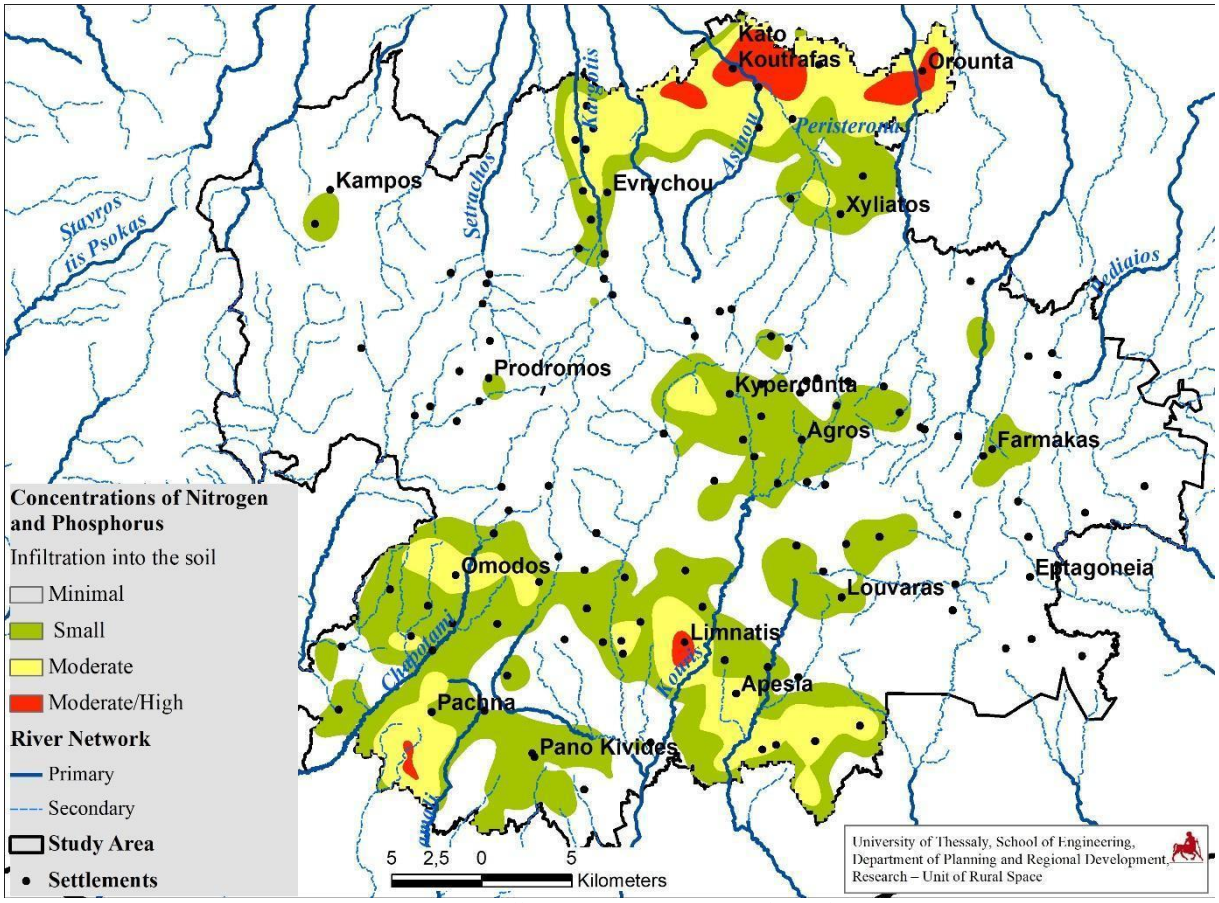


Figure 123 - Nitrogen pollution zones, Source: Geological Survey Department

Management of water use in agriculture

Almost all communities have a collective irrigation network (pressurized pipes and open channels). A total of 499 irrigation groups has been recorded (field survey[89]) (391 public (Irrigation Departments-ID) and 108 private (Irrigation Associations-IA)), which are densely concentrated in central Troodos within the boundaries of the large aquifer. Redesign and implementation of new plans for the rational management of land and available water are required due to the reduction in the number of farms, cultivated areas, and the irrational and inefficient use of water for irrigation (losses, absence of a register of boreholes, water supply and consumption).

Management of water use in water supply

TAY, as the competent authority, regularly conducts quality checks on groundwater and surface water in the water supply network. The networks within the settlements are in good condition, but the headworks (installations from the sources to the settlement)[90]. The observed shortage of water supply during prolonged periods of drought reveals the unsatisfactory enrichment of the water reservoirs and, consequently, a reduction in the yield of water wells (approximately 175 in Troodos). The downward trend in the quantitative status of Troodos groundwater is prompting the search for water not through boreholes, but through the strengthening of water conservation measures at the community level, such as reducing losses from the water supply network by replacing old pipes, etc.

Protected areas

The region is part of and includes

The need to protect Cyprus' rich natural resources, endangered species, biodiversity, landscapes, and natural and cultural resources in general has led to the enactment of several laws and regulations. The protected areas (see Figure 124) in Troodos concern:

A. Forests and wooded areas, which, due to their particular importance, are subject to special systematic management and protection based on the principles of sustainability, multiple use, and holistic management.

[89] National Strategy for the Development of Mountain Communities, 2019

[90] idem

i) state forests, which, according to[91] forestry legislation, are divided into:

- primary state forests: permanent forest areas, national forest parks, and flora and fauna protection areas
- secondary state forests: multiple-use forests, community forests, municipal forests, tree nurseries and grazing areas

ii) private forests where no management, protection, or reforestation measures are implemented, even though the law allows for the creation of private forest cooperatives (unutilized).
For better management, forests are divided into forest regions, and the Troodos forests are divided into four forest regions.
Also, for better protection of certain species based on the European Directive (Directive 92/43/EEC), parts of the forests in the area have been included in the *Natura 2000 Network*, while others have been declared *National Forest Parks* (such as the Troodos National Forest Park) or *Nature Protection Areas* under the Policy Statement (such as the Cedar Valley, the Black Cliffs, and the Black Forests in Madari).

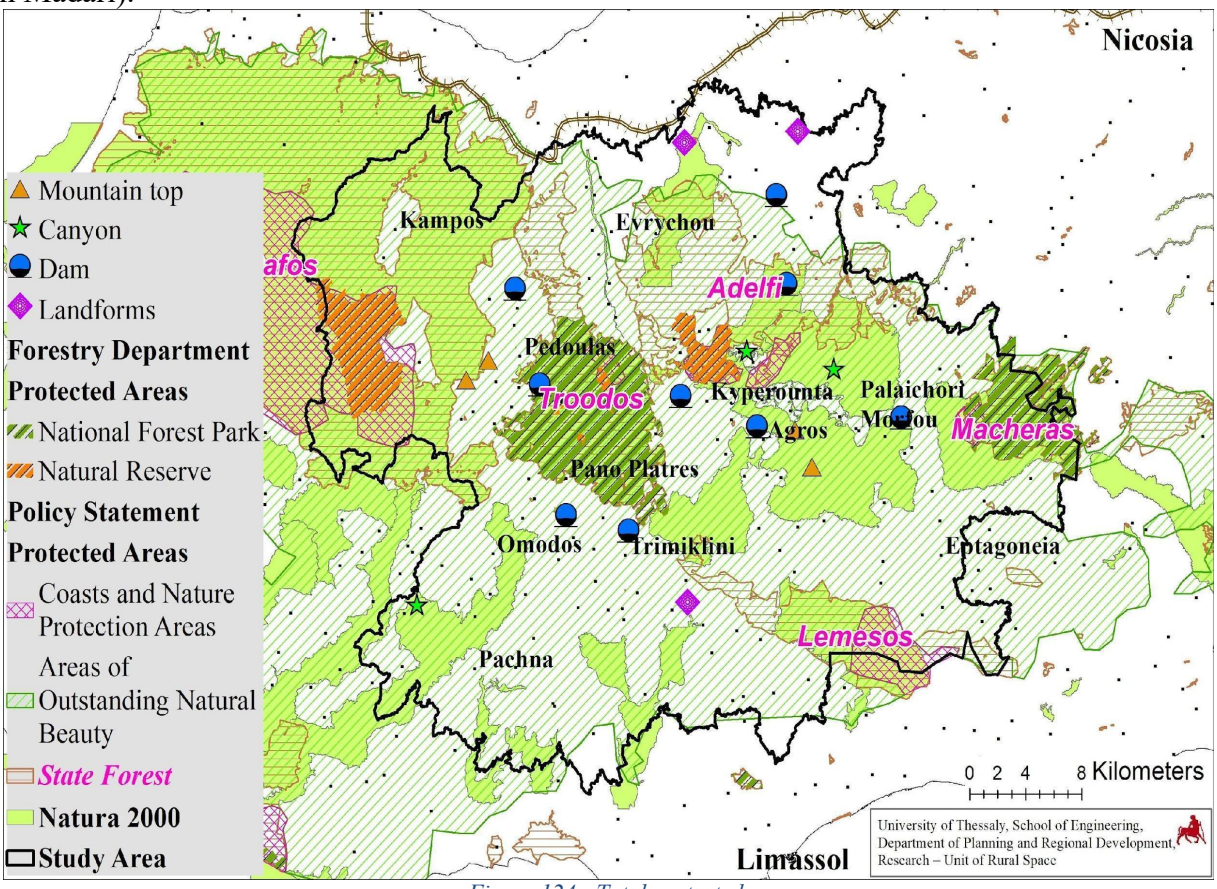


Figure 124 - Total protected areas

B) Protected natural areas
The main legal framework for protected areas is based on: (a) laws that set out how the European Natura 2000 network areas are managed, with the Environment Departments and the Hunting and Wildlife Service in charge, and (b) the national legislative framework, which defines protected areas through the Policy Statement issued by the Department of Town Planning and Housing and the Department of Forests.
i) According to the Policy Statement, Troodos, an area rich in biodiversity, contains many protected areas with different content: *(a) Area of Outstanding Natural Beauty, (b) Protected Landscapes, (c) Nature Protection Areas, (d) Natura 2000 Network Areas.* Nineteen protected areas (Natura 2000 network) have been identified in Troodos.

[91] "*Forests and their protection*", 2008, Ministry of Agriculture, Natural Resources and Environment, Department of Forests

ii) Based on national legislation (Forest Law /2012), this concerns protected areas within state forests: a) Natural Reserve (NR)[92], b) National Forest Park (NFP)[93], c) Natural Small Reserve (NSR)[94].
iii) priority habitats and species. Important habitats are found in Troodos both within and outside the NATURA network (such as 9560*, 62B0*, 9590*, 6220*, 9390*, 5220*, 9530*) and priority plant and animal species[95] (plant species: *Arabis kennedyae*, Pinguicula crystallina*, Chionodoxa lochiae**, and animal species: *Natrix natrix cypriaca*, Euplagia quadripunctaria*, Dolichophis cypriensis*)*
iv) species listed in the Red Data Book of Cyprus
The Red Book (RB) of Flora of Cyprus includes 328 species, of which 238 (14.5% of the native flora) are classified as threatened in the categories of the International Union for Conservation of Nature (IUCN) categories: Critically Endangered, Endangered, and Vulnerable. There are 36 hotspots of endangered plants in Troodos.

Specific mapping and assessment of ecosystem services
Based on literature review, ecosystem services in Cyprus were formally introduced by Vogiatzakis et al. [299], who developed the first national set of MAES indicators, establishing a framework for assessing ecosystem functions and supporting ecosystem management. Their work provided the basis for implementing the EU Biodiversity Strategy in Cyprus, outlining both the initial indicators and the rationale for their selection. In total, 269 potential indicators were assessed in terms of data availability at the national/subnational level and their suitability for MAES and were classified using a "traffic light" system on the basis of overall suitability (i.e. conceptually and in terms of datasets). The results showed that 89indicators (Green indicators) can be directly used for assessing ES in Cyprus. Amongst these 89 Green indicators, 28 are considered to be new additions to the EU MAES list, since they were proposed solely for Cyprus ecosystems, as a result of consultation with local stakeholders. Provisioning and cultural services could be adequately mapped, but lack of data was observed for several regulating services (e.g. erosion, pollution, carbon sequestration). Not all Green indicators, identified herein, are relevant for assessing ES provided by ecosystems in Cyprus, whereas green indicators which measure similar ES might be redundant. For a given geographical context, there might be relevant (and important) indicators which are not included in the MAES list, and this is why consultation with stakeholders is advisable. Knowledge gaps and needs for further improving MAES on the island are also discussed.
In 2024, Zoumides Ch. & Bruggeman Ad. (SELINA:[96] Country Fact Sheet: Cyprus (CY)) conducted a review of projects concerning biodiversity, ecosystem condition, and ecosystem services assessment and accounting since 2022. This document presents a few studies and projects on mapping and assessing ecosystem services that took place or are ongoing after 2020. It presents the following case studies on mapping and assessment of ecosystem services with a focus on areas in Cyprus:

- Troodos National Forest Park [295].
- Larnaca's Salt Lakes [293].
- Rizoelia National Forest Park [296].
- Agricultural Dry-Stone Terraces in Troodos Mountains [298].
- Appraisal tools to mitigate soil threats [297].

It also notes that ecosystem services are explicitly mentioned in the National Biodiversity Strategy, which identifies gaps in practical implementation, such as mapping, assessment, and valuation

[92] Areas in the forest that have not been significantly disturbed by human intervention

[93] Forests that have not suffered significant degradation and a) provide high biodiversity, particularly landscapes and geomorphology, b) are managed for the purpose of protecting and conserving ecological processes and the remarkable natural features they contain, and c) offer recreational and educational activities that are harmoniously integrated with the environment.

[94] Areas with rare species of flora or fauna at national, regional, or global level.

[95] As defined in the Protection and Management of Nature and Wildlife Law of 2003 (153(I)/2003), which harmonizes Directive 92/43/EEC

[96] SELINA- Science for Evidence-based and Sustainable Decisions about Natural Capital, European project

(Vogiatzakis & Manolaki, 2022). However, in terms of practical implementation (mapping/assessment/valuation) there are gaps, i.e., there is no specific obligation. The LIFE IP Physis project (LIFE IP PHYSIS LIFE18 /IPE/CY/000006 (Pandoteira)) aims to harmonize national obligations with European requirements, starting from Natura 2000 sites. However, there remains a lack of explicit legislative mandates for comprehensive ES mapping across Cyprus.
Finally, it presents the results of the broad consultation in Cyprus (2024), which highlighted that, while measures are being taken to highlight the importance of ecosystem services, there are difficulties in integrating them into decision-making processes, underlining the need for better utilization and implementation.

Areas known for the provision of specific type of ecosystem services
According to research by Kounnamas C, Andreou M (2022)[97], "Troodos National Forest Park, located in the center of Troodos mountain range is one of the most important natural environments of Cyprus. It has been included to the Natura 2000 network of the Island due to its important natural ecosystems and its great biodiversity. Based on the Common International Classification of Ecosystem Services (CICES 5.1), 36 ecosystem services have been identified in the area. The majority of ecosystem services are concentrated at the Troodos peak and the nearby areas. The same pattern applies for the Cultural Services. Provisioning and Regulation-Maintenance services are concentrated at the center and western part of the site. The site's habitat types were mapped and their distribution in the area is presented in respective maps. Carbon stored in plants was 622,705 tons in total (73.18 t C per ha), calculated as per habitat type (according to Directive 92/43/EEC - Habitats Directive) and as per TESSA habitat classification. Seven TESSA and 10 Appendix I habitat types were identified. The largest part of the site is dominated by Evergreen Broadleaf Forests (7799 ha), followed by Mixed Forests (624 ha) and Deciduous Broadleaf Forests (60 ha). The carbon stock included in AGB (Above Ground Biomass), BGB (Below Ground Biomass), Dead Wood & Litter and SOM (Soil Organic Matter) were evaluated for each habitat type. The annual carbon biomass removal (roundwood and fuelwood) is 80.82 t C y (0.009 t C y per ha), while the carbon sequestered in Troodos National Forest Park is 11,880.33 t CO eq y(0.38 t C y per ha). The information produced serves as a useful tool to competent authorities for raising awareness on the importance of ecosystem services and increase the public's support in the area's conservation".

Presence of predators / big carnivores
There are no predators or big carnivores in Cyprus. The only carnivorous mammal is the fox (Vulpes vulpes undatus), which is endemic to the island but, despite its important role in the ecosystem (Department of Forests), has been declining in numbers in recent years. In addition, there are various mainly migratory birds such as vultures, sparrowhawks, buzzards, kestrels, etc., as well as reptiles (snakes, chameleons, etc.).

7.3 Agricultural systems in the studied territory

7.3.1 Overview of agriculture in the country

Below are some key statistics on agriculture in Cyprus (free area): in 2021, according to the *CYSTAT*, Cypriot agricultural holdings:

- Cover 106,479 ha and represent 18% of the country's total area
- Are partly involved in organic farming: 5.87% of the area and 3.6% (1,233 ha) of agricultural holdings
- Agricultural activity (farming, forestry, and fishing) contributes 1.3% to the Gross Domestic Product

[97] "Mapping and assessment of ecosystem services at Troodos National Forest Park in Cyprus", One Ecosystem 7: e77584. https://doi.org/10.3897/oneeco.7.e77584

Table 15 - Overview of the agriculture in Cyprus. Source: CYSTAT 2011, 2021

	Total	%
Number of farms	34,046 (2021) 38,859 (2011)	-12.4
Agricultural Land Used		
Cultivated Land	106,479 ha (2021) 118,398.1 ha (2011)	-10.1
Animals (number)		
Goats and sheep	607,675 (2021) 509,126 (2011)	19.4
Bovine	84,611 (2021) 53,413 (2011)	58.4
Economically active population in the primary sector	7,345 (2021) 9,244 (2011)	-20.5

The above data for the scale of Cyprus show that the total number and cultivated area of agricultural holdings is decreasing significantly (12.4% and 10% reduction respectively from 2011 to 2024), while both sheep and goat farming and, in particular, cattle farming are increasing.

7.3.2 Overview of agriculture in the Troodos area

In Troodos, agriculture is the traditional activity of the inhabitants, practiced by 8,167 agricultural holdings (covering 14,196.68 ha) and 258 livestock holdings (with 35,051 sheep and goats and 1,131 bovine). Its productive specializations include arboriculture, viticulture, annual crops which mainly support livestock production, fallow land and grazing areas, pastoral sheep and goat farming, and beekeeping. The majority of farms are small family-run multi-active agricultural holdings with mixed crops, scattered throughout Troodos.

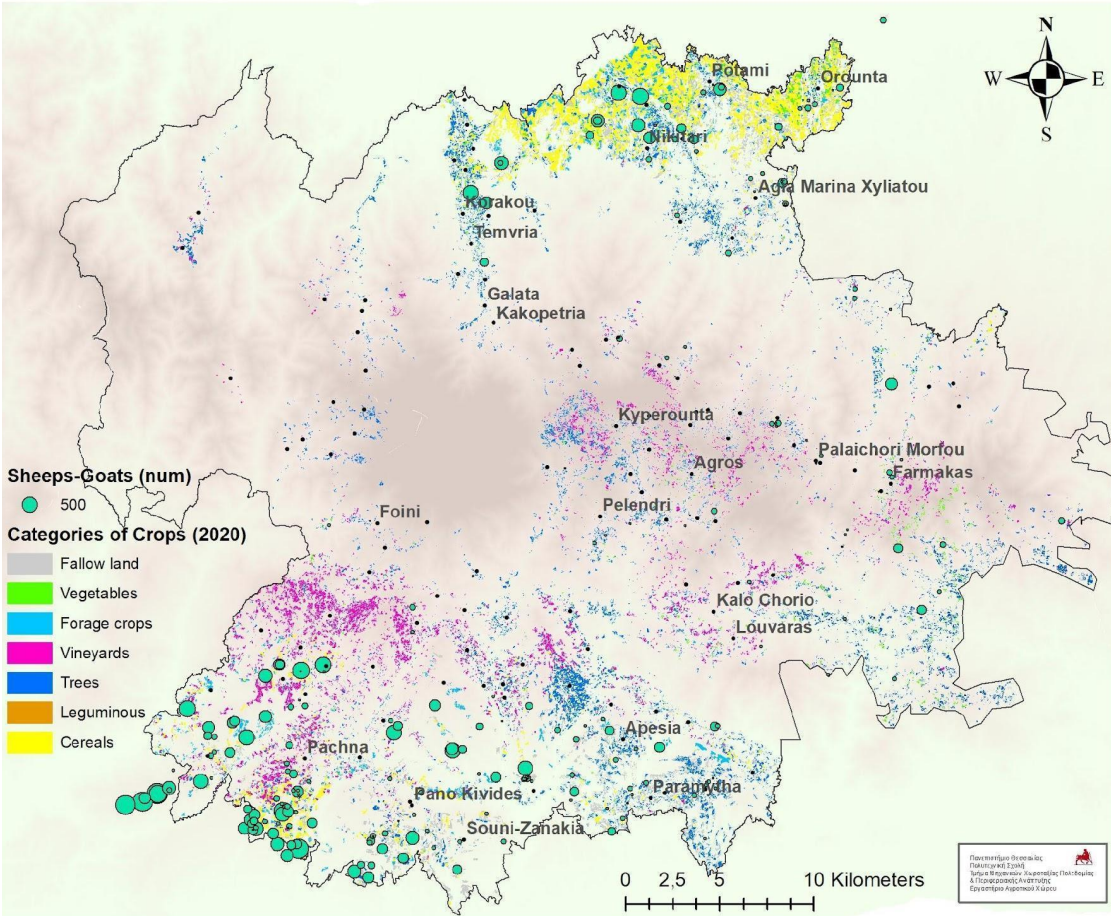


Figure 125 - Crops and animals in Troodos, Source: CAPO 2020, Veterinary Service of Cyprus 2020

Diversity of farm types

Three key factors characterize subsistence farming:

1. Almost half of the farms belong to farmers who live permanently outside the area. This situation

reflects the evolution of the phenomenon of rural exodus, which affected the region mainly after the 1980s. Farms whose owners live outside Troodos («farm outside») are an important asset for agriculture in Troodos. They own land, know farming techniques, and have ties to their land. The common thread linking them to farmers who live permanently in Troodos is their shared origins and the social and economic ties they maintain with Troodos.
2. The second characteristic is the high degree of aging of this agricultural population. Of all farm managers, 50.8% are over 65 years of age, while those over 75 years of age account for 19.1%. In contrast, the percentage of young farm managers under the age of 30 is only 1.8%. This age structure highlights the critical nature of the situation regarding the future and the continuation of agricultural activity in the Troodos region. There are 120 farms (1.5%) operating in the area under a legal form (private individuals, church).
3. The third characteristic based on the size of the farms and their production orientation is that the vast majority of these farms are not viable businesses on their own. Even if the practice of registering the family farm under two members of the same family and thus dividing it into two units is followed, the sizes are such that this situation is not radically changed.
However, local research has shown that the number of "real" farmers is smaller among those "farms outside." In the case of farms whose managers reside permanently in Troodos, it appears that the practice of registering the farm in the name of only one person is followed for reasons of better management of the workforce and insurance (of the workers and the farm manager). In contrast, in the case of farms whose managers reside permanently in neighboring towns, the practice differs. The "real" farm is managed by one person and consists of smaller farms belonging to more than one person from the same family, which are registered independently with the CAPO.

The various forms of exploitation that have developed and continue to develop (integration into the EU) reveal an adaptation to the spatial and socio-economic conditions of Troodos, reflecting its entire past and recent history. A comprehensive approach takes into account, on the one hand, the ownership status, employment needs, and income supplementation, and on the other hand, the regulations of the CAPO (Cyprus Agricultural Payments Organization) and the EU (crop declarations and subsidies).
In the area of family farms and employment, there's a hybrid situation that comes from a mix of a) the geophysical disadvantages that mountainous terrain brings to farming, b) population outflow (migration to cities) and the maintenance of ties with the community of origin and privately owned agricultural land therein.
Multiple factors contribute to the final configuration of the various forms of exploitation found in Troodos:

- between landowners and land use, there is the issue of leasing, the tax system, and EU subsidies, which shape the picture presented by the CAPO,
- the confusion between the owner-cultivator and the owner of agricultural land, who is limited to receiving land rent, including subsidies,
- farms as production units under unified management are ultimately formed informally, incorporating into this structure plots of land that are formally declared as independent farms.

The diversity of farms is determined by:

- the existence of two large groups of people employed in agriculture (permanent and farm-outside),
- the relatively flexible status of multi-activity,
- the participation of retirees,
- the possibility of informal hiring, taxation, and community subsidies.

This framework provides the following categories of farms, which we cannot quantify or locate due to a lack of official information on employment:

- Real farms with professional farmers
- Supplementary income farms (multi-activity farmers) with:
  - dominant position of agricultural activity,
  - dominant position of non-agricultural activities,
- Farms for self-consumption and continuation of tradition (vineyards, orchards, etc.).

The “farms outside” (leading by domestic migrants) play an important role in the last two basic

categories, contributing to agriculture and the management and maintenance (no-abandonment) of agricultural land. They also strengthen their ties with their homeland by actively participating in the social life of the mountains.
The question arises as to what their future relationship with agriculture and agricultural land in Troodos will be. Addressing this issue requires the design of a policy, accompanied by the necessary services, to help retain “farms outside” in agricultural activity.
However, this reality raises the question of the future strategic choices of these urban farmers regarding the land they manage and the agricultural activities they engage in. Another aspect of this issue concerns their definition as "real farmers" (new CAP), which is reintroduced by the new CAP (2021-2027), and their participation in subsidies and environmental management.
The aim of this analysis is to identify the key target groups for inclusion in an integrated support policy which will strike a balance between supporting the establishment of farmers through criteria adapted to mountain conditions and the body of multi-active farmers, who should be included in local agri-environmental programs.

Spatial system of agriculture and livestock farming in Troodos

The total area of "agricultural land" use comprises two basic categories: a) all land designated as agricultural land belonging to private individuals, residents, public and social bodies and historically recognized as such, and b) agricultural land currently used by agricultural holdings based on specific production and cultivation systems. The approach to this category of land use therefore focuses on the evolution:
a) the difference between total and utilized agricultural land,
b) the distribution and concentration of utilized agricultural land,
c) abandoned agricultural land as an object of recovery and/or management.
The search for a rationale for the distribution of utilized agricultural land currently in relation to other land uses, and its evolution over the last 35 years (1985-2020), which has led to a reduction in agricultural land, is of more historical significance. Instead, what matters today is the effort to protect this land as an important asset of Troodos and Cyprus. The decline in agricultural land from approximately 32,966 ha before 1985 to 14,196.7 ha in 2020 (-56.9%) reveals a significant issue of abandonment and future management.
The current situation is the result of three key factors: British policy, the rural exodus after around 1980, the decline of traditional agriculture due to the higher yields of intensive farming, and the difficult conditions imposed by the mountainous terrain (altitude, climate, slopes) on agricultural activity. Today, as shown in Figure 126; the organization of the spatial model of agriculture on the scale of Troodos is limited to: a) the lower altitude areas (mountainous Morphou and South Krasochoria and Koumantaria), which happen to be the closest to urban centers, b) to the areas where the state has implemented its two basic infrastructures, irrigation and land redistribution, c) to the areas along rivers and dams, and d) to the lower lands of certain valleys.
The issue at stake is that a review of the entire spatial model is required to redefine the relationships and interdependencies between different land uses and protection zones, rather than to modify the zones themselves. The aim is to establish the relationships at the points of contact between different uses more precisely for environmental, productive and socio-economic reasons.

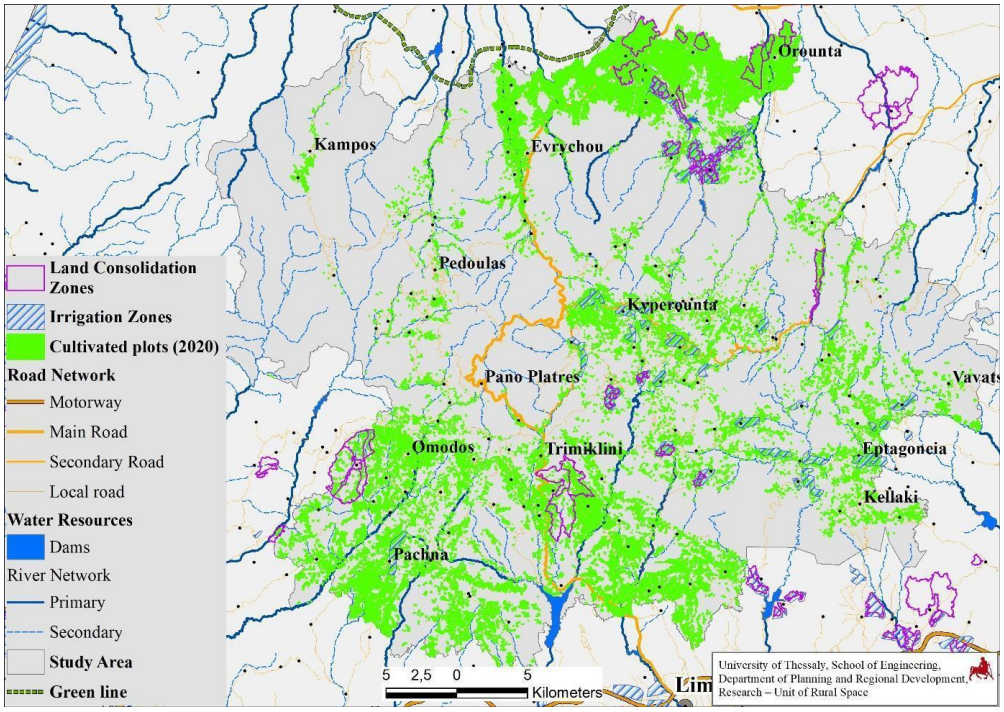


Figure 126 - Crops and agricultural infrastructures, Source: CAPO, 2020

The search for a solution to the issue of protecting agricultural land requires it to be integrated more effectively into horizontal environmental policies. More specifically, the issue of abandoned agricultural land could be addressed by attracting and settling new farmers, and by integrating it into environmental management activities. Ultimately, a recovery policy must be selective, focusing on individual cases within a framework that identifies available plots of land and proposes settlement zones for each community.

7.3.3 Analysis of the use of agricultural land

The total UAA amounts to 14,196.68 ha in 2020 (according to CAPO), representing 12.34% of the total surface of the Troodos region, compared to more than double this extent in 1985. The cultivated agricultural land is distributed across tree crops (3,502.5 ha), vineyards (2,392.9 ha), annual crops (4,478.8 ha, of which 3,790.24 ha consist of cereals and fodder crops), fallow land (2,908.01 ha), and grazing land (318.08 ha). With regard to livestock farming (Cyprus Veterinary Services, 2020), sheep and goat farming (35,051 head) predominates across 242 sheep and goat farming units. In addition, there are 16 cattle farms, 5 pig farms, and 8 poultry farms in operation.

7.3.4 Evolution of agricultural land in Troodos

Historically, the use of agricultural land has been mainly determined by the nutritional needs of the population. Despite the geographical constraints shaping the terrain and slopes, and the access difficulties presented by mountainous terrain, agricultural land use was historically extensive, as evidenced by the density of terraces and land registry data. This use includes areas that were cleared by inhabitants in previous centuries, largely respecting the natural laws governing land use, in order to feed the overpopulation of the mountains caused by specific climatic conditions (low average temperature) and limited natural resources (vegetation, water, etc.).

7.3.5 Available and Utilized Agricultural Land today

In Troodos, "available agricultural land" (AvAL) is historically determined and limited by forest cover, relief and altitude (valleys, steep slopes), barren land and the hydrographic network. "Utilized agricultural area" (UAA) is linked to population density, but also to the number and average size of farms within each community and historical region. These geomorphological, geophysical, and social combinations currently differentiate the distribution of these two categories of agricultural land,

production systems, and landscapes within Troodos. The total UAA amounts to 14,196.68 ha in 2020 (according to CAPO), covering only 12.34% of the total area of Troodos, compared to more than double that area in 1985. The difference reveals the large-scale abandonment and "loss" of agricultural land in just 35 years.
The cultivated agricultural land (Figure 127) is used for tree cultivation (3,502.5 ha), vineyards (2,392.9 ha), annual crops (4,478.8 ha, of which 3,790.24ha concern cereals and fodder crops), fallow land (2,908.01 ha), and grazing (318.08 ha).

7.3.6 Continuous abandonment of agricultural land

The decline in human activity as a result of rural exodus and the isolation of several sub-regions due to the division of the island have disrupted local farming systems, which were based on a Mediterranean agro-sylvo-pastoral system linked to small-scale family processing. The decline in this activity is now evident in the landscape, with agricultural land being abandoned and reforested, reclaimed, or eroded. The exodus of the population after 1980 was followed by the gradual abandonment of agricultural land. The decline in agricultural land in the Troodos region over time is evident but difficult to measure due to inconsistencies in statistical sources.[98]

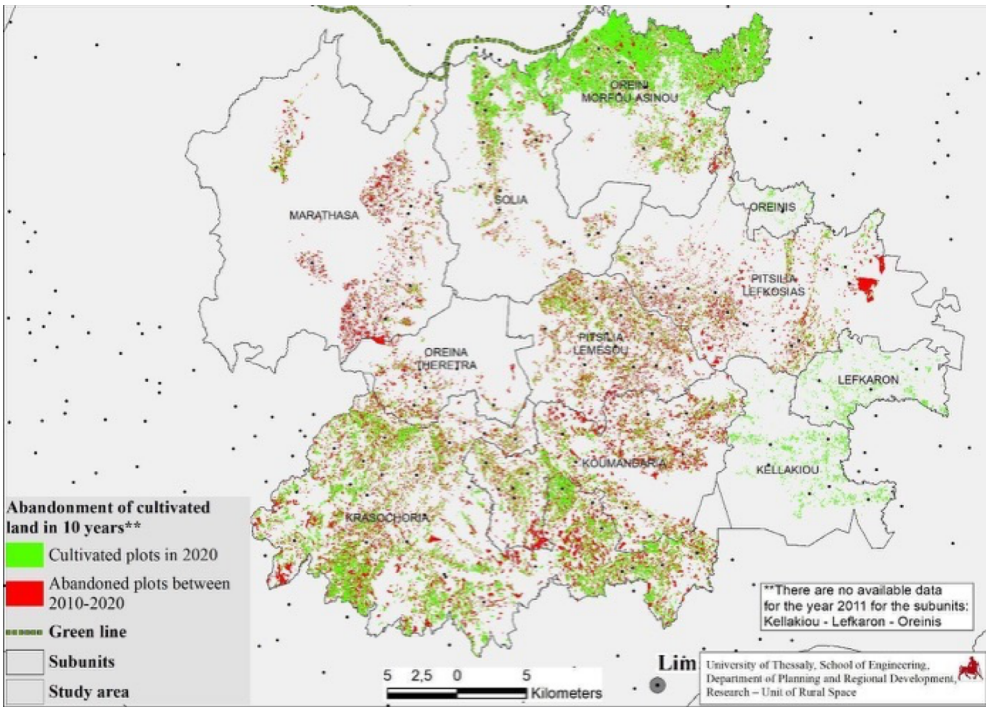


Figure 127 - Cultivated and abandoned plots, Source: CAPO 2010, 2020

Areas of abandoned agricultural land are identified by classifying abandoned plots into zones according to proximity and density criteria. The spatial extent of the mass abandonment of agricultural land is reflected by its presence in all of the aforementioned farming zones within the communities, including high-productivity zones (e.g. land redistribution and irrigation). Proximity to the inter-community road network seems to be the main factor limiting abandonment.

[98] After 2004 (Cyprus' accession to the EU), CDPO improved the situation by providing detailed inventories and digital data on agricultural parcels. Its inventories record, at the community level, the agricultural parcels cultivated by all farms with an area of more than 3 decares, regardless of the farmer's place of residence.

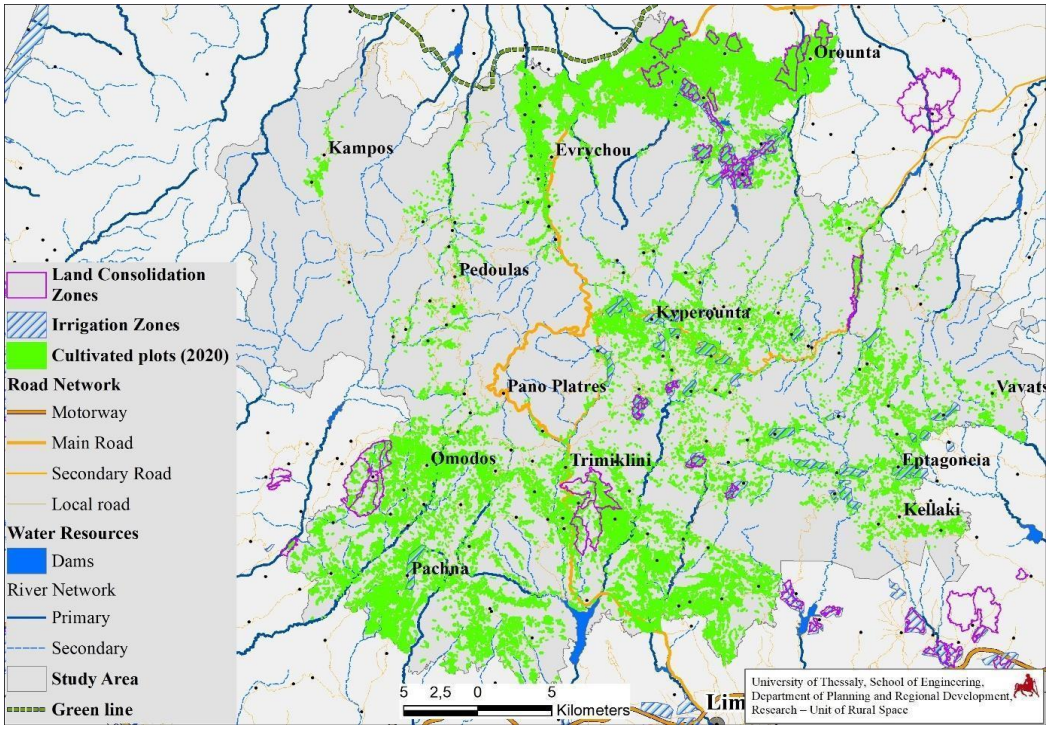


Figure 128 - Spatial dimension of abandoned land, Source: CAPO 2020

The challenge of preserving agricultural land and activity in Troodos is determined by the pressures of urban planning and environmental protection, but also by the trend of abandonment and desertification[99]. This trend is reinforced by the difficult conditions for managing mountain farming systems and the inability to increase the added value of local products. This raises the question of how to reclaim abandoned land by new or existing farmers and integrate it into environmental management plans.

7.3.7 Spatial distribution of cultures

Despite the significant reduction in cultivated land in the Troodos region, the distribution of existing staple crops within the remaining UAA reveals the existence of distinct zones and areas with specific production specializations.

According to the inventory of cultivated areas (CAPO), Troodos is dominated by permanent crops (arboriculture and viticulture), followed by various annual crops, fallow land, permanent pastures, and other areas. Based on CAPO data (2020) with geographic coordinates[100] (Figure 129), permanent crops are located in the central zone of Troodos (Krasochoria, Koumandaria, and Pitsilia) and annual crops in the north, north-east and south of Troodos.

[99] Fallow land and land abandonment/desertification are two very different systems. Fallow land is land that is set aside to allow the soil to recover and restore its fertility. Land abandonment/desertification is the abandonment of land without any agricultural purpose.

[100] CDPO data has a spatial reference. Based on the geographical coordinates available, the exact location of the data and information under investigation is identified

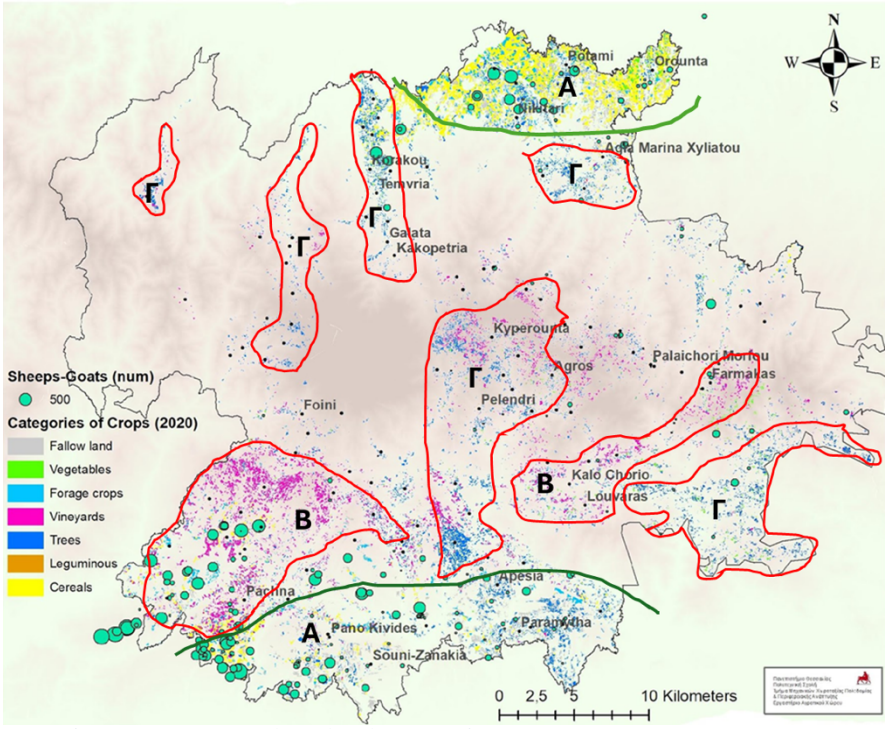


Figure 129 - Distribution of main crops in Troodos: abandonment of mountainous areas Source: CAPO 2020

Based on the above and their representation in Figure 129, the cultivated spatial pattern that emerges consists of the following zones:
1) Zone A in the low-lying areas of Oreni Morphou, northern Solea, and southern Koumantarochoria (Fasoula) and Krasochoria (Kyvides). This zone, considered peri-urban in the broad (Morphou Mountains) or narrow (southern Koumantarochoria) sense of the term, contains significant areas of fallow land.
2) Zone B, which includes the northern parts of Krasochoria and Koumantarochoria and the zone of Kalo Chorio-Louvaras-Farmakas, where vineyards predominate.
These two zones also account for the majority of sheep and goat farming, which has been in continuous decline both in terms of area and numbers.
3) Zone C (central Troodos), which is dominated by tree crops, with the Kyperounta-Limnati zone as its central axis, the second important zone is the central and southern valley of Solea, and finally the valley of Marathasa and the zone of Kampos-Tsakistra.
The current combination of cultivated land, crops, and livestock has resulted in the formation of pockets of agricultural production with distinct crops and specializations. Next, the structure and value of crops on the scale of Troodos, historical regions, and communities are examined within these productive hubs.

7.3.8 Overall presentation of the farming sectors

For centuries, land management and use in Troodos was based on the Mediterranean agroforestry system. Today, however, this system no longer functions in a unified and coherent manner; instead, it operates in an isolated and divisive way. In particular, livestock farming has long been considered responsible for the degradation of the natural environment. Rather than supporting its traditional role as an intermediary in ecosystem management by adapting the grazing systems developed by this sector, the decision was made to restrict it.
In the following subchapters, we present the production specializations based on CAPO data (2020), namely permanent crops, annual crops, and basic livestock breeding.

7.3.9 Permanent crops (a)

(a1) arboriculture

- *Olives* (1,347.13 ha) are found in the Solea Valley and around Troodos area. Olive cultivation, a traditional crop in the region, is mainly dry farming. Only oil-producing varieties have certain water requirements (2600 m^2/ha).
- *Deciduous fruit trees* (pear, pear-apple, plum, cherry, quince, lotus, apple, nectarine, almond, peach, pomegranate, apricots trees) are cultivated on 1,083.04 ha and are located throughout Troodos with varying concentrations. Deciduous fruit trees are irrigated crops, relatively water-intensive (5170 m^2/ha). The plots with deciduous fruit trees are located near irrigation sources, despite their dispersion. The high yield of these crops keeps their cultivated area at high levels.
- Traditional trees (almond and hazelnut) are cultivated on 798.00 ha and are found in high concentrations in Limnati and generally in the eastern communities of Krasochoria, as well as in the a
- rea of Asinou and Oreni Morphou. Hazelnut cultivation is a dry crop, while the water requirements for almond cultivation amount to 3550 m^2/ha. The high yield of hazelnuts (€14,830/ha) contributed to the re-evaluation of the systematic exploitation of hazelnut forests in northern Pitsilia by the local organization (Leptokardia Hazelnut Management) according to field research (2018).
- The orchards (variety of trees per plot) are cultivated on 275.07 ha and are scattered throughout the surrounding communities in Troodos area. This is a fairly significant area, which allows several households to remain in the production process, according to local research (2018)
- Carob trees are cultivated on 286.26 ha and are located in the southern part of Troodos area (Limnati, Korfi, Apeisia, Paramytha, Spitali, Fasoula Apsiou, Pachna, Agios Amvrosios, Kivides). The carob tree, a traditional crop on the island and especially in the above area, is a dry crop that had been neglected due to low income. Recent research findings on both land management in combination with extensive livestock farming and the commercial exploitation of the product are creating conditions for its development.
- *Citrus fruits* are grown on 240.09 ha and are located in the southern part of Troodos as a particularly water-intensive (7430 m^2/ha) crop (Limnati, Kapileio, Gerasa, and more intensively in Koutrafas, Koilada Solea, and Xyliatos). As a crop of high economic value, it is preferred by producers, especially professional farmers[101],
- The remaining trees (permanent tree crops (avocado, etc.), walnut trees, prickly pears, fig trees, pistachio trees, palm trees) are cultivated on a total of 69.3 ha and are scattered throughout Troodos without any concentrations. Of these, permanent tree crops and walnut trees are considered to be among the most water-intensive crops, but their minimal area does not raise concerns in terms of water management.

(a2) viticulture

Viticulture[102] has traditionally been one of the main crops in Troodos. The policy of uprooting vines in both the 1980s and early 2000s caused a significant decline in cultivation, contributing to the degradation of the landscape and erosion problems (falling dry stone walls).

[101] Professional farmer is defined as a producer who derives his income from agricultural activity.

[102] Cyprus is one of the oldest wine-producing countries in the world and has an exceptional variety of wines that have stood the test of time.

Vine cultivation (2,392.9 ha) specializes in wine grapes (2,262.98 ha), while the areas dedicated to table grapes (49.64 ha) and traditional vines (80.28 ha) have been minimized. The latter are located in Omodos and Pachna, while wine and table grapes are found throughout the areas of Krasochoria, Koumandaria, and Pitsilia. According to the methods used, the cultivation of wine grapes is dry and, together with the traditional cultivation of vines on terraces, contributes to the protection of the environment (at least in terms of water use) and the preservation of the landscape. In contrast, table grapes are irrigated (2230 m^2/ha).

The implementation of replanting measures through the European Programs, Coordination, and Development (EPCD) contributes to the restoration of the landscape through the recultivation of terraces, either by utilizing old varieties or by adopting new, improved varieties.
The lack of water, labor, and succession for future generations of winegrowers and winemakers, as well as the reduced value of wine grapes (€120), contribute to the continued decline of viticulture, according to field research (2018).

7.3.10 Annual crops (b)

In this particular crop category, cereals for grain production and fodder crops occupy an important place, as do the cultivation of fresh vegetables and potatoes. Significant areas are included in the set-aside scheme.

Annual crops are mainly found in Orini Morphou, Solea, and, to a lesser extent, in South Krasochoria. The remaining areas have very little land under annual crops due to their specialization in permanent crops.

(b1) aromatic plants: permanent shrub crops, basil, Damask rose
According to the CAPO (2020) cartographic background, aromatic plants[103] are cultivated on small plots of land in certain communities. Based on this data, in 39 communities scattered throughout Troodos, 106 producers cultivate 38.2 ha. 10.4 ha are cultivated in Agros, 4.3 ha in Potami, 2.4 ha in Omodos, 2.0 ha in Paramytha, 1.6 ha in Lazania and 1.6 ha Pano Kivides, 1.3 ha in Trimiklini, 1.2 ha in Vasa Koilaniou and 1.2 ha Gerasa, and 1.0 ha in Agios Ioannis and 1.0 ha in Mandria. The remaining communities cultivate between 0.01 and 0.7 ha. The areas with Damascene rose bushes are located almost entirely in Agros and only in a few small plots in Omodos. The fact that a) these crops do not require irrigation, b) there is good market response, and c) their products have multiple uses, favors the further development of aromatic plant cultivation.

(b2) *Vegetables, melons*
According to available data sources (SSC and CAPO), the areas in this category vary (from 0.1 to 23.7 ha) for the various types of vegetables -melons, with the total cultivated area amounting to 411.63 ha (CAPO, 2020) despite their high yield as crops. Vegetables (267.68 ha) and potato cultivation (127.87 ha) occupy an important position. Vegetables are dominated by various vegetables (162.07 ha) and tomato cultivation (79.89 ha).
Potato cultivation is concentrated in the areas of Orunda and the Solea Valley. The communities of Farmaka and Kampi specialize in tomatoes, cucumbers, and cruciferous vegetables. Meanwhile, the communities of Odo, Arakapas, Agioi Vavatsinia Dieron, and Melini specialize in growing vegetables. The category "various vegetables" is distributed throughout Troodos, with small concentrations in the Solea Valley, the Pitsilia area, Asinou-Oreni Morphou, and partly in Koumandaria. Field research (2018) identified farmers' willingness to expand vegetable cultivation.

(b3) Flowers and ornamental plants

[103] Aromatic plants are defined as crops that are included in the CDPO with category code (a) 239 - Category name: *Permanent Shrub Cultures*, which includes the following crops: Aronia, Raspberry, Blackberry, Goji Berry, Sea Buckthorn, Blueberry, Asparagus (day), Lavender, Lemon Balm, Oregano, Sideritis, Hyssop, Mint, Thyme, Mint, Marjoram, Dittany, Rosemary (Lasmaria), Tarragon, Laurel, Wormwood, Sage (Spatzia), Achillea, Zambucus, Alouisa, Throumba, Kiouli, Aloe, Capers, Asparagus (wild) - agreli, Strelitzia, Roses, Cranberry, and (b) 176 - Category name: Basil

These crops are cultivated on very small areas, both in greenhouses and in open fields, and are presented as a separate crop category due to their high productivity. They are high-cost crops that have been established by producers through investment plans.

(b4) Cereals and Fodder Crops

According to CAPO data (2020), the category of crops *Cereals-Fodder Plants* covers a significant cultivated area of 3,790.24 ha. This development is linked to the demand for animal feed for livestock farming within and outside Troodos, and in particular (a) the cultivation of animal feed for grain production (barley, wheat, etc.), (b) the cultivation of grass for grazing (mixed crops), and (c) the cultivation of fodder for green manure to improve soil fertility.

Specifically, according to CAPO 2020 data, the largest area is devoted to barley cultivation (1,906.05 ha), contributing high-quality product to animal feed, especially in sheep and goat farming in Cyprus. This is followed by the cultivation of durum wheat, soft wheat, and other cereals.

These crops are concentrated in Pachna, Dora in the southern part of Troodos and in the communities of the Asinou-Oreinis Morphou and Solea areas (Orounta, Koutrafas, Katydata, Evrychou, Potami, Nikitari, Agia Marina Xylatou, Galata, Flassos, Sina Oros, Tembria, Vyzakia, etc.). Based on field research (2018), a large part of the land declared to the CAPO as cultivated with cereals and fodder crops[104] are used for grazing, mainly to meet the nutritional needs of the farm's animals due to the absence of pastures for a period of 3-5 months per year[105].

(b5) permanent pastures[106]

Permanent pastures are part of the agricultural land of a farm or state-owned land (the use of forest land is prohibited under the 2012 Forestry Law) within communities. They represent a very small percentage (~2.2%) of the cultivated land in Troodos and concern only 44 farms out of a total of 258 farms with livestock. At the national level, pastures account for <2% of UAA (2020).

The criterion for an area to be considered grazable by the CAPO and to receive subsidies requires the existence of grassland for grazing and the existence of livestock farming. Maintaining permanent pastures in the cultivation system of a livestock farm allows the farmer to access Green Aid. The Ministry of Agriculture, Rural Development, and Environment (MARD), in the context of supporting productivity and the natural regeneration of pastures, has imposed a restriction on grazing during the main flowering period of herbaceous species (February 15 to April 15) as a condition for receiving green aid. In communities or areas where the relationship between grazing capacity and grazing load is problematic, there is a greater need to ensure the rational management of these areas. The CAP Strategic Plan 2023-2027 includes a provision (€25 per hectare per year) aimed at improving grazing land with a view to environmental protection and productivity.

(b6) Fallow land

Fallow land falls under the category of annual crops and occupies a large area in Troodos (2,908.01 ha in the 2020 CAPO). In theory, set-aside is a temporary interruption of cultivation of a plot of land as part of a crop rotation system to restore its productivity[107]. The fact that no specific obligations are required in terms of land management[108], makes it possible to receive direct aid and/or additional aid due to participation in agri-environmental measures.

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[104] The producer cultivates not to harvest crops but to graze his animals or to collect hay to meet the nutritional needs of his animals.

[105] Limited period due to climatic conditions and minimal available water resources.

[106] Permanent pasture in the RDP is defined as land (a) either used for growing grasses or other herbaceous forage crops by cultivation (sown) or naturally (self-sown) and has not been included in crop rotation for five years or more, may include other species such as shrubs and/or trees suitable for grazing, provided that grasses and other herbaceous forage crops predominate, and (b) either suitable for grazing and part of established local practices where grasses and other herbaceous forage plants are not traditionally predominant on grazing land.

[107] On land under set-aside, only mechanical tillage for weed control is permitted under the relevant legislation.

[108] Set-aside is one of the crops that farmers can include in their cropping system as part of agricultural practices (practices beneficial to the climate and the environment: diversification and maintenance of areas of ecological focus).

It is observed that many producers (30.6%) maintain their farms by declaring them as set-aside in order to retain their entitlement to CAP 2023-2027 subsidies. Of these farms, 27% declare 50-99.9% of their cultivated area as set-aside, while 12.7% declare only set-aside. The allocation of land for set-aside (2,908.01 ha (20.48% of agricultural land), (CAPO, 2020)) is the result of agri-environmental planning and, above all, European subsidies. *The identification of significant areas dedicated to set-aside (fallow land) but also abandoned land in communities with livestock farming argues for the need to explore the possibility of greater flexibility in their use for the production and utilization of fodder.* Addressing the issue on three levels: Troodos, community, and farm. It is necessary to explore the integration of set-aside (fallow land) land into an *agri-environmental management plan*.

The ongoing and prolonged drought has a significant impact on the productivity of arable crops and, in particular, on the production of animal feed, which indirectly affects livestock farming (ensuring animal welfare conditions). As a result, the EU has recently taken steps to adopt decisions under CAP legislation on derogations from specific eco-design requirements. These derogations concern the use of crops that are part of agricultural practices (including set-aside) for animal feed production in order to benefit livestock farming.

7.3.11 Basic livestock breeding (c)

Livestock farming was one of the main activities on the island and in Troodos, with traditional grazing systems that contributed to the local economy and the preservation of ecosystems and landscapes. The policy implemented to date has led to a decline in livestock farming[109] [110]. Initially, it was "pushed" to the edges of mountainous areas and then "forced" to concentrate in semi-mountainous and more low-lying areas, according to a study on sheep and goat farming in Cyprus (2013). In Troodos, extensive livestock farming (sheep and goat farming and beekeeping) is scattered throughout, while intensive livestock farming (pig farming, cattle farming, poultry farming, rabbit farming) occurs in specific areas.

The term "extensive" livestock farming is used here in the sense that:

- animals graze (as long as climatic conditions allow on a daily and seasonal basis) and are not kept in stalls throughout the year,
- it does not approach livestock farming from the perspective of animal husbandry (use of feed in nutrition) but as a land resource in the sense of the relationships and links it incorporates with both the natural environment and the local community.

Therefore, the term "extensive" sheep and goat farming is approached not as a closed system limited to the relationship between production unit and market, but as an open system that incorporates and/or influences spatial elements of the place (natural resource management, landscapes, grazing practices, know-how, etc.).

(c1) extensive livestock farming

(c1.1) sheep and goat farming

Sheep and goat farming, and goat farming in particular, is found in 64 communities in the region and is a significant activity in Troodos. There are 35,051 sheep and goats raised on 242 livestock farms (Veterinary Service of Cyprus, 2020).

Sheep and goat farming, as the main extensive livestock farming activity, is found:

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[109] In Cyprus, organized groups and interests have made continuous efforts to relocate livestock farms and generally restrict animals to livestock zones or livestock areas. The concentration of animals in limited areas was also facilitated by subsidies for livestock feed and the fact that 10% of sheep and goat farmers (average unit size 70 animals) do not own agricultural land, 17% (average size 40 animals) own less than 15 decares of land, while many of the others do not own sufficient land for the production of coarse fodder (1994 Agricultural Census). To this should be added the lack of infrastructure (water supply, electricity, roads).

[110] According to the "Study on sheep and goat farming in Cyprus. Significance, Structure, Problems and Prospects of Cypriot Sheep and Goat Farming, 2013", the main reasons for the decline in the economic importance of sheep and goat farming are:

(i) the lower yield (feed/meat or milk produced) and reproductive capacity of sheep and goats compared to other animals,
(ii) comparatively higher labor costs due to the difficulties of mechanizing the work,
(iii) dependence (due to insufficient fruit and coarse feed) on imported concentrated feed,
(iv) the production of dairy and cheese products from sheep and goat milk is in unequal competition with the corresponding products from cow milk, which are produced more economically and are cheaper and have a guaranteed market as they are also available for pasteurization.

- in the southern part of Troodos, mainly in: Pachna, Dora, Agios Amvrosios, Agios Therapon, Kivides, Souni-Zanakia, Malia, Lofou, Alassa, Vasa Koilaniou, Sanida, Lofou. Livestock farming developed as an activity replacing the cultivation of table grapes,
- in the northern part of Troodos, mainly in: Koutrafas, Nikitari, Potami, Flassou, Agia Marina Xylatou, Evrychou, Orounda.
- outside protected areas[111].

Under the 2012 Forestry Act, grazing within forest areas is prohibited. However, it should be noted that pilot projects, research, and management plans for protected areas show that grazing helps to preserve biodiversity and protect against fires. Controlled grazing of sheep and goats could help in the management of these zones. Grazing is also an important ecosystem service.

(c1.2) beekeeping

Beekeeping remains relatively stable, with small-scale operations scattered throughout Troodos. The communities of mountainous Larnaca (Odos, Melini, Vavatsinias, Agioi Vavatsinias) are particularly specialized in this activity. The diversity of flora in Troodos helps the development of beekeeping, which in turn contributes to increased biodiversity through pollination, according to field research (2018). At the same time, it attracts beekeepers from all over free Cyprus.

(c2) intensive livestock farming

Meanwhile, intensive livestock farming is also practiced in Troodos. This involves:

c2.1) Pig farming: Only two pig farms are active in Orotta (~15,000 animals) and one in Kato Koutrafas (12,500 animals).

c2.2) Cattle farming: according to data from the Department of Agriculture, this is found in 11 communities (Orounta, Potami, Doros, Apsiou, Pano Kivides, Alassa, Katydata, Agia Marina, Oikos, Pachna, and Paramytha) and raise a total of 1,131 Holstein, Friesian, and local dairy cattle. The animals are fed purchased feed.

c.2.3) Poultry farming: according to data from the Department of Agriculture, this is found in 8 communities in Pitsilia, Nicosia (Apliki, Askas, and Fterikoudi), Oreni Morphou (Agia Marina Xyliatou, Agios Georgios Kaikallou, Koutrafas) and Solia (Eurychou). There are a total of 87 premises corresponding to 8 units, raising 85,404 chickens and 63,812 hens. They are involved in meat and egg production. Small chicks are supplied by hatcheries located in neighboring lowland villages. Their feed is based on animal feed-grain that comes from abroad. According to the on-site investigation, the units cooperate with incinerators in the Nicosia area for the incineration of non-productive animals.

c.2.4) Rabbit farming: Rabbit farming, apart from domestic production, is organized in a unit with four premises and a capacity of 3,240 rabbits in Pelendri.

c.2.5) Fish farming

According to the Cyprus River Basin Management Plan (2016)[112] seven (7) small freshwater aquaculture units, some of which also operate as fish hatcheries, are active in the Troodos mountain range. Farming takes place in concrete tanks that use water from nearby springs and rivers[113].

7.3.12 Importance of organic farming

Organic production in Cyprus has made tremendous progress over the last twenty years. According to the Department of Agriculture's Register, organic farming has grown from 0.22% of the total cultivated area in 2003 to 5.87% in 2023. In addition, the number of organic farmers has risen from 85 in 2003 to 1,233 in 2020, with an organically farmed area of 5,465 hectares (4.1% of the total cultivated area[114]).

[111] Exclusion dating back to the time of the British occupation of the island, especially sheep farming. This long-standing ban is based on legislation on the protection of forest areas and the environment.

[112] Cyprus River Basin Management Plan for the Implementation of Directive 2000/60/EC (Period 2016-2021)

[113] The relevant river water bodies are CY_9-6-m_RP_HM (Kouris), CY_3-3-d_RP (Argaki tou Karvouna), CY_1-2-a_RP (Diarizos), CY_3-3-b_RP (Karyotis) and CY_9-6-p_RP (Kryos).

[114] Ministry of Agriculture, Rural Development, and Environment: Strategic Plan 2025-2027, ed. 2024

Table 16 - Organic farming in Troodos. Source: Department of Agriculture, 2017.

Areas	Surface (ha)	Organic Farmers (No)
Pitsilia Nicosia	3.74	7
Morfou mountain	132.02	48
Solea	31.0	21
Marathasa	7.04	13
Pitsilia Lemesou	42.03	24
Mountain Resorts	10.58	9
Krasochoria	228.43	117
Koumandaria	44.73	36
Total	499.57	275

Troodos is making a commendable effort to promote traditional crops, helping to strengthen their ties with the place of production and seeking to increase the value of their producers. According to data from the Cyprus Organic Farmers Association (COFA), efforts to develop organic farming began tentatively in 1987 and intensified in 2002[115]. According to data from the Department of Agriculture (2017), there are 275 organic farmers in the region, cultivating 49,957ha organically, which constitutes 37% of Cyprus' organic farmers[116].

The organic farmers of Troodos are spread across the communities of Fasoula, Kalo Chorio, Limnati, Paramytha, Pachna, Pano Kyvides, Arsos, Agios Ioannis, Katadita, Potami, Orunda, Nikitari, Kato Koutrafas) of certain types of crops on a small scale.

According to data from the Department of Agriculture, organic production concerns:

- cultures: olives (which are constantly increasing), tree crops (almonds, berries, fruit trees, deciduous trees (apple, pear, cherry, peach, etc.), prickly pears, avocados, figs, mangoes, carobs, citrus fruits), cereals, vines, and various other crops (aromatic herbs, vegetables, melons, and fallow land)
- livestock farming: 1 poultry farm in Kato Koutrafa.

7.4 Policies and Institutional Environment

7.4.1 Impacts and challenges of agricultural policy

According to the National Strategy for the development mountainous communities *for the majority of its measures, agricultural policy in Cyprus adopts criteria common to the whole of Cyprus, with the exception of certain measures which by definition and by content (e.g. part of the agri-environmental measures) concern Troodos. The problem lies in the non-adaptation of the criteria (level of investment, economic performance of the farm, etc.) and the need to design specific notices for mountain areas due to their specific conditions (priority for the establishment of young farmers, small investments, small investment projects of farms, etc.).*

In the Diagnosis performed for the Spatial Planning Study for Mountain Communities in Troodos (2022) of the area there were three main issues identified:

1. The typical modernization measures of the CAP are considered rather ineffective due to mainly the prevalence of very small family farms and the significant handicaps of the Troodos area due to its geomorphology and climate. Furthermore, the Diagnosis suggest that the deficiencies of farmers'

[115] In 2002, the first financial support for organic farmers was recorded, as part of the Ministry of Agriculture's policy to promote and develop organic farming in Cyprus

[116] According to organic farming data from the Department of Agriculture (2017) and the results of the Organico LIFE+ research project (2016).

professional/collective organizations aggravate the situation. On the other hand, one should add to the difficulties of the designed CAP to be adapted to the small-scale agricultural enterprises of the Mediterranean, the inability of the Cypriot state to adapt the Rural Development Plan to the specific needs of the mountains.
2. Although the particular problems of the mountainous areas in Cyprus have been acknowledged, in alignment with the relevant EU policy, the effectiveness of the measures adopted, depending mainly on the area, is still doubtful due to the very small size of the farms.
3. The gradual shift of the focus of the CAP towards environmental goals seems to result to an increase the advantage of the better organized Forestry Service and Department for the Environment and, hence, better placed in the competition of EU funding. In the same context, the lack of organization among farmers prevented their participation in the design and implementation of agri-environmental programs, schemes and actions, whose main objective was the conservation and enhancement of biodiversity.

7.4.2 Income support measures

Basic Income support for sustainability

According to the Strategic Plan for the Common Agricultural Policy 2023-2027, there are no special provisions for mountainous areas as far as the Basic Income support for sustainability intervention is concerned. Thus, all farmers and/or land managers in Troodos can apply for the same amount per hectare as in all of Cyprus. The indicated amount is 223.76 €/ha, with a range of ± 15% depending on the number of beneficiaries.

Complementary support for small holdings

All farms in Cyprus that manage less than 30 of land are also entitled to a Complementary redistributive income support for sustainability. In that case the indicative amount is 27.87 €/ha, with the same range depending on the number of beneficiaries i.e. ± 15%.

Complementary support for young farmers

Farmers/farm managers younger than 41 years old having undergone formal agricultural education or professional training are entitled to a Complementary income support for young Farmers which amounts to 85.00 €/ha ± 15%.

Coupled income support

Farmers breeding sheep/goats can also apply for a coupled income support which for sheep and goats amounts to 8.80 €/head ± 15%.

7.4.3 Land use and land reform policies

A provision that is directly linked to land use is the provision under the CAP strategic plan to maintain and preserve permanent pastures (GAEC 1) and complementing that the possibility of Member States to prohibit land use changes in permanent pastures within Natura 2000 sites.
At the National level a policy declaration for the countryside, a land planning document, issued first in 1992 and updated since in 1996, 2010, 2014 and 2024, regulates development and construction within and outside settlements. The Policy declaration delineates planning zones defining land uses. In that document agricultural use and environmentally protected areas are defined, hence protected, from development pressures like construction. Areas under land reclamation and/or public irrigation infrastructure characterized as High quality land and higher protection level is provided for them.

7.4.4 Productivity improvement strategies

The implementation of the Rural Development Policy as implemented since Cyprus' accession to the EU and thereafter, has allowed for the enhancement of significant investments in Troodos according to data from the Ministry of Agriculture. Based on the available data, in total, in Troodos in the period 2004-2017, producers received in the form of public aid (European and national aid) under the Rural Development pillar a total of €35,118,219. The degree of absorption of aid per measure refers to the respective total amounts of each measure for the country. The most important of these measures are indicated:

- Investments for the modernization of agricultural holdings: 9.3%

- Restructuring and adaptation of agricultural holdings: 25.4%
- Small-scale on-farm processing (food processing-crafts): 35.6%
- Early retirement: 8.45%
- Young farmers: 15.53%
- Organic farming of agricultural products: 12.77%
- Participation in Quality Systems: 45.49%

There is a significant absorption in the areas of age renewal (young farmers) and value addition (processing and quality systems).

7.4.5 Sustainability and climate resilience measures

a. *Eco-schemes*

Another element of the direct payments is the "eco schemes" or Schemes for the climate, the environment and animal welfare. These are payments each one of which should cover at least two of the following objectives:

1. *climate change mitigation, including reduction of greenhouse gas emissions from agricultural practices, as well as maintenance of existing carbon stores and enhancement of carbon sequestration;*
2. *climate change adaptation, including actions to improve resilience of food production systems and animal and plant diversity for stronger resistance to diseases and climate change;*
3. *protection or improvement of water quality and reduction of pressure on water resources;*
4. *prevention of soil degradation, soil restoration, improvement of soil fertility and of nutrient management and soil biota;*
5. *protection of biodiversity, conservation or restoration of habitats or species, including maintenance and creation of landscape features or non-productive areas;*
6. *actions for a sustainable and reduced use of pesticides, in particular pesticides that present a risk for human health or environment;*
7. *actions to enhance animal welfare or combat antimicrobial resistance. (Reg 2115/2021)*

Eco-schemes were not directed at specific areas but have been built on practices and rather targeted towards crops or group of crops. Based on the crops targeted and the occurrence of these crops in the area under study one can select 7 eco-schemes that could be applied in mountainous and semi mountainous areas. Additionally, these schemes are not active every season and are not really supporting professional farmers, rather than extensive crops.

Soil fertility and quality improvement*

1. Chopping of pruning residues of trees and vines. Chopped residues should be applied either around the trunks or across the lines. Farmers would receive a subsidy of 200€/ha
2. Farmers should apply certified compost around the trunks for tree orchards and the stump for vineyards as well as to the whole of the parcel for land cultivated with potatoes, vegetables and cereals. Support for annual crops averages to 1700 €/ha while for permanent ones around 1200 €/ha.
3. Farmers with carob trees can apply for support provided they sow cover crops between the trees on at least 30% of the land and cover the soil around the trunk with organic matter. The support can reach 470 €/ha.
4. Use of certified seeds and participation in organic cereals scheme or use of either wastewater sludge or slow-release fertilizers. Support ranges from 100 to 270 € per ha.

Reduction of pressure created by chemical plant protection products towards water and soil

5. Support for soil solarization for vegetable crops including under cover cultivation, with approximately 1800 €/ha
6. Use of nematode resistant potato varieties supported with approximately 1200 €/ha
7. Farmers are encouraged to use mechanical weeding instead of using herbicides in systematic vineyards and aromatic / medicinal plantations as well as other tree orchards. There was an

additional support for orchards located in areas over 600 m above sea level and a provision for specific aid to traditional orchards (hazels, almond trees, carob trees and rose trees of Agros). Support was also provided for scattered trees. The support ranged from 320€/ha for scattered trees and orchards below 600 m to 900 €/ha for aromatic/medicinal plants.

b. Sectoral support measures: Grapes and wine sector

Among the measures that provide support to the wine and grape sector, a specific intervention aims at the maintenance of historical features of vineyards and conservation of the landscape. It is comprised of aid for the creation of new dry-stone terraces and/or the restoration of old ones.

c. Agri-environmental interventions under the Rural Development pillar

1. An intervention was designed for potatoes, one of the most important intensive market-oriented crops of Cyprus. A risk assessment as far as the environment and animal health were concerned is provided for, with the assistance of an advisor. Furthermore, farmers are supported to employ an advisor, jointly design and implement:

- a management plan in order to minimize probable environmental impacts as described in the risk assessment
- an irrigation water management plan
- an action plan in order to control and reduce pesticide residues in the produce which include risk analysis, sampling and laboratory analysis
- appropriate management of discarded produce in order to avoid spreading of psychopathological infections.

The overall support can reach 350€ /ha.

2. Long term crop rotation (6 years) for potatoes and cereal crops is also supported amounting from 460 to 950 €/ha for potatoes 300 €/ha for cereals.

3. Maintenance and small-scale restoration of drystone walls inside or at the perimeter of the parcel. The use of concrete or other similar material is forbidden. The amount of aid per hectare reached the 340 €.

d. Aid to areas facing natural or other area-specific constraints under the Rural Development pillar

The designation of areas with natural or other area specific constraints in Cyprus resulted to 78 communities characterized as mountainous while 35 communities have been classified as facing significant natural constraints and one with specific constraints [117].
This intervention supports farms located in areas facing natural constraints in order to compensate farmers for the reduction of income and the increased costs resulting from agricultural activities in these areas.
The amounts of support vary according to the category of the area and the size of the farm:

Table 17 - Farms per type of area

Class A "Mountain areas"	
• 0.3 Up to 30 ha	• 140 €/ha
• 31 to 100 ha	• 112 €/ha
• 101 to 300 ha	• 90 € /ha

[117] *a) Mountain areas: existence of very difficult climatic conditions and/or steep slopes, areas north of the 62nd parallel.*
b) Areas facing significant natural constraints: based on eight biophysical criteria covering climate, poor soil productivity and steep slopes.
c) Areas affected by specific constraints: where continued land management is necessary to conserve the environment and the countryside, or to protect the coastline. (https://agriculture.ec.europa.eu/system/files/2023-12/factsheet-income-supprt-ancs_en.pdf)

• More than 300 ha	• -
Class B “Areas facing significant natural constraints”	
• 0.3 Up to 30 ha	• 55 €/ha
• 31 to 100 ha	• 44 €/ha
• 101 to 300 ha	• 35 € /ha
• More than 300 ha	• -
Class C “Areas affected by specific constraints”	
• 0.3 Up to 30 ha	• 55 €/ha
• 31 to 100 ha	• 44 €/ha
• 101 to 300 ha	• 35 € /ha
• More than 300 ha	• -

7.4.6 Environmental regulations by theme

a. Natural resources

Water

The main policy document concerning water management in Cyprus is the River Basin Management Plan (RBMP) of Cyprus, the 3rd version of which was issued in 2023, and it covers the 2022-27 period. According to the Water Framework Directive (2000/60/EC) all Member States are obliged to issue and update regularly such Management Plans for their river basins. In Cyprus the unique RBMP covers the whole area of the island under the effective control of the Republic of Cyprus and the first was issued in 2011, followed with an update in 2016.

The RBMP consists of the national plan for the management of Surface and ground water bodies, while the policy for the protection and management of water resources is stated. It also contains measures for the achievement of a good qualitative and quantitative status of the water bodies, the sustainable use of water in all sectors (urban, agricultural, industrial as well as the environment).
Furthermore, more strategy documents related to water management have been issued during the last decade. Each revision of the River Basin Management Plan is accompanied by an Aridity management plan, Finally an Action plan for the mitigation of water and rain scarcity and has been launched at the end of 2024.
There are no specific water management measures for the Troodos area or even mountainous areas. The island, as mentioned above, is considered as one river basin, hence management guidelines are applicable for all areas. In general, water management in Cyprus, is aiming at the reduction of water extraction and use. That is translated in:

- gradual control and regulation of water drilling;
- water pricing even in private drillings taking in account environmental and resource costs;
- direct linkage of the farm subsidies to a registered source of irrigation water;
- implementation of an annual distribution plan of state water reservoirs (water permissions) based on available water quantities for the specific year. Human consumption is fully covered, excessive quantities are reserved for future dry years, ecological flow is assured and the existing demand for irrigation is covered with the rest of the water. Annual permissions have the form of a quota. If a farmer exceeds the quota assigned to the parcel, an excessive consumption fee is imposed;
- support for acquiring improved irrigation systems and practices implemented;
- establishment of individual water metering devices in all water use points and pricing based on the volume consumed;
- establishment of water metering devices in private drillings.

Furthermore, a large part of the CAP strategic plan's environmental provisions has to do with the protection of water quality. (See 7.1.5.1 and 7.1.5.3.)

Soil

One can notice that, as in almost all EU Member states, there is a lack of structured policy for the management of soil resources. This should be attributed to a similar lack of policy at the EU level. The only official international policy document existing concerning soil protection is the United Nations Convention to Combat Desertification (UNCCD)[118], a multilateral environmental agreement launched in 1996 and ratified by the Republic of Cyprus in 1999. Within the convention there is an Appendix (IV), concerning the Mediterranean countries. In compliance with the convention the Republic of Cyprus has composed and updated a National Action Plan for combating desertification and reducing the impacts of aridity.

However, within the framework Common Agricultural Policy there is a multiplicity of measures aiming at soil protection. One could mention that a significant part of the enhanced conditionality provisions is directly or indirectly aiming at combating soil erosion as well as soil quality degradation. More specifically, CAP strategic plans´ provisions in order to maintain agricultural land in Good Agricultural Environmental Conditions (GAEC) include GAEC 5 and 6 with the objectives to prevent soil erosion through appropriate practices (e.g. tillage) taking in account physical conditions like slope etc. as well as minimum soil cover during the critical periods. Furthermore, two more GAEC rules have to do with soil quality improvement, namely GAEC 3 to maintain soil organic matter and soil structure through a ban of burning arable stubble and GAEC 7 intended to preserve soil potential through crop rotation.

Nevertheless, only a small part of the CAP strategic plan´s environmental provisions have to do with the protection of soil quality, while only the support for maintenance, repair or building of dry-stone wall terraces could be considered as combating soil erosion (See 7.1.5.1 and 7.1.5.3.). A considerable deficiency when mountainous areas such as Troodos, where steep slopes characterize the landscape, are concerned.

b. Climate change

The international treaty that is the basis for the EU Climate Policy is the Paris Climate Convention. Cyprus as a Member States complies with the provisions of the treaty and the Green deal launched by the European Commission in 2019. Hence, a National Plan for Energy and Climate for the period 2021-2030 was launched in 2021 with three quantified objectives: Achieve climate neutrality by 2050, reduce Greenhouse Gas (GHG) emissions by 21% up to 2030 and increase the use of Energy from Renewable Sources in order to reach a 23% of final consumption by 2030.
As far as adaptation to climate change is concerned, the Republic of Cyprus has already issued (February 2025) a National Strategy for Adaptation to Climate Change and a relevant Action plan. However, as in all other cases referred to above, there was not any spatial specification of the plan, and the only reference to mountainous areas was in relation to cultural heritage and tourism.

c. Biodiversity

In response to the UN Convention on Biological Diversity and alignment with the EU biodiversity strategy the Republic of Cyprus and in particular the Department of the Environment of the Ministry of Agriculture, Rural Development and the Environment has launched in 2020 the National Strategy and Action plan for Biodiversity.
Following the guidelines included in the national strategy and particularly the provision to integrate biodiversity conservation in all aspects of policy implementation the Policy Statement for Troodos, as part of the land planning policy classified the protected areas of Troodos to the following categories (See figure):
(a) *Areas of Outstanding Natural Beauty*: Characterized by extensive areas of land, water or mixed terrain that have remained unaffected or minimally affected by human activities and in which a large

[118] "*The objective of this Convention is to combat desertification and mitigate the effects of drought in countries experiencing serious drought and/or desertification, particularly in Africa, through effective action at all levels, supported by international cooperation and partnership arrangements, in the framework of an integrated approach which is consistent with Agenda 21, with a view to contributing to the achievement of sustainable development in affected areas*." Art 3 of UNCCD

number and variety of remarkable ecological, geomorphological and aesthetic features are preserved. Construction of buildings used for traditional activities e.g. agriculture, forestry is permitted in these areas, while the establishment of industrial plants may be permitted under certain conditions.
(b) *Protected Landscapes:* areas of great aesthetic, ecological and cultural value. Protected landscapes are the areas around water reservoirs, gorges, mountain tops and cliffs.
(c) *Nature Protection Areas*: these are areas of the hinterland that have: (a) particularly sensitive ecosystems with habitats containing diverse or rare or endangered species of native flora or fauna and (b) outstanding geomorphological features with special scientific, cultural or aesthetic value or monumental character and which form part of the identity of the area.

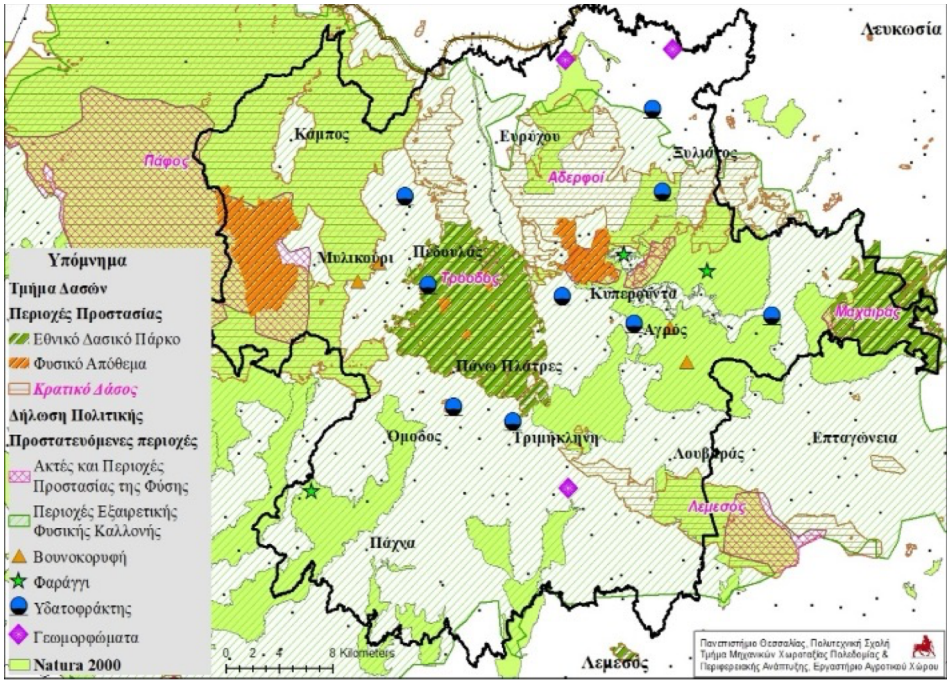


Figure 130 - Protected Areas in the study area

(d) *Areas included in the European network of protected areas Natura 2000*: the rich flora and fauna is included in the European Natura 2000 network covering a total area of 845 km^2, i.e. 57.2% of the area. In particular, 251 km^{2}belong to "Sites of Community Importance (SCI)" as defined in the Habitats Directive (92/43/EEC) and 504 km^{2}to "Special Protection Areas (SPA)" as defined in the Birds Directive (2009/147/EC previously 79/409/EC) "on the conservation of wild birds". Finally, 90 km^2 belong to both categories.

d. Forest protection through the Rural Development Programme

The Forestry Department manages the Forestry Programmes of the Rural Development Programmes (RDPs) from 2004/06 - 2007/13 - 2014/20. Through these programmes, both its own and private and community actions have been co-financed. In summary, through the 2004-2006 CIP, €825,386 was given to the private sector and €137,193 to communities. For the 2007-2013 CIP €709,067 was given to the private sector, €3,221,592 to the Communities and €864,252 was used by the Forestry Department.

7.5 Markets and value chains

7.5.1 Main characteristics of the agricultural value chains

7.5.2 Market infrastructures

The lack of organization among farmers, the relatively small production volume per product due to the wide variety of products, and the existence of many small multi-active farmers raise the issue of ensuring the necessary critical mass, at least for certain products. This situation is reflected in the network types of all sizes that currently comprise the Troodos products markets. This mix of multiple-

size markets, short, national, and international distribution networks in turn reflects a relative outward-looking dynamic of Troodos agriculture.

7.5.3 Producers' selling practices /Marketing circuits /Presence and functioning of local markets/ Intermediaries

Agricultural and livestock products (vegetables, fruit, grapes, potatoes, animal feed, milk, etc.) produced locally are sold in the markets (street and municipal) of Nicosia, Limassol, Paphos, and Larnaca, either through traders or by the farmers themselves, mainly in bulk, but also in standardized or processed form. Farmers sell their products in neighboring villages, fruit shops, wineries, dairies, agri-food units, local cultural festivals promoting local products, home delivery, and visitors to the area. In addition, several farmers sell their products to local farmer organizations and cooperatives, which then promote them in bulk, standardized, or processed form on the market (to traders, fruit shops, supermarkets, and abroad). Finally, a significant number of farmers process part of their produce at the farm level[119] and sell it to local small businesses and visitors to the area, especially during local festivals, as a processed product.

New market forms are slowly developing in the region:

- ⇨ Short supply chains linking production to consumption (e.g., production in Arakapa supplying the market in Paphos with citrus fruits, and strawberries; production in Treis Elies supplying consumers in Limassol, etc.).
- ⇨ Distribution of products through quality agreements: e.g. The "Vasiliki Gi" based in Odos & "S.E.D.I.G.E.P ORINIS PITSILIAS TROODOS' based in Agros, farmer groups, distributes its products on the market in standardized form (retailers, fruit shops, supermarkets, abroad) by adopting certification systems (GLOBALGAL) and developing quality agreements with big supermarkets,
- ⇨ Distribution of products through local product festivals: honey roads (Odou, Melini), apple festival (Kyperounta), rose festival (Agro), zivania festival (Pelendri), soujouko (Silikou, Fikardo), sweets (in various communities), mandarins (Arakapa - Dierona), Traditional Food & Festival (Dymes) traditional sheep or goat cheese (Pachna), etc. These celebrations last 2-3 days, attract a large number of visitors, and feature local products for sale.
- ⇨ Visitable farms: examples
  - ecological farms growing organic olives, cherries, vegetables, etc.
  - farms run by farmers and beekeepers (Melini, Dyme, Chandria, etc.)
  - beekeeping and Mount Machera (Odou, Pelendri, Kalopanagiotis, etc.)
  - thematic farms in Eptagonia (Fox theme park, Televantidis horses)

Many farms with vineyards, mainly wineries, have been included in the wine routes.

7.5.4 Agricultural product value chains

The Troodos region has significant potential for producing high-quality and added-value products by utilizing locally produced agricultural and livestock products, traditional know-how, production techniques, and centuries of knowledge. Due to global increase in input prices, fresh products are regaining market niches; however, the number of farmers is insufficient to meet both local and tourist demand from summer to autumn.

Moreover, manufacturing and small or household processing units are quite developed in Troodos, contributing to the increase in the value of agricultural products and creating local value chains, supporting the local economy and strengthening entrepreneurship, mainly in family businesses.

a. Production and Processing of Local Products

Agricultural food

[119] The rural development policy implemented since 2004 supports agricultural holdings in diversifying and marketing the products they produce. Farmers in Troodos have taken advantage of this measure, absorbing 30% of the total funding

Manufacturing activity (field survey, 2018) mainly concerns food processing units (over 700) which operate either as small-scale industries (30% of them) or as cottage industries[120] (70% of them, most of which are unlicensed).

Table 18 - Manufacturing activities in small-scale industry and cottage industry in the agrifood sector

Types of agrifood manufacturing activities	
Small Scale Industry (SSI)	Cottage (artisanal) industry (CI)
Wineries / alcoholic beverages (zivania) / vinegar	Wine and zivania productions
Baked goods (arcatela, rusks, etc.)	Soutzouko's production
Sweets and grape products	Spoon sweets
Charcuterie (pork, sausage, lountza) - Tsamarela	Bread making
Spoon sweets	Rose distillation
Water bottling	Charcuterie
Pastry shops	Honey
Carob Products	
Dairy Products (Halloumi, Anari, etc.)	
Olives, Oil	
Honey and honey products	
Vegetables and fruits (cherries, peaches, apples, almonds, etc.)	
Eggs	
Rose products (rose jam, rose water, etc.) and aromatic herbs	
Other agricultural products (meat, fish, poultry, frozen foods, etc.)	
Source: Field research (2018)	

Similar agricultural products are produced by small-scale and 'home' industries, which allows for the development of partnerships.

Troodos' flagship product is wine, particularly Commandaria, which has seen significant growth in recent years, without overlooking the importance of cured meats, rose processing, baked goods, and fruit products.
Especially for grapes as the emblematic product, there is a lack of identification and promotion of the oenological characteristics of local bulk wines (mainly produced on a farm scale), Without the necessary oenological (technical and advisory) support and the necessary chemical and organoleptic analyses, this often creates a false impression of the quality of wine produced in Troodos. The recently established wineries have upgraded the quality of bottled wine, but the recognition they enjoy at international exhibitions is not linked to their place of origin. In order to promote the vineyards, wines, and spirits of Troodos as a whole, systematic research and study of the wine-growing potential, varieties, sub-regions, and types of wine is required for coordinated promotion.
The main categories of products of recognized quality produced and processed in the region include:

- Organic products: mainly olives, aromatic plants, fruits, and vegetables, which take advantage of the potential of low-input and organic farming.
- Products with the voluntary "mountain" label: certify the quality of mountain products and enhance their market recognition. Namely, 3PRO TROODOS project developed a label as a

[120] Although the cottage industry unit has now been established, many producers continue to not take advantage of this form and operate without the required licensing. This prevents them from marketing their products in organized and official markets. They continue to produce processed products which they sell "informally" on the market through personal networks.

voluntary mountain label that is at place for S.E.D.I.G.E.P ORINIS TROODOS FARMERS ASSOCIATION.

- PDO, PGI, and traditional products linked to local heritage valorize traditional varieties, techniques, and production methods, and often offer different variations by subregion, depending on historical and agricultural characteristics:
    - Grapes (emblematic product) for quality wines, such as Commandaria (PDO), Limassol wine villages, Pitsilia, and as a base for spirits (zivania), soujouko, palouzes, etc.
    - Haloumi cheese (PDO) and processed meat products/cold cuts (pork, sausage, Pitsilia lountza (PGI).
    - Rose products such as Agrou sweet rose and Agrou rose water (PGI).
    - Oil as a product of agroecological agriculture.

The low use of inputs in crops allows for the exploitation of national and European incentives for the production of quality products. Despite the small number of producers, these initiatives significantly increase their value.
There are spatial differentiation and complementarity, with small-scale industries located in larger settlements and smaller cottage industries in remote settlements, creating complementarity and preserving traditional specializations.

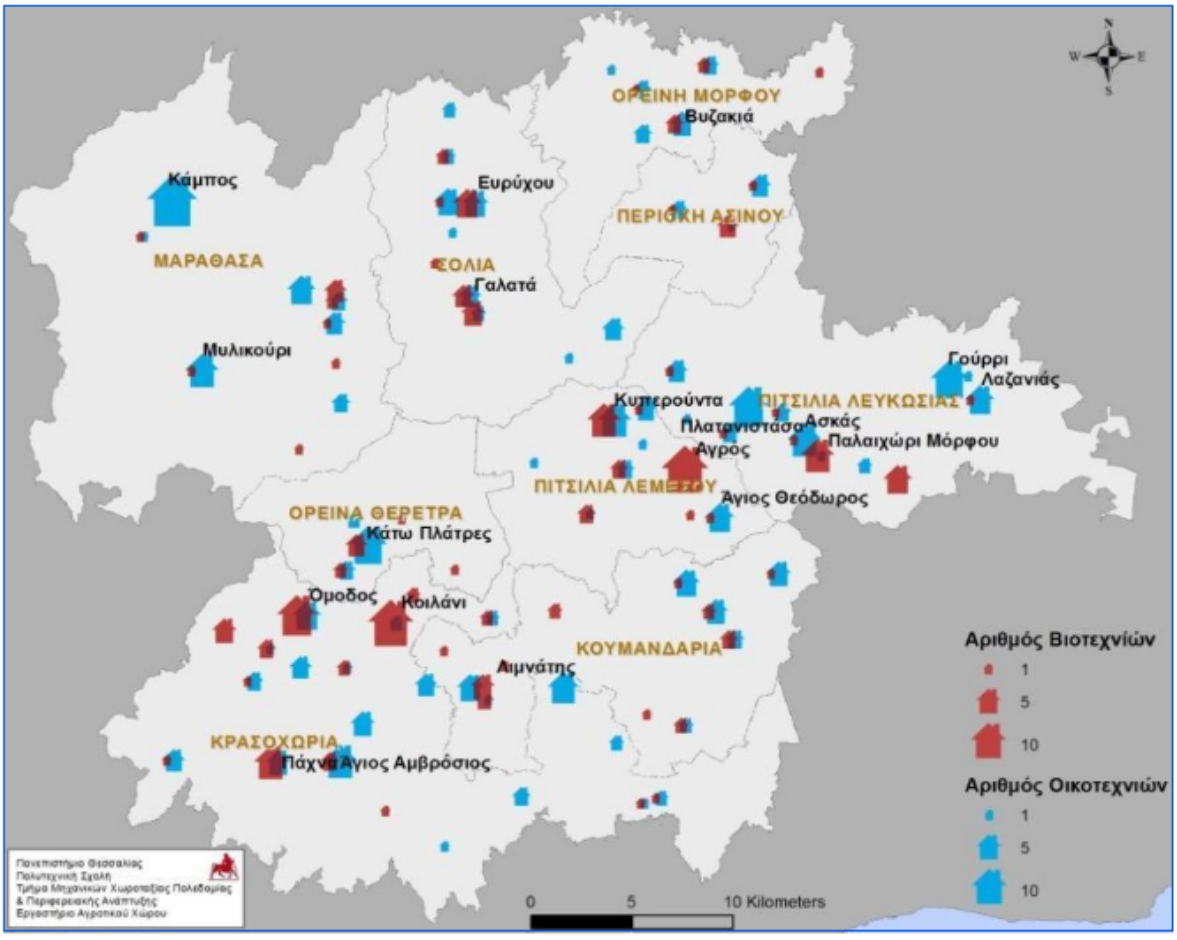


Figure 131 - Spatial distribution of small-scale food production and home-based food production in Troodos

b. *Handicrafts*

At the same time, there are craft workshops, such as workshops for traditional products (handmade lace in Omodos, traditional embroidery in Limnati, clay workshops in Finikoudes, etc.) which promote the traditional techniques of Troodos through festivals and demonstrations. They are supported by the Cyprus Handicrafts Service, contributing to the preservation and promotion of cultural heritage.

7.5.5 Various marketing challenges and opportunities for agroecological products

The development of crops in Troodos, such as vines, fruit trees, and other products, takes place in micro-regions and valleys with specific soil and microclimatic characteristics (temperature, humidity, wind, sunshine), which give the products distinctive quality characteristics. The large number of these micro-regions or "terroirs[121]" explains the wide variety of varieties and products in the region and highlights their value as high-quality productive capital.

However, the lack of institutional recognition of "terroirs" and the failure to confirm their quality characteristics through laboratory analyses limits the added value of products and, consequently, the economic value of the land. The potential locations of terroirs are identified based on the density of traditional crops, such as cherry trees in Marathasa, almond trees in Pitsilia, olive groves in Solea, and hazelnut forests in Polystipos, whose products are renowned for their quality.

The quality of Troodos products stems not only from the characteristics of the soil and climate, but also from inherited techniques and practices (traditional varieties, weeding, pruning, drying, maintenance of dry-stone walls, extensive farming, low inputs, low water consumption). This links the products to the agricultural heritage of the region, contributes to the preservation of the agricultural landscape, biodiversity, and ecosystems, while supporting the sustainability of local production.

The organoleptic properties of the products (taste, aroma, color, texture) give them high recognition among consumers, but this is based mainly on reputation rather than systematic scientific documentation.

Marketing challenges and opportunities

The main challenges for the commercial exploitation of Troodos agroecological products are:

- The recognition and certification of internal quality characteristics through laboratory analyses.
- The promotion of the relationship between products and their place of production, in order to create a clear identity and quality guarantees for consumers.
- The utilization of micro-regions/terroirs to increase the added value of products and strengthen the rural economy.
- Marketing risk minimization through farmers' cooperatives, due to well managed logistic and standardization management.

Conversely, opportunities include:

- The development of products with high differentiation and unique characteristics linked to the place of production.
- The creation of exploitable stories and marketing for tourism, food tasting, and product promotion in the market.
- Strengthening institutional tools and certifications (PDO, organic, "mountain" label) for the recognition of local agroecological systems.

Overall, the region has significant potential for the promotion and commercial exploitation of agroecological products, with a strategy that combines agricultural production, heritage, ecological sustainability, and market differentiation.

[121] Terroir is «a geographical area defined and determined by a community of people who have historically developed a set of distinct cultural characteristics, knowledge, and practices based on a system of interactions between the natural environment and human factors"
Proposed definition by the INRA/INAO working group. Updated during UNESCO international meetings. See: Planète Terroirs, UNESCO - November 10, 2005.

7.5.6 Valorization of the resources through its connections with the territory

The region can adopt the process of reorganizing the resources it possesses (heritage, productive potential, etc.) in order to subsequently activate its resources (identification, promotion, market positioning) and thus their differentiation, provided that structures for cooperation and coordination between actors are established (Figure 132). The degree of resource activation in the region is assessed using the ADRA method (Assessment of the Degree of Resource Activation - Table 19). This method was used to assess a) the links between resources, end products and the region, and b) the degree of resource activation in the region.

The existing and potential links between resources, end products and the region were assessed on the basis of the various local resources available in the region. These components are grouped into thematic categories that characterize and shape the products and services of the Troodos region. These categories include the natural and cultural heritage of the region, as well as human activities that exist in the region and are directly or indirectly linked to this heritage.

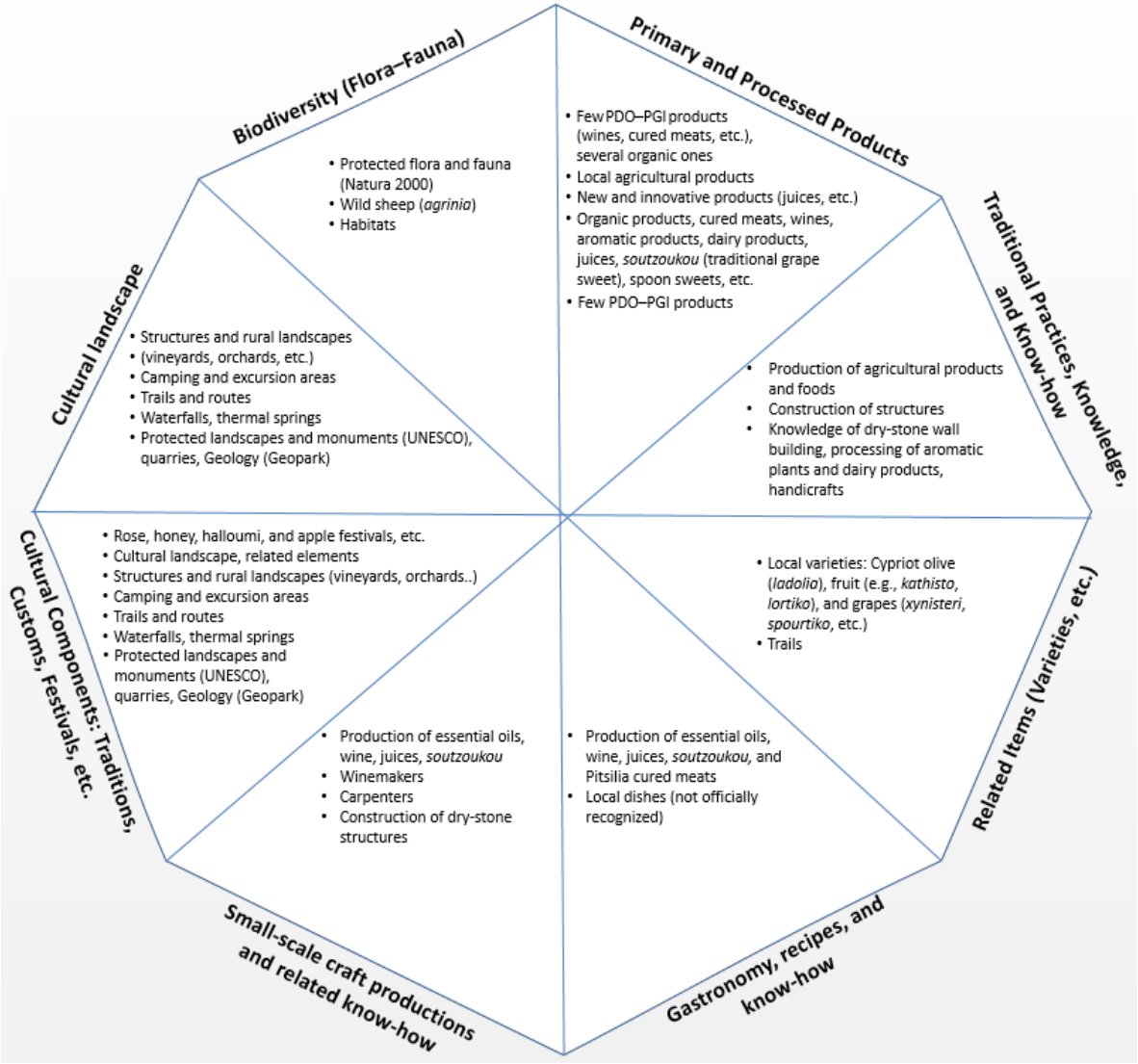


Figure 132 - The links between local resources and final products, organized by thematic categories of the various components of local resources. Source: Research team analysis

Based on the above diagram, which illustrates the interlinkages among the components of local resources, Table 19 presents three levels of resource activation along with a corresponding description of each activation level.

Table 19 - Degree of Activation and Valorization of Agricultural Resources. Source: Research team analysis

Degree of Activation	Description of the degree of resource activation
1 highlighting & emergence	• Many agricultural products with recognized reputation (fruit, grapes, vegetables, herbs) but failure to capitalize on their reputation • Existence of local varieties, organic production of products • Agricultural and livestock products from Troodos are used in the production of local handicrafts without being promoted on the market • Minimal promotion of the internal quality characteristics of the products • Some producers, mainly young people, are interested in further exploiting the quality characteristics and producing innovative products and services (environmental, etc.) • Existence but lack of promotion of land types • Large number of multi-active producers • Lack of coordination and management network (efforts by Development Agency of Troodos)
2 Extension Certification Recognition	• The products have a recognized but not guaranteed reputation • Few producer organizations, and only in the primary sector • There is inherited knowledge about product production that is exploited individually (rose water, soutzouko, etc.) • Minimal efforts to generate new knowledge (Dimatos farm, wineries, organic farm, etc.) • Establishment of product festivals as a means of promoting Troodos products • Need to strengthen the collective framework of reference related to production/exploitation (charter, specifications, sectoral (e.g., tourism) or cross-sectoral (agriculture, manufacturing, tourism entrepreneurship) quality agreement)
3 Development	• Only the cases of Koumantaria and Rodostamo are identified: recognition and organization of professionals will contribute to the recognition of the resource outside the region and will allow the development of territorial marketing for the unique products of Troodos. • Existence of a reference framework (cooperation and quality agreement). • There are economic effects in the region (job creation, income, etc.). • Creation of tools and organization that allow for the promotion of products and the development of the region's attractiveness (Geopark)

The final assessment of resource utilization shows, on the one hand, the large number of potentially exploitable components and, on the other hand, the limited degree of utilization that has been achieved to date. This highlights the potential and prospects for increasing the value of local agricultural products from Troodos.

7.6 Cross-cutting themes - enabling or disabling factors

This section highlights cross-cutting themes shaping the Troodos region from an agroecological perspective, linking urgent land management needs with key environmental and climate-related challenges, including natural disaster risks, pollution, and the impacts of climate change, as well as associated adaptation requirements. It also explores opportunities for economic diversification, examining how sustainable land management, agriculture, and heritage-based tourism can create new income streams and strengthen local livelihoods, as well as enabling and disabling factors, identifying the conditions, policies, and institutional arrangements that either support or hinder the sustainable development of the region.

7.6.1 Environmental challenges

The Troodos region faces multiple, interconnected environmental challenges that threaten both its ecosystems and the sustainability of human activities. The main pressures include recurrent wildfires, climate change impacts, land abandonment, unsustainable water and soil management, and increasing human pressures such as tourism and urban expansion. These challenges are further complicated by fragmented governance structures, which often limit the effectiveness of prevention, management, and restoration measures. This section examines the key environmental challenges in Troodos through two main lenses: a. Environmental Sustainability and b. Land Abandonment, Water, and Soil Management Challenges.

a. Environmental sustainability

Wildfires are the most significant environmental threat in Troodos, as in many Mediterranean islands. Beyond forest destruction, fires increase the frequency and severity of floods, contribute to the degradation of cropland and pastures, and reduce property values in urbanized areas. According to the *National Strategy for the Development of Mountain* Communities (2019), fire risk is particularly high along major roads during the summer months.

Natural conditions -including dry, hot summers, strong winds, steep topography, and highly flammable biomass- create an inherent susceptibility to fire. Human activities further aggravate this risk: intense and diffuse urbanization, increasing summer tourism, and inadequate waste management. Uncontrolled dumping in unsuitable sites contributes to groundwater pollution, generates unpleasant odors, degrades landscapes aesthetically, and increases fire hazards. Although an Integrated Waste Disposal Facility (IWDF) exists, illegal or uncontrolled dumps remain frequent.

The complicated environmental governance system in Cyprus raises concerns about its effectiveness. Responsibilities for fire prevention and suppression are fragmented:

- The Forestry Department is responsible for preventing and extinguishing fires occurring in forests or within a radius of up to 2 km from the forest edge.
- The Fire Service handles fires in settlements or at distances greater than 2 km from the forest, while fire prevention in these areas falls under the Provincial (Regional) Administration.
- Civil Defense, assisted by the Police, manages evacuation plans, but the decision to evacuate lies with the local Prefect.
- In cases of other natural disasters (floods, earthquakes, etc.), Civil Defense coordinates with the Fire Service.

This fragmented system, with overlapping responsibilities, reduces coordination and overall effectiveness, highlighting governance as a key challenge for environmental sustainability.

Climate trends further exacerbate environmental pressures, including declining rainfall, rising temperatures, increased heat stress on forests, and a higher frequency of extreme weather events. These changes increase risks of desertification, landscape degradation, and reduced agricultural productivity. Particularly vulnerable areas include Marathasa, the Limassol mountain resorts, and the 'Krasochoria Limassol' winegrowing villages, identified as critical zones for land degradation.

A holistic approach to environmental sustainability in Troodos involves:

- Revitalizing High Nature Value (HNV) agricultural systems: fruit orchards, vineyards, olive groves, pastoralism, and beekeeping
- Protecting terraces and biodiversity
- Implementing sustainable water management
- Adopting climate adaptation measures

Active land management enhances resilience: well-maintained terraces show healthier soils and greater ecological stability. Farmers often diversify crops, including vegetables, to counter low valorization of fruit crops and import competition, improving productivity and economic viability.

<u>Summary of pressures and trends:</u>

- Environmental pressures: wildfires, land abandonment, inefficient water use, soil erosion, uncontrolled waste dumping, illegal landfills, increased summer tourism
- Climate trends: declining rainfall, water scarcity, rising temperatures, heat stress on forests, extreme weather events, dry and hot summers with strong winds, high biomass flammability
- Risks: desertification, landscape degradation, water scarcity, groundwater pollution (nitrates, arsenic), over-pumping for irrigation
- Vulnerable areas: Oreina Theretra, Marathasa & Solea (sensitive), winegrowing villages (critical zones)
- Governance challenges: fragmented fire management responsibilities across Forestry Department, Fire Service, Provincial Administration, Civil Defense, and Police, leading to overlapping duties, reduced coordination, and limited effectiveness

b. Land abandonment, water and soil management challenges

Troodos faces significant environmental pressures that threaten both its traditional landscapes and ecosystem services. The area's diverse topography, microclimates, and long-standing land-use traditions form a strong foundation for sustainable, low-impact agriculture capable of preserving biodiversity, improves soil and water management, and enhancing ecosystem services. However, the widespread abandonment of agricultural land is a central challenge -particularly terraced fields- leading to the degradation of terraced fields, loss of agricultural activity and agro-biodiversity, and increased vulnerability to wildfires, soil erosion and desertification risks. Without ongoing maintenance and recovery, these shallow soils become increasingly vulnerable to further degradation, loss of natural vegetation, and declining biodiversity, all of which are exacerbated by semi-arid climatic conditions and the growing impacts of the climate crisis which is especially pronounced in regions like Troodos.

The recovery and management of abandoned agricultural land is important because it addresses three interconnected agro-environmental goals:

a) environmental: preservation of ecosystem services; protection of terraces; prevention of wildfires, erosion, and desertification; regulation of natural elements such as water resources and microclimate; and the enhancement and shaping of the landscape,

b) productive: increase in the production of agricultural and livestock products to meet national agri-food needs and the recognition of the value of mountain products with their contribution to the natural environment, and

c) social: attraction of new farmers and renewal of the agricultural workforce in the Troodos region, fostering sustainable rural livelihoods and community vitality.

Reversing abandonment trends requires an integrated redesign of land-use, water, and soil-management practices. Declining farm activity reduced cultivated land, and inefficient irrigation: marked by network losses and the lack of a coherent system for monitoring boreholes and water consumption: underscore the need for coordinated, community-level planning. With groundwater levels steadily falling, improved water security should focus on conservation measures such as reducing leakage through modernized supply networks rather than further drilling.

Improvement of land and water management also intersects directly with biodiversity protection and fire prevention. Maintaining terraces, restoring vegetation, and applying controlled grazing can stabilize soils, reduce soil erosion and desertification risk, and support habitat diversity. Although grazing is restricted under the 2012 Forest Law, evidence from research and management plans shows that well-regulated sheep and goat grazing helps preserve biodiversity and reduces wildfire risk by managing undergrowth. However, recent wildfires have led the governmental departments to reevaluate the grazing activities around Residential Rural zones and Natura 2000 areas.

The region's rich floristic diversity further strengthens apiculture, which in turn supports pollination and ecosystem resilience while attracting beekeepers from across Cyprus. By aligning these natural assets: soil, water, biodiversity, and traditional practices: with local processing, branding, and nature-based tourism, Troodos can build a multifunctional and environmentally resilient rural economy.

c. Cultural Identity, Governance, and Integrated Landscape Sustainability

Cultural heritage and governance structures are central to sustaining Troodos as a productive, biodiverse, and culturally vibrant region. Traditional practices, such as terrace farming, pastoralism,

and beekeeping, not only support biodiversity and ecosystem services but also constitute a living expression of local identity. Products with geographical designations (PDO/PGI wines, oils, honey) reinforce this cultural pride, linking the landscape, local knowledge, and economic value. Similarly, the promotion of terroirs and other heritage sites highlights the intrinsic connection between natural and cultural landscapes, creating opportunities for heritage-based tourism that strengthens both awareness and livelihoods.

Governance and collaboration play a pivotal role in ensuring these opportunities are realized sustainably. Cooperative schemes, producer networks, and collective management structures enable local actors to access resources, share knowledge, and coordinate initiatives. Effective governance ensures that agriculture, tourism, and cultural heritage work in synergy, rather than in competition, supporting both ecological integrity and economic resilience.

7.6.2 Opportunities for economic diversification

Troodos's economy is deeply rooted in its multifunctional landscape, where agriculture, nature, and cultural heritage coexist and reinforce one another. This interconnected setting provides a strong foundation for sustainable development, particularly through land-use diversification that links traditional agriculture with tourism. High Nature Value (HNV) systems: such as terraces, vineyards, olive groves, pastoralism, and beekeeping: not only can sustain local livelihoods but also preserve the ecological integrity and scenic character of the region.

Integrating these practices into tourism offerings, for example through farm visits, tastings, and hands-on experiences, could significantly enhance income diversification for local producers while strengthening appreciation for traditional products and landscapes.

Despite this rich potential, tourism in Troodos has not yet fully capitalised on the assets provided by its agricultural and cultural environment. Although the institutional framework for visitable farms already exists, such farms have not been developed in practice, and structured tourist networks connecting agriculture, gastronomy, and heritage remain weak. As a result, tourism activity remains fragmented and does not systematically highlight or benefit from the region's agricultural identity. The absence of organised farm-based experiences limits opportunities for visitors to directly engage with local production systems, reducing the overall value that tourism could generate for rural communities.

A similar gap exists in the recognition and promotion of terroirs. While few quality designations such as PDO and PGI for local products exist (e.g. PDO halloumi cheese and PGI wines, cured meats, Agros Rosewater and Glyko Triantafyllo), the broader terroir potential of the region remains largely underacknowledged and insufficiently developed (e.g. oil, honey, potato, fruits etc.). Without stronger territorial branding and formal recognition of distinct agroecological zones, Troodos cannot fully leverage its high-quality products to enhance visibility, market value, and tourism appeal. Future initiatives: such as the development of terroirs and other heritage sites: can complement this effort by highlighting the unique interplay between landscape, culture, and gastronomy. However, such benefits will only materialise once terroir recognition and farm-based tourism structures are fully activated and integrated into the region's development strategy.

Cooperation and governance remain critical for unlocking these opportunities. Farmer cooperatives and collaborative schemes facilitate access to resources, knowledge, and markets, supporting the creation of new ventures. Strengthened collaborative structures would also improve the region's capacity to integrate agriculture, tourism, and heritage management, fostering a more resilient and diversified local economy.

In summary, Troodos can leverage its unique combination of HNV agricultural systems, cultural and agri-food products, and tourism potential to diversify its economy sustainably. Formal recognition of terroirs and the establishment of visitable farm institutions, combined with strong governance and cooperative frameworks, will enable these opportunities to support environmental preservation, socio-cultural vitality, and long-term regional resilience.

- Land-use mix (agriculture and tourism): Offers significant opportunities if managed sustainably; the institutionalization of *visitable farms* can create new development opportunities and has already been initiated.

- Tourism is a growth driver if aligned with local food and eco-experiences. There is a need to better organize the touristic product
- The ultimate goal is landscape-level sustainability and effective territorial governance: productive, biodiverse, and culturally vibrant Troodos mountains: productive, biodiverse, and culturally vibrant Troodos mountains.

7.6.3 Enabling versus Disabling Factors

The sustainable development of the Troodos mountains depends on balancing environmental stewardship, economic diversification, and cultural heritage preservation. The region's distinctive landscape: with terraced cultivation, traditional dry-stone structures, vineyards, orchards, and rich biodiversity: provides a strong foundation for multifunctional land use that integrates agriculture, tourism, and heritage-based activities.

Enabling Factors

Several factors support the ecological integrity and socio-economic vitality of Troodos:

- Multifunctional land use: The combination of agriculture, forestry, pastoralism, and tourism strengthens both ecological and economic resilience.
- Place-based branding and market recognition: PDO/PGI products, such as local wines, olive oil, and honey, provide economic value while reinforcing local identity.
- Small-scale artisanal production: Wineries, traditional bakeries, and other craft-based industries preserve cultural heritage and diversify income sources.
- Traditional mountain cultural systems: Practices such as terracing, dry-stone walls, and rotational grazing support carbon sequestration, soil retention, and biodiversity.
- Revitalization of cooperatives and producer groups: These networks facilitate resource sharing, knowledge exchange, and organization of sustainable initiatives.

Collectively, these enabling factors sustain productive, biodiverse, and culturally vibrant landscapes. They also provide a platform for linking economic development with environmental stewardship and heritage conservation.

Disabling Factors

Despite these strengths, several challenges constrain the sustainable development of Troodos:

- Land abandonment: Leads to terrace degradation, loss of agro-biodiversity, increased wildfire and erosion risks.
- Demographic decline: Reduces the labor force needed to maintain traditional agricultural and pastoral systems.
- Limited value-added production and distribution channels: Hinders economic viability of local agricultural and artisanal products.
- Fragmented environmental governance:
    - Management of forests, agricultural land, pastures, water bodies, Natura 2000 sites, and High Nature Value (HNV) areas is dispersed across multiple authorities.
    - Protected area regulations and strict environmental policies sometimes hinder integrated, mixed-use land management.
    - Insufficient stakeholder engagement limits participation in spatial planning, agri-environmental programs, and European HNV initiatives.
    - Underutilization of national and EU funding mechanisms restricts opportunities for local development.

These disabling factors reduce community ownership, constrain coordinated action, and threaten both the ecological and socio-economic sustainability of the region.

Integrating Enabling and Disabling Factors

Addressing Troodos' challenges requires coordinated, landscape-level governance that aligns environmental conservation, cultural heritage, and economic diversification. Opportunities for revitalization include:

- High Nature Value (HNV) systems: Vineyards, olive groves, pastoralism, and beekeeping can restore abandoned terraces, maintain biodiversity, and support heritage-based tourism.
- Cultural landscapes and place-based branding: PDO/PGI products link local identity to economic and symbolic value, enhancing both market recognition and community pride.
- Mixed-use land management: Coordinating agriculture, tourism, and heritage promotion strengthens livelihoods while preserving ecological integrity.
- Cooperatives and producer networks: Facilitate knowledge sharing, resource access, and sustainable project organization, helping to overcome structural and governance limitations.

By leveraging enabling factors and addressing disabling ones through integrated territorial governance, Troodos can maintain productive, biodiverse, and culturally rich mountain landscapes. Such an approach supports resilient natural and human systems, encourages younger generations to remain engaged in agriculture and rural life, and ensures that Troodos continues to thrive as a model of sustainable mountain development.

Table 20 - Cross-Cutting Themes: Enabling vs. Disabling Factors for Troodos

Dimension	Enabling Factors	Disabling Factors / Challenges	Examples / Impacts
Environmental Sustainability & Land Management	- Extended terraced cultivation- Traditional dry-stone structures- Trees and vineyards maintaining soil and carbon retention- High Nature Value (HNV) systems (vineyards, olives, pastoralism, beekeeping)	- Land abandonment- Terrace degradation- Loss of agro-biodiversity- Increased wildfire and erosion risk	- Well-maintained terraces support biodiversity and erosion control- Abandoned terraces in Marathasa, Krasochoria show overgrowth and erosion
Economic Opportunities & Diversification	- Mixed land use (agriculture + tourism) - Place-based branding (PDO/PGI wines, oils, honey) - Small-scale artisanal production - Visitable farms and eco-agritourism	- Low-value products - Limited distribution channels - Lack of coordinated tourism offerings	- Wine trails, honey tours, farm experiences can generate additional income - Without coordination, tourism fails to reach potential
Cultural Heritage & Governance	- Cultural heritage landscapes - Traditional mountain culture systems - Regeneration of cooperatives and producer groups - Community-based resource management	- Demographic decline - Limited local stakeholder participation - Strict environmental regulations limiting consensus on land use	- Cooperatives enhance market access and knowledge sharing - Without participation, policies may not align with local needs
Overall Landscape-Level Sustainability	Integration of environmental, economic, and cultural strategies	Fragmented management; competing pressures from abandonment, climate trends, and regulatory constraints	- Coordinated approach supports productive, biodiverse, and culturally vibrant landscapes

7.6.4 Other key issues

The Troodos mountains has historically been neglected as a development area, particularly between 2000 and 2017. This prolonged period of inattention contributed to urbanization and the decentralization of the region, reducing both economic activity and the management of natural resources.

Recent institutional developments, such as the establishment of the Office of the Commissioner of Mountainous Communities and the Declaration of the National Strategy for Troodos, have helped redirect attention and mobilize resources. These initiatives have facilitated access to European Union funds, enhancing both public and private capacity to support sustainable development in the region. However, these actions remain fragmented and are not always coordinated to maximize their impact.

Farmers in the region often lack the training to work in harmony with natural ecosystems, frequently managing the land with short-term profit as the primary goal. Agroecological approaches, such as regenerative farming practices, represent a pathway to re-establish a productive and sustainable relationship between farms and nature. The ultimate objective is to equip farmers with the knowledge and skills necessary to manage land and natural resources in ways that are both profitable and sustainable for future generations.

8 CROSS-TERRITORIAL SYNTHESIS: BARRIERS AND ENABLERS OF AGROECOLOGICAL TRANSITION

This section aggregates and confronts the STEP 0 contextual assessments led in the five TAPELINE territories[122] (Sections 3 - 7), drawing on a cross-comparison exercise conducted with the project partners. Results are organized by cross-cutting theme:

1. Demography, generational renewal & workforce
2. Structural rearrangement
3. Land tenure & land-use dynamics
4. Climate, water quality & environmental pressures
5. Farming systems, agroecological assets & multifunctionality
6. Markets, value chains, quality schemes & organic farming
7. Policy & institutional frameworks
8. Knowledge, advisory systems & socio-cultural relationship to change

Each theme is described, covering how it manifests across territories, where situations diverge markedly, and whether – and how – it functions as a barrier, an enabler, or both depending on local configurations.

8.1 Overview of cross-cutting thematics

8.1.1 Demography and generational renewal

Ageing of the farming population and the question of generational renewal is reported in all five territories and is treated as a barrier throughout: it threatens farm continuity and the uptake of innovative practices. The age distribution of the farming population is a top-scored concern in Wallonia; in Valais, ageing is compounded by farming models based on secondary employment; in Troodos, 50% of farm managers are older than 65; Lazio combines ageing farmers with the depopulation of inner areas; Saxony-Anhalt faces demographic ageing and shrinkage, selective out-migration and labour-market restructuring.

In Valais, the collective alpine-pasture institutions are noted, however, as supporting knowledge transmission and youth retention, representing one of the few concrete levers identified against generational challenges.

8.1.2 Structural rearrangement

This demographic pressure sits alongside a broader structural decline and concentration of farms across the territories: diminishing numbers of farms and increasing farm size in Wallonia; in Cyprus, the number and cultivated area of holdings decreased by 12.4% and 10% respectively between 2011 and 2024, and in Troodos specifically fewer than 5% of holdings manage more than 30% of the agricultural area; declining farm numbers are also reported in Lazio; in Switzerland, the number of farms in mountain and hilly regions dropped by roughly 50% between 2016 and 2024.

The resulting farm-structure profiles diverge, however, sharply across territories: Saxony-Anhalt's average farm size (approximately 280.78 ha, against 65.04 ha for Germany overall) contrasts with the roughly 60% of Troodos farms below 1 ha, the small and highly diverse holdings of Valais, and Lazio's heterogeneous structures ranging from intensive peri-urban agriculture to marginal inner areas. Wallonia occupies an intermediate position, with a continuous farm-enlargement trend.

[122] For easing the cross-comparison, the following acronyms are used to refer to the territories : WAL (Wallonie, Belgium) ; SA (Saxony-Anhalt, Germany); VAL (Valais) ; LAZ (Lazio, Italy) and TRO (Troodos, Cyprus)

Workforce constraints are reported in Wallonia (restructuring of the agricultural workforce), Saxony-Anhalt (debates on working conditions in agriculture) and Lazio (difficulty finding agricultural labour).

8.1.3 Land tenure and land-use dynamics

Land-tenure insecurity and difficult access to land is reported in all five territories, consistently as a barrier limiting long-term investment. In Wallonia, land-price inflation and volatile access to land are the dominant expression; in Saxony-Anhalt, most farmers do not own the land they manage, which specifically disables long-cycle practices such as agroforestry and hedge planting; in Valais, young entrants without farming heritage face difficult access, compounded by competition for land with tourism and construction; in Troodos there is a mismatch between declared and actually managed land, alongside fragmented holdings; in Lazio, farm fragmentation coexists with competition for land from photovoltaic installations.

Divergent land-use dynamics are oberved according to the geographical context: the mountain territories (Valais, Troodos) face land abandonment, including natural forest encroachment on formerly farmed land in Valais, and abandoned terraces driving erosion and wildfire risk in Troodos, while lowland systems (Wallonia, Lazio) face land competition and intensification pressure, expressed as land-price inflation in Wallonia and competition with photovoltaic plants in Lazio. In Valais and Troodos specifically, abandonment feeds a degradation loop: encroachment and loss of open agricultural landscapes in Valais, and degradation of terraces, loss of agrobiodiversity and higher wildfire and erosion risk in Troodos. At the same time, Trodoos recognizes abandoned land as a recoverable productive asset that could be reactivated through knowledge, local practice and collective governance rather than high capital investment. The same abandoned-land stock is thus read as both a barrier today and a potential enabler if governance and knowledge conditions change.

8.1.4 Climate, water quality and environmental pressures

Climate change is reported as a first-order pressure in all five territories: droughts, heavy rainfall and increasing water and wind erosion in Saxony-Anhalt, with a mean warming of +1.5°C and declining soil moisture; water scarcity, wildfires and multiple natural hazards in Troodos and Valais; climate-change mitigation and adaptation among the top-scored concerns in Wallonia; groundwater quality pressures shared by Lazio, Saxony-Anhalt and Wallonia. Water quality and agro-chemical pressure is a closely related, partially overlapping theme: nitrates and pesticides in water resources in Wallonia; chemical pollution of groundwater and surface water in Saxony-Anhalt, where "Rote Gebiete" carry stricter fertilisation rules; and, in Lazio, Nitrate Vulnerable Zones extending over approximately 238,300 ha, of which around 146,028 ha is agricultural land.

8.1.5 Farming systems and multifunctionality

The dominant farming systems differ markedly by territory: 77% of agricultural land in Valais is grassland; large arable and dairy enterprises dominate in Saxony-Anhalt; field crops coexist with grassland-based livestock systems in Wallonia; Troodos is characterised by traditional polyculture of vineyards, olive groves and fruit trees on terraces; and Lazio spans seven contrasting agroecosystems, from Roman horticulture to extensive inner-area systems.

This diversity of systems is also where territories report genuine pre-existing agroecological assets: Wallonia's mixed low-input systems show high resilience and autonomy, good potential for crop-livestock integration and a well-conserved landscape; Valais's grassland-based extensive systems carry heritage-linked production value and tourism-diversified farm incomes, though the isolation of lateral valleys poses some constraints; Troodos's terraced cultivation, dry-stone structures and

tree-based polyculture represent high ecological value with agritourism potential; Saxony-Anhalt already hosts model farms for agroforestry and is debating bioeconomy development and renewable-energy demand, including agroforestry-fed local heat networks; and in Lazio, multifunctional agriculture and rural multi-entrepreneurship, plus agrivoltaics are debated as enabler – reducing on-farm energy costs and aiding adaptation to extreme weather.

8.1.6 Markets, value chains, quality schemes and organic farming

Quality schemes and territorial identity are recurring assets: a high density of PDO/PGI products in Valais; a wide range of quality labels (PGI, DOC, DOCG) in Lazio; recognised but under-utilised quality mountain products in Troodos; and emerging agroecological mid-sized value chains with strong MAP interest in Wallonia. These schemes double as enablers when they open more remunerative markets and help maintain landscapes – the Raclette du Valais PDO is the clearest example – and Troodos and Lazio both see potential for further territorial branding. However, in Valais, the PDO system is described as having paradoxically weakened traditional farming systems by not specifying the natural production context, to the benefit of lowland dairy producers.

Organic farming shows an uneven, market-dependent trajectory across the five territories: it peaked at 12% of the UAA in Wallonia in 2020 before declining for lack of market outlets; stands at 14.6% of farms and 9.8% of agricultural land in Saxony-Anhalt; reached 173,950 ha in Lazio in 2022 (7.4% of the national organic UAA); covered 5.87% of Cyprus's cultivated area in 2023; and remains less developed in Valais than in other Swiss regions. This pattern connects directly to a shared barrier: market and outlet limitations, reported in Wallonia, Saxony-Anhalt, Troodos and Valais.

Value-chain configurations themselves diverge sharply: omnipresent vertically integrated industrial chains in Wallonia; cooperative- and PDO-structured chains in Valais; low-value products and limited distribution in Troodos; a strong chemical industry alongside an emerging bioeconomy sector in Saxony-Anhalt; and multifunctional agriculture combined with quality labels in Lazio. Cooperatives, producer groups and farmer networks act as a partial counterweight and shared enabler in Valais (producer cooperatives in meat and milk enabling short circuits), Troodos (regeneration of cooperatives and producer groups), Wallonia (farmer networks around organic and conservation agriculture) and Saxony-Anhalt (solidarity farming / SoLaWi initiatives). A further shared barrier, transition costs and lack of financial security during conversion, is reported in Wallonia (discouraging farmers from changing model), Saxony-Anhalt (short-term, high-investment costs calling for financial incentives or risk-mitigation mechanisms) and Troodos (land management oriented to short-term profit).

The market in Wallonia is further characterized by the increased competition between innovative value chains for limited market shares and a disconnection from local food traditions that constraint the development of agroecology-related products. However, downstream actors in the territory, notably retailers, are increasingly seeking to translate ESG/CSRD commitments into measurable farm-level agroecological indicators.

8.1.7 Policy and institutional frameworks

The institutional setting itself differs structurally: four territories operate under the CAP, while Valais follows the Swiss direct-payment system; Saxony-Anhalt is a further outlier, operating within a distinct East-German transformation context (coal phase-out by 2038, structural development programmes, a regional bioeconomy strategy). Public support frameworks play, nonetheless, a structuring role everywhere: CAP eco-schemes, agri-environmental measures and targeted regional agroecology programmes in Wallonia; eco-schemes and rural development measures incentivising agroforestry, crop diversification and reduced input use in Saxony-Anhalt; mountain-specific provisions of the CAP Strategic Plan 2021–2027 in Troodos; land and youth

policy tools and the Agricultural Plan of the Lazio Region in Lazio; and, outside the CAP, the Swiss direct-payment system in Valais, including payments for biodiversity promotion. These payment schemes are consistently framed as enablers.

The same policy landscape also generates friction, reported in Wallonia (imbalance of CAP support between coexisting farming systems), Saxony-Anhalt (difficulties maintaining hedges and other landscape features in the way farmers judge best), Troodos (strict environmental protection limiting consensus on mixed-use land management in protected areas such as Natura 2000), Lazio (at least three partially overlapping planning instruments governing renewable-energy installations on farmland), and Valais (high dependence of farms on subsidies).

Furthermore, Saxony-Anhalt partners raised a central concern associated with the lack of long-term planning, compounded by the stricter fertilisation rules in "Rote Gebiete". On the other side, the post-coal structural transformation, which channels public programmes towards a circular bioeconomy (the Structural Development Programme, the DiP initiative) offers great potential for agroecology and agroforestry sectors. In Troodos, fragmented governance limits prevention and restoration capacity, and farm-based tourism remains undeveloped despite an existing institutional framework. Nonetheless, the renewed institutional momentum in Troodos (Commissioner for Mountainous Communities, a National Strategy for Troodos, EU funds) offers a unique opportunity to develop agroecology-related activities in the region. In Lazio, the ongoing regional agricultural territorial-planning process – in which the study team is directly involved – offers a concrete institutional entry point for embedding agroecology.

8.1.8 Knowledge, advisory systems and socio-cultural relationship to change

The socio-cultural relationship to transition diverges markedly across four of the five territories (this theme was not raised as a distinct issue in Lazio). Many farmers in Saxony-Anhalt perceive their systems as already sustainable and are reluctant towards the idea of transformative change – a stance echoed in the shared barrier of psychological and cultural resistance, alongside Wallonia (farmers' psychological barriers to adopting conservation and organic practices) and Troodos (training gaps and short-term profit orientation). By contrast, farming is strongly embedded in cultural heritage in Valais (heritage breeds, alpine-pasture institutions) and Troodos (terraces, dry-stone structures) – a heritage embedding that, in Valais specifically, is credited with supporting knowledge transmission and youth.

A related shared barrier is knowledge and advisory gaps, reported in Wallonia (a dual advisory landscape generating divergent recommendations), Saxony-Anhalt (questioned adequacy of agricultural extension services) and Troodos (lack of farmer training for ecosystem-based management). In Wallonia, the coexistence of commercial and independent advisory systems generates a heterogeneous knowledge environment.

8.2 Implications for the territorial strategic roadmaps

The cross-territorial comparison confirms that agroecological transition is not constrained by a lack of technical solutions alone, but by the interaction of demographic, economic, institutional and socio-cultural factors that shape the capacity and willingness of farmers and other value chain actors to change. While the five territories differ considerably in their farming systems, geographical conditions and governance arrangements, they share a consistent set of structural challenges: an ageing farming population, difficulties in accessing land, increasing climate and environmental pressures, uncertainty regarding the economic viability of transition, and the need for more coherent policy and advisory support.

The comparison illustrates that these barriers rarely operate in isolation. Instead, they reinforce one another. For example, insecure land tenure discourages long-term investments in agroforestry and landscape restoration; limited market opportunities reduce incentives to adopt environmentally beneficial practices; fragmented governance weakens collective management of natural resources; and demographic decline exacerbates labour shortages while reducing opportunities for knowledge transfer. Agroecological transition should therefore be approached as a systemic process requiring coordinated interventions across multiple domains rather than isolated measures.

A second lesson is that identical themes can play contrasting roles depending on the territorial context. Land abandonment, for instance, constitutes an immediate environmental and socio-economic challenge in mountain territories, yet also represents a strategic reserve for restoring productive landscapes if accompanied by appropriate governance, collective action and knowledge support. Similarly, quality labels and territorial branding can create substantial added value when effectively linked to local production systems, but may fail to reward agroecological practices if disconnected from their environmental and cultural context. Existing institutional frameworks can likewise function either as enabling conditions or as sources of administrative complexity depending on their coherence and long-term stability.

The assessment further highlights that all territories already possess significant agroecological assets on which future transition pathways can build. These include resilient mixed farming systems, permanent grasslands, traditional terraced landscapes, agroforestry initiatives, multifunctional agriculture, cooperative networks, quality schemes and strong territorial identities. The roadmap should therefore prioritise the mobilisation and strengthening of existing territorial resources rather than promoting entirely new production models. Agroecology emerges less as a radical replacement of current farming systems than as a process of enhancing existing ecological functions, local knowledge and territorial cooperation.

Across territories, the analysis also points to several cross-cutting priorities for action. These include improving generational renewal and access to land, reducing the economic risks associated with transition, strengthening advisory services and farmer-to-farmer learning, creating stable market opportunities that reward agroecological performance, and ensuring greater policy coherence across agricultural, environmental, spatial planning and rural development instruments. Particular attention should be given to governance mechanisms capable of coordinating actors across sectors and scales, since many of the identified barriers extend beyond the farm level.

Finally, the comparison confirms the value of adopting a territorial approach to agroecological transition. Although common strategic priorities can be identified across the TAPELINE territories, their implementation must remain place-based and adapted to local ecological, socio-economic and institutional conditions.

9 FARM TYPOLOGIES AND SAMPLING STRATEGIES IN EU TERRITORIES

9.1 Methodology

9.1.1 Pre-existing approaches

Performing exploratory analyses on structural factors of production to classify farming systems is not specific to the TAPELINE context: it has been tested and documented in a variety of European contexts. To position the TAPELINE workflow within this literature, a narrative review of existing farming-system classifications in Europe was initiated by MLU. Papers were retrieved through a desk research combining three groups of keywords - ("farming system*" OR "farm system*" OR "agricultural system*" OR agroecosystem*) AND (classification OR typology OR typologies OR categorization) AND (Europe OR "European Union" OR EU) - and screened so that every major typology method, major European farming context and major time period is represented at least once. After screening, a first set of 20 papers were selected for in-depth analysis against a review grid (see Appendix 12.7). The retained studies (i) explicitly classify farming systems, farms or agricultural production systems, (ii) describe the methodology used to create the typology, and (iii) present the resulting categories as a main result; studies merely applying existing typologies, or focused solely on performance, sustainability or policy impacts, were excluded. The corpus was balanced across arable, livestock, mixed crop–livestock, Mediterranean, intensive/extensive and organic/conventional systems, and the analysis addresses how each study defines a "farming system", which dimensions are included (production characteristics, economic structure, environmental conditions, social aspects, institutional factors), and whether the framework builds on established typologies or novel concepts. The methodological filiations & main results associated with this set of selected works are also reported in Appendix 12.7.

The analysis grid is organized along four overarching themes: (1) the conceptualization of farming systems, (2) data and indicators, (3) classification methodology, and (4) usefulness for policy and sustainability assessment. Across the reviewed corpus, classifications range from EU-wide to regional and local case studies, at farm, household, landscape or NUTS scales; data sources are dominated by FADN, Eurostat, national agricultural censuses and farm surveys, with more recent studies mobilizing IACS/LPIS and remote-sensing data; and methods span cluster analysis, principal-component and multiple-correspondence analyses, latent-class and latent-profile models, archetype analysis, self-organizing maps and other machine-learning approaches. The resulting typologies typically identify three to eight interpretable groups built primarily on structural and production variables, while the sustainability dimensions (economic, environmental, social) remain unevenly integrated. More broadly, national censuses and the FADN have long supported more or less complex farm typologies at various scales.

9.1.2 Approaches used within TAPELINE

For each pre-typologies defined in specific project territorial contexts, the aim was to estimate the distribution of the farm population across different categories or groups predefined.

The central objective pursued through this process was to be able to answer the following research question: are specific farming system (e.g. crop farming system) characterized by higher level of engagement of practices (Step 1), socio-economic or environmental outcomes (Step 2), or stronger correlation between practices and outcomes (Step 3) ; and ; if a larger heterogeneity between farmers was found within specific groups in terms of engagement in agroecology and/or outcomes;

The distribution of the farm population across the clusters identified are also used either for planning a stratified sampling strategy (e.g. in Cyprus) or controlling (ex-post) the span between the sample selected and the population of farmers (other countries).

Two methodological workflows have been developed within the project to design 5 robust, representative & comparable typologies of farming systems, translating the Step 0 methodological step recommended by the FAO ahead of the TAPE implementation:

- A shared exploratory statistic approach led across Wallonia (9.2), Saxony-Anhalt (9.3), Lazio (9.4), and Valais (9.5): relying on IACS data; leading to a predefined set of *Farming System Orientations* (FSO) :
  - Wallonia: 10 FSO (including 5 archetypal and 5 mixed-diversified systems) ; retrieved across 4 Regrouped agricultural regions (RAR)
  - Saxony-Anhalt: 9 FSO ; retrieved across 4 *agroecological zones (AEZ)* and 5 *Boden-Klima-Raüme zones* (*BKR*, official soil-climate zones)
  - Lazio: 10 FSO including 5 specialized & 5 mixed systems ; retrieved across 7 regional agroecosystems.
  - Valais: 10 FSO including 5 specialized and 5 mixed systems.

- An alternative semi-quantitative method used in Troodos (9.9); relying on regional statistics (including technical-economic orientations of farms) and other structural factors (socio-demographic variables, economic sizes…) to discriminate farm production systems. Quantitative dataset biases were addressed through qualitative operations based on field knowledge. This work was used also to design a stratified sampling strategy.

One of the main motive behind searching for such alternative approaches to develop the pre-typology ahead of leading the TAPE campaigns was that the official classification of farm holdings proposed by the EU Commission (*Technical-Economic Orientations defined under EU Commission regulation No 1242/2008)* was observed (a) under review and difficult to retrieve at population level from regional administrations and (b) unrepresentative of farming system diversity known by local experts (especially in the context of Troodos). That is why the project partners sought for more informative approaches to distinguishing better local farming production systems in line with local knowledge, while aiming to ensure the reproducibility of the workflows developed to other EU territories.

In this context, TEO attributions, when available (Wallonia, Switzerland), were used solely to better define the boundaries of the population and better align it with the sample collected; and further discrimination of the rescoped population was further led through the alternative statistical & semi-qualitative approaches introduced above.

9.1.3 Statistical methods used

Pre-typologies exposed in Sections 9.2 to 9.5 were defined at the target population level based on a shared workflow relying on IACS structural factors of production (crop & livestock), using both hierarchical clustering on principal components (HCPC) and archetypes analysis (AA) methods explained below:

(1) : **Hierarchical Clustering on Principal Components** [296] is a three-step multivariate method implemented in the *FactoMineR* package (Husson, Josse and Pagès, 2010). First, a principal component method (PCA for continuous variables, MCA for categorical, MFA for structured groups) is applied to the dataset, reducing dimensionality and denoising the data by retaining only the first principal components. Second, hierarchical clustering using Ward's criterion is performed on these components rather than on raw data, yielding a more stable partition; the optimal number of clusters is determined empirically by minimizing the ratio of successive between-inertia gains. Third, a K-means consolidation step refines the partition obtained from the dendrogram.

(2) : Archetypal Analysis (AA) is an unsupervised dimensionality reduction method that characterizes a dataset through a set of k archetypes: extreme, prototypical observations lying on or near the convex hull of the data cloud. Unlike clustering methods that assign each observation to a

single group, AA represents each observation as a convex combination of archetypes, and each archetype as a convex combination of the original observations, thereby preserving interpretability in the original variable space. The method minimizes the residual sum of squares between observed data points and their archetype-based reconstructions, solved iteratively via an alternating least-squares algorithm with simplex constraints. The number of archetypes k is typically selected by inspecting the elbow of the reconstruction error curve as a function of k. AA is particularly suited to datasets where the structure of interest lies at the boundaries of the data distribution rather than at its center, making archetypes more interpretable than cluster centroids in contexts characterized by mixed or gradient-like profiles. Its implementation in R is provided by the archetypes package [301].

9.2 Farming system orientations and sampling in Wallonia

The study population is located in Wallonia, Belgium [NUTS level 1 - BE3], which covers a total area of 16,900 km², and a population of 3,692,283 inhabitants in 2024. In 2024, the UAA represented 7,320 km², equivalent to 732,000 hectares. 12,381 farm units were accounted by the regional administration [15]. The sample size was calibrated around a target of 100 holdings, including at least 30 holdings from the Farm for Good network (certified organic and regenerative agriculture). By July 2026, this target was approached with 90 farmers surveyed ; including 32 originating from the Farm for Good network. The sampling strategy was operated around convenient method (cold calling on existing contact lists, farmer's networks) and snowball method within agroecological & conventional networks identified at local & regional level. Additional sampling criteria considered during the iterative and progressive weighting of the sampling process (adjustments): organic certification, agricultural region, size, market access. Feedback and advice from enumerators to diversify the sample were also taken into account during the process to diversify as much as possible the farming system orientations and farming models (including conventional farm management systems). Ex-post control criteria for assessing the representativeness and bias induced by the distribution of farms sampled including Share or organic farms, share of farms across Technical & Economic Orientations (TEO) and -later defined- *Farming Systems Orientations* (FSO).

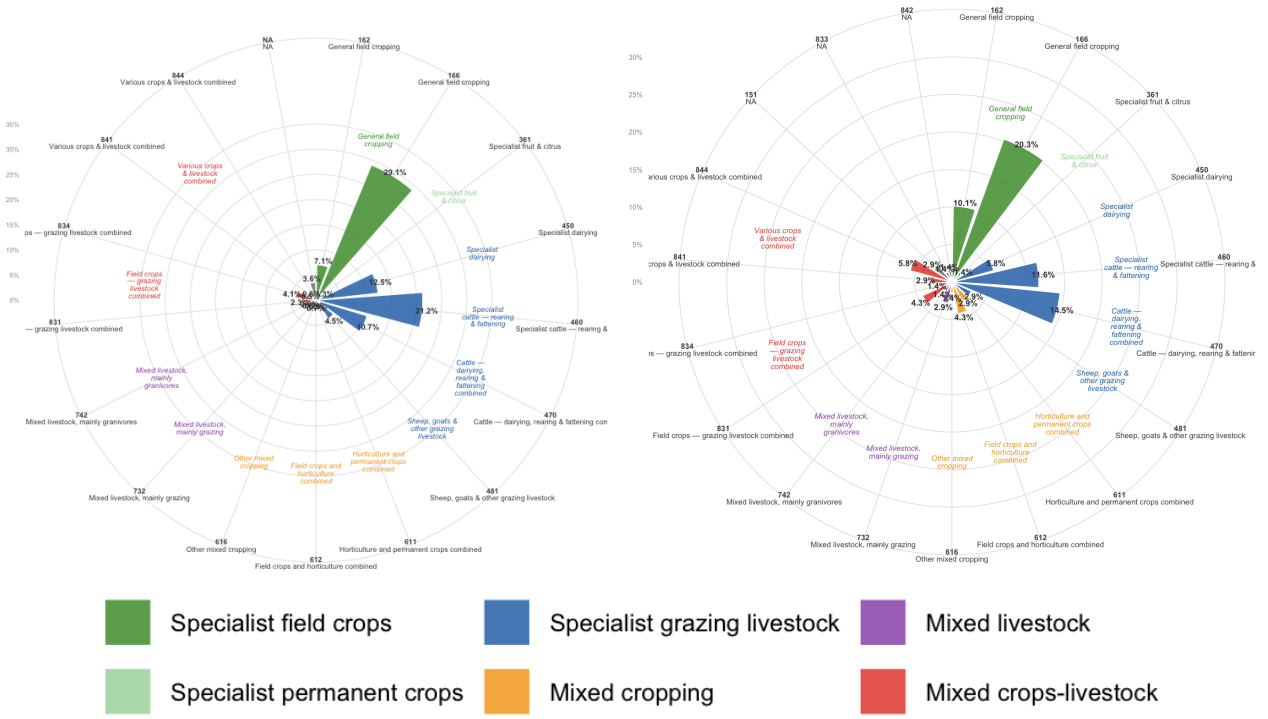


Figure 133 - [LEFT] Distribution of the farm administrative units registered in the Walloon Integrated Administration and Control System (IACS) in 2024 across the Technical-Economic Orientations (TEO) defined under EU Commission regulation No 1242/2008, within the sampling perimeter. [RIGHT] Distribution of the farms sampled and matched to the regional IACS across the TEO's.

The case study farm population was initially oriented towards crop farming systems (TEO 1[123]) and mixed crop-livestock systems (TEO 8[124]). Regional IACS data shows that in 2024 ; 36% of all farms fall within TEO 1 and 10% within TEO 8 in 2024. Thus, the targeted population represents around 46% of the overall farm population on the territory. The same year, TEO 1 accounted specifically for 35% of UAA and TEO 8 for 15% of UAA. Overall, around 50% of UAA and a similar fraction of the regional farm population was thus initially framed by the sampling scope.

However, the snowball sampling process led to a wider perimeter of farming orientations, including livestock-oriented systems (Figure 133). The perimeter of the target population was then reframed after the data collection using the observed TEO as filter.

This way, the discriminating process is deliberately restricted to the orientations the sample can speak to. Concretely, the subset is obtained by joining the IACS to the regional TEO reference table and then filtering to the set of TEO codes observed in the sample.

This final perimeter spans six of the eight groups:

- specialist field crops (TEO 1),
- specialist permanent crops (3),
- specialist grazing livestock (4),
- mixed cropping (6),
- mixed livestock (7)
- mixed crops-livestock (8)

Two specialist groups remain excluded from the sampling: horticulture (TEO 2) and granivores (5) : they fall outside the study perimeter and are dropped. After applying this filter, roughly 11,540 holdings still enter the rest of the discriminating process, i.e. about 77% of the ~14,950[125] TEO-typed IACS holdings. Within this retained population, specialist grazing livestock (~51%) and specialist field crops (~37%) are by far the dominant orientations, followed by mixed crops-livestock (~8%), while permanent crops, mixed cropping and mixed livestock together account for only a few percent.

The output of the HCPC algorithm processed on the Walloon IACS data is showed through *paragons*[126] in Figure 134 around the key discriminating factors entering in the PCA and clustering analysis. The raw distribution across regions (RAR) is shown in Figure 135.

[123]Definition based on EU Commission Regulation (EC) No 1242/2008 : *At least 2/3 of production value from arable crops*
[124] Definition based on EU Commission Regulation (EC) No 1242/2008 : *At least 1/3 of production value from arable crops ; and at least 1/3 of production value from herbivores & fodder crops.*
[125] the farm count is higher than the ~12.400 farms reported by the regional administration. The working assumption is that this reflects an artefact of the administrative identification system: a single physical farm unit could appear under two distinct producer identifiers (for example a separate ID for crop and animal declarations, or holdings split across two legal entities/declarants).
[126] Paragons denote the most characteristic observations within each cluster derived from Hierarchical Clustering on Principal Components (HCPC) algorithm. Selected as the individuals closest to the cluster's centroid in the reduced principal component space, they encapsulate the modal or extreme values of the discriminating variables (e.g., production factors, structural traits) that define the cluster's profile.



Figure 134 - Description of the 5 clusters defined at regional level using the HCPC algorithm [296] on restrained Walloon IACS. Production factors (animal and crop productions) were aggregated into 16 categories.

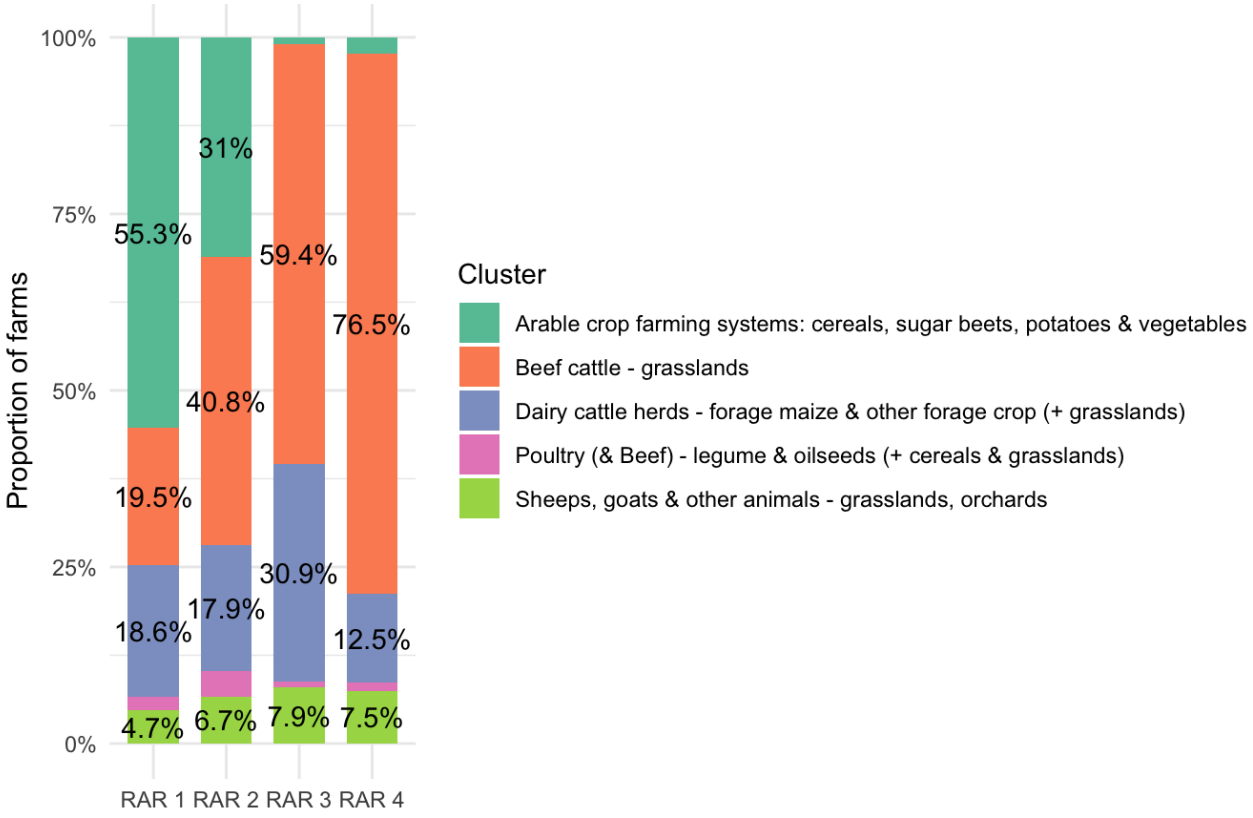


Figure 135 - Distribution of Walloon farms - registered in the regional IACS - into clusters across regions (RAR)

Similar to the exercise based on clustering, an overview of the results of the archetype analysis applied to the Walloon IACS is presented in Figure 136 and Figure 137.



Figure 136 - Description of the 5 archetypes and the undifferentiated group (bottom-right corner) defined at regional level using the archetype method [294]on restrained Walloon IACS.

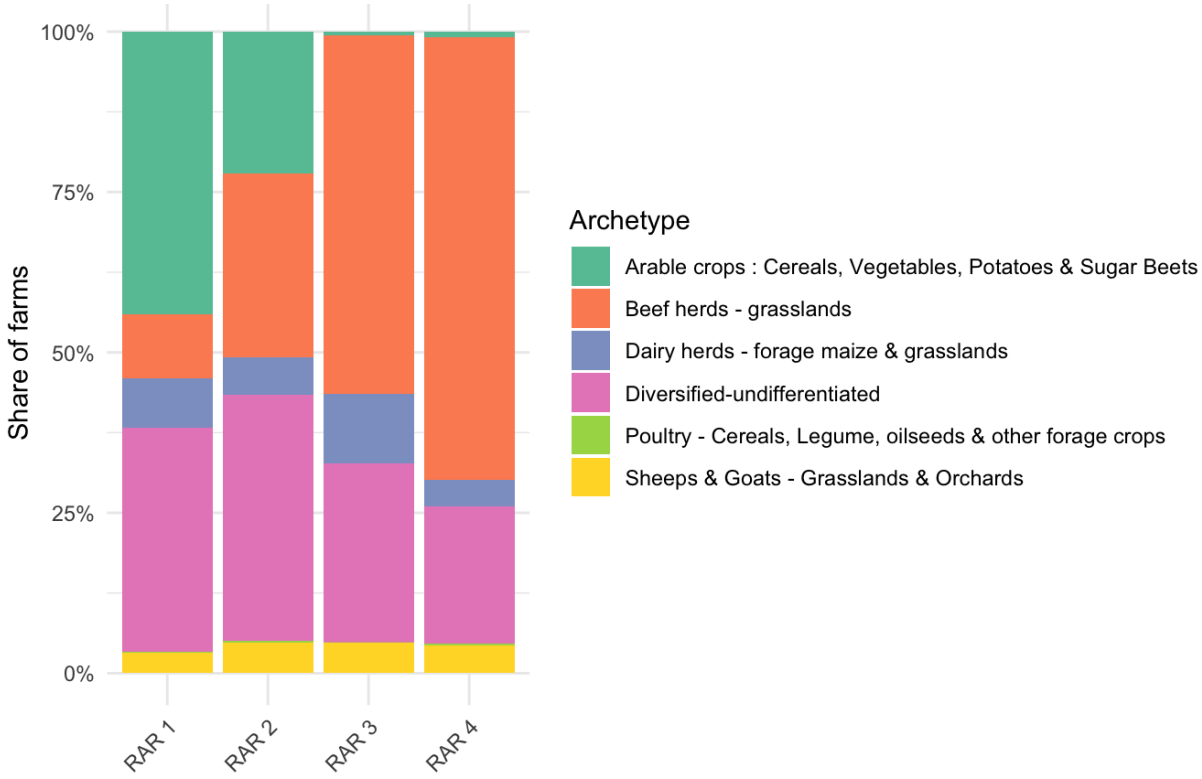


Figure 137 - Allocation of Walloon farms - registered in the regional IACS - into archetypes across regions (RAR)

Crossed allocation and merging into 10 Farming Systems Orientations (FSO)

Ferdinand and Baret [295] proposed a classification method grounded on the intersection of archetypal analysis and hierarchical clustering analysis, developed to identify and categorize the diversity of farming practices at the regional level. Unlike standalone archetypal analysis, which classifies only individuals sufficiently close to an archetype and may result in a high proportion of unclassified observations, the combined approach increases the proportion of classified farmers while allowing for the distinction between CA-types with extreme and salient practices and intermediate types comprising farmers whose practices fall between these references. This method was applied to the study of Conservation Agriculture practices in Wallonia, Belgium, based on a survey of 48 farmers, and is designed to be replicable in other regional contexts by adapting input variables according to local knowledge. The methodology developed in the present study is directly derived from this analytical framework.

A four-step process is applied to classify the observations (Figure 138):

1. First, each group of farms whose maximum alpha coefficient is ≥ 0.64 and thus significantly attached to one single archetype lead to 5 core Farming System Orientations (FSO_1 to FSO_5).
2. Then, farms that could not be attributed to a single archetype (alpha coefficients < 0.64, "Diversified-undifferentiated" column) are re-allocated using their attached HCPC cluster. Because each cluster is structurally closest to one of the 5 archetypes, this produces 5 "mixed: close to one archetype" groups. Those mixed groups act as intermediate between two archetypal FSO's (e.g., MIX_4 ~ *Integrated crop and livestock systems* in between FSO_1 / *Arable crops* and FSO_4 / *Beef herds*).
3. The aggregated profile of each FSO group is then recomputed around core discriminating factors and the distribution across subregions is compared (Figure 141).
4. Finally, all descriptive variables not yet included in the exploratory analysis are used as observatory factors to illustrate the FSO (Figure 142, Figure 143, Figure 144, Figure 145, Figure 146, Figure 147, Figure 148).

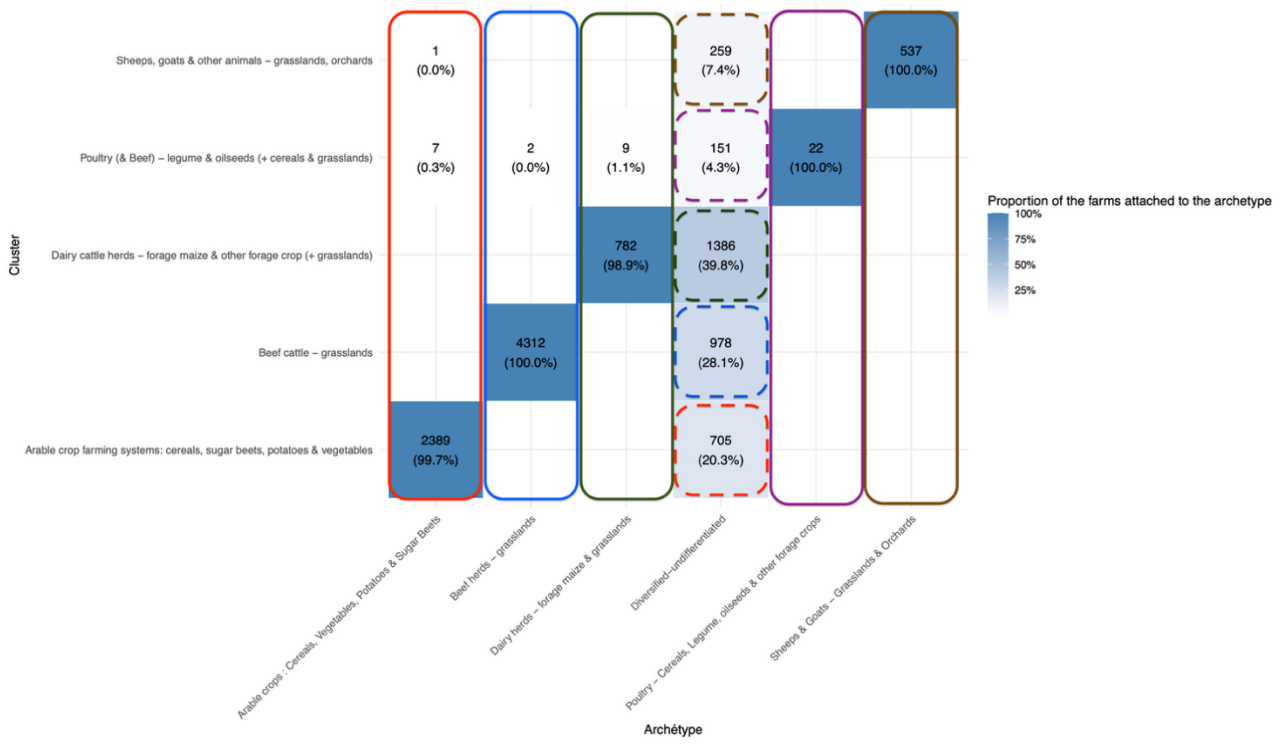
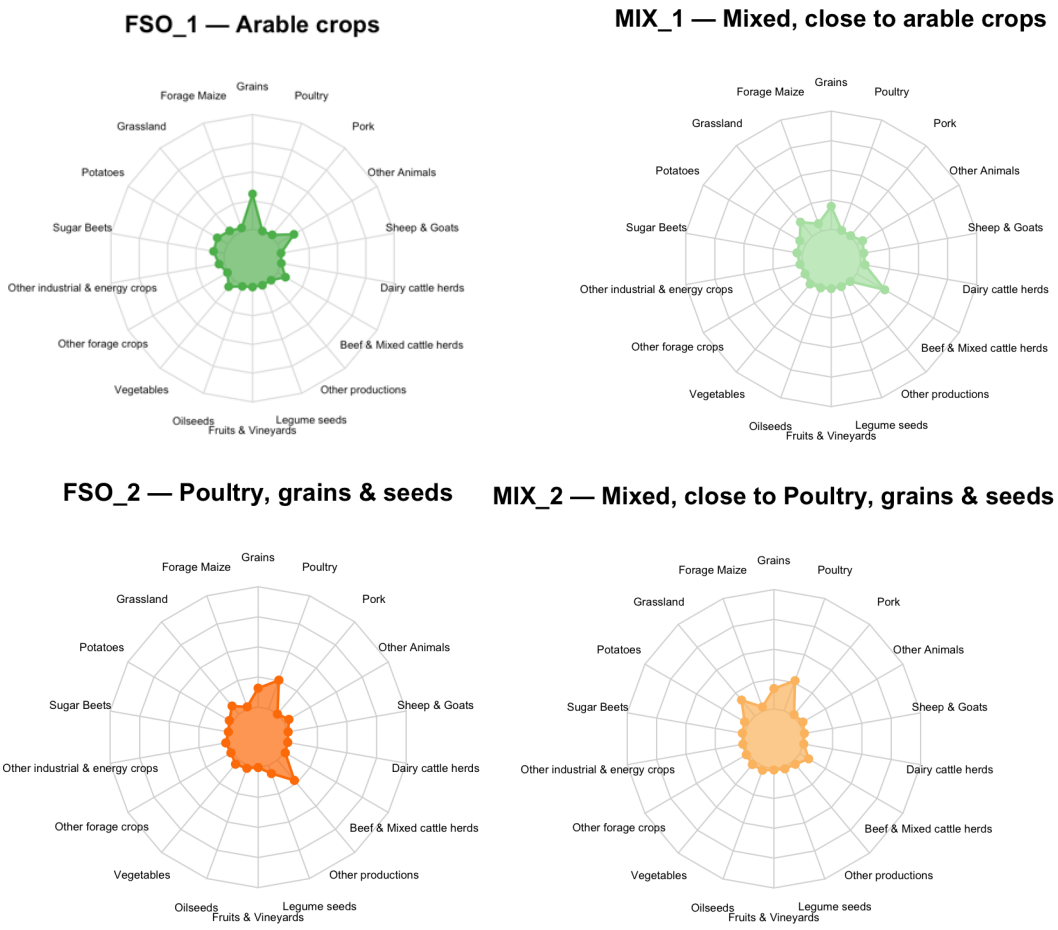


Figure 138 - Number of farms allocated to the 5 clusters and 5 archetypes created in Wallonia, and grouping process into Farming System Orientations (FSO)



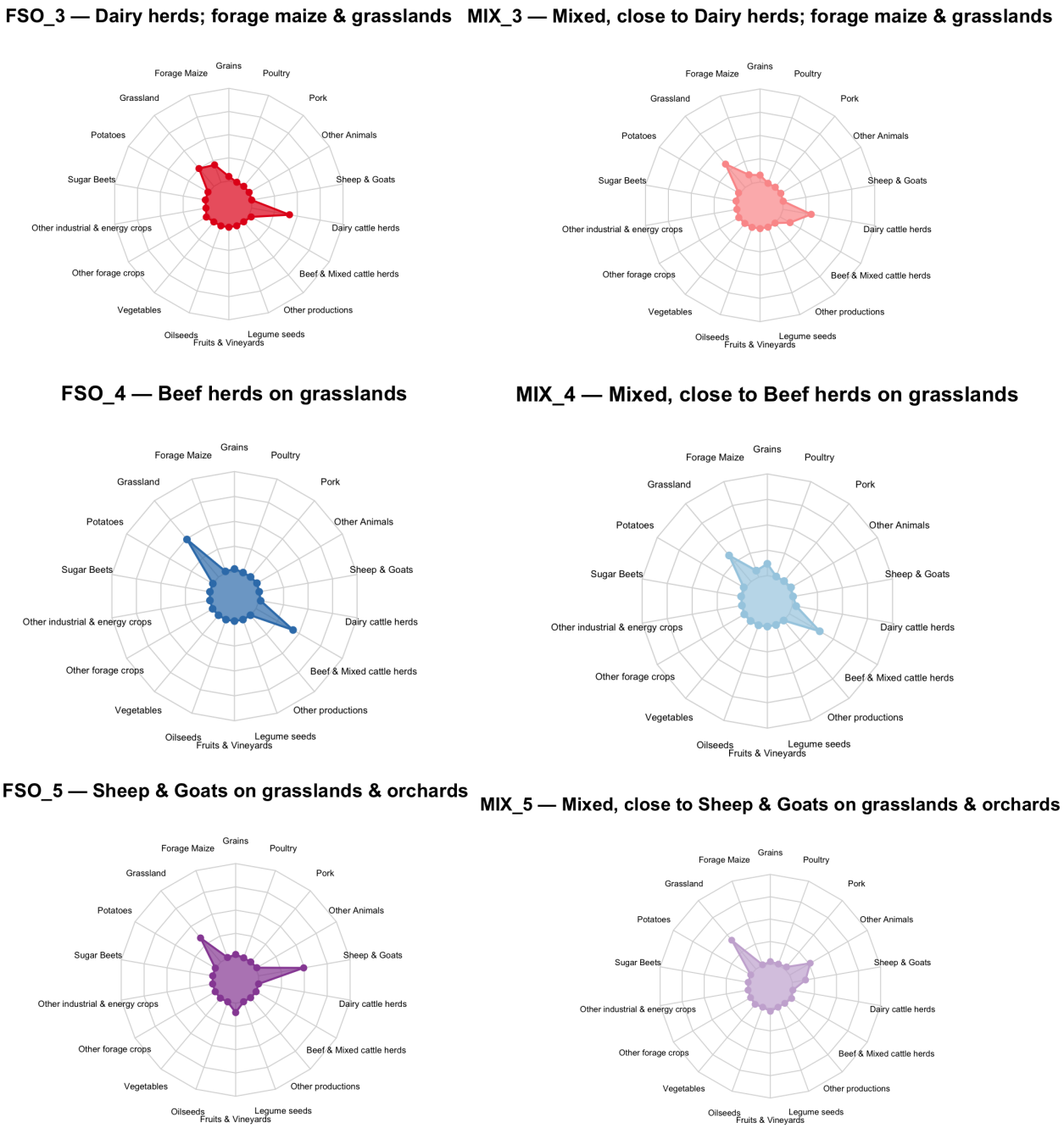


Figure 139 - Discriminating factors describing the 10 Farming System Orientations (FSO) after grouping clusters and archetypes attributions.

The allocation of farms across FSO can be illustrated considering the archetype profiles as the edges of a 5-dimensional space englobing the full set of farms in the IACS population (Figure 140). The mixed groups (light opacity) are constituted from the farms attributed to a cluster matching with a specific archetypes. They are more diversified systems ; non-significantly associated with any of the archetypes but yet remain close to one or several of those.

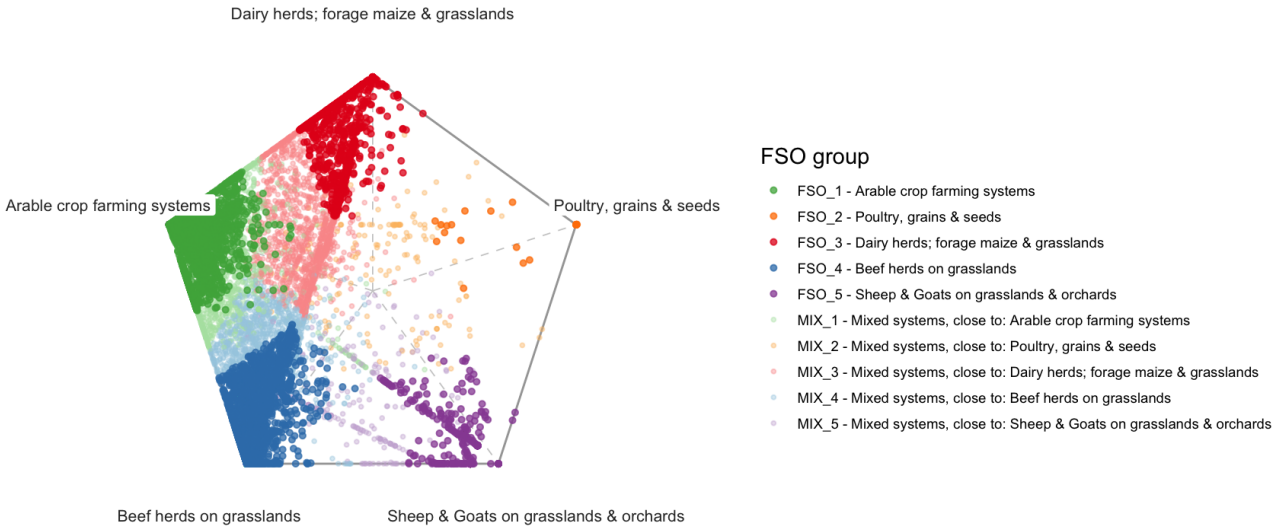


Figure 140 - Allocation of Walloon farms across archetypal and mixed Farming System Orientations (FSO) in a 5-dimension space

The allocations per RAR (Figure 141) fit with what is already know about the technical-economic orientations of farms in Walloon agricultural regions (Figure 14).

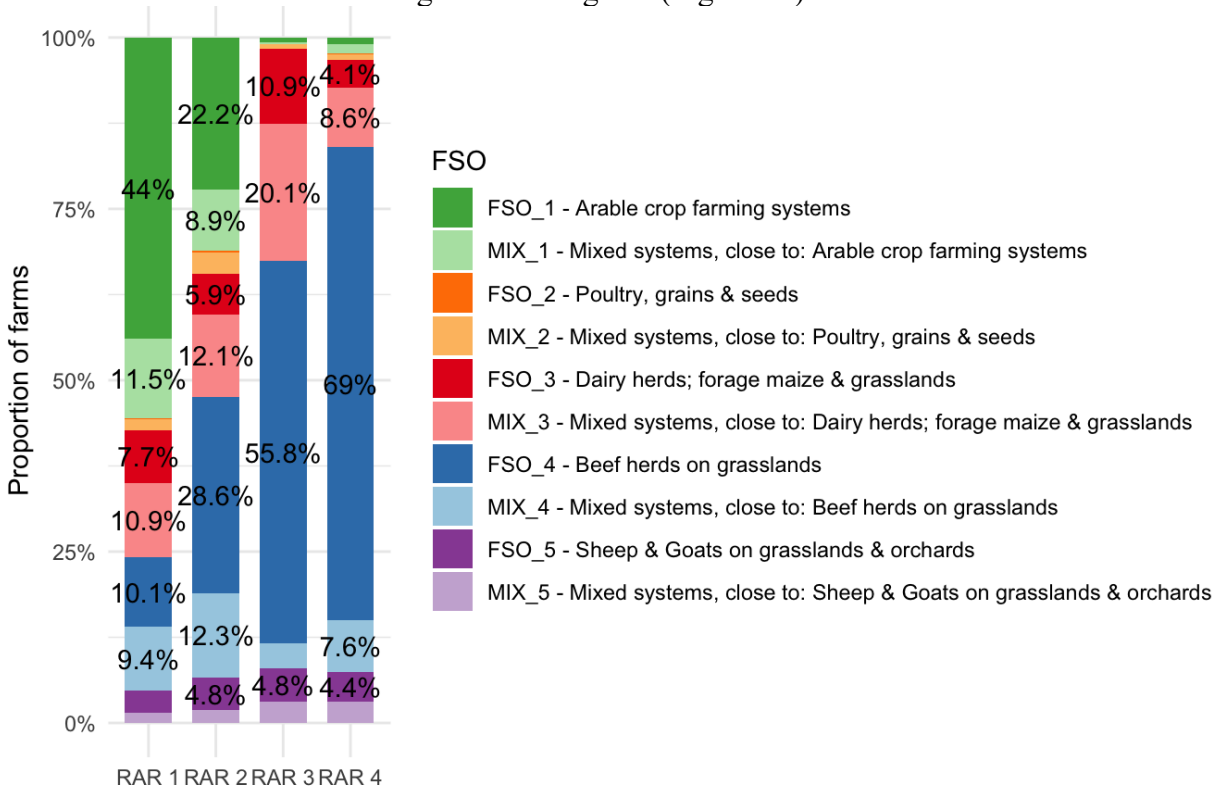


Figure 141 - Distribution of farms registered in the Walloon IACS across Farming System Orientations (FSO) consolidated based on the crossed allocation between clusters and archetypes

Relying on the population-level IACS dataset, it is possible to observe a set of complementary descriptive statistics on farm management characteristics refining the image of each FSO group:

Farm size (Total area) [hectares] - Figure 142: Mean farm size in subregional FSO groups ranges from about 14 ha to 120 ha. The largest farms are found in the arable group FSO_1 (76 ha) and in the mixed groups oriented towards arable crop farming, poultry and dairy production: MIX_1 (75 ha), MIX_2 (74 ha) and MIX_3 (69 ha) : while the smallest belong to the Sheep and Goats groups FSO_5 (17 ha) and MIX_5 (18 ha). Size heterogeneity is by far the highest in MIX_1 (SD ≈ 102 ha): it is driven by an outlier above 2,000 ha, probably an entrepreneur cultivating potatoes on rented land across different regions, whose structure artificially inflates the group mean; the arable group FSO_1 also shows a widespread (SD ≈ 68 ha). A clear regional gradient appears for the grazing systems, where livestock-oriented farms are markedly larger in the Ardenne (RAR 4) than in the northern silty

regions (RAR 1) : e.g. FSO_4 - Beef farms rises from ~17 ha in RAR 1 to ~62 ha in RAR 4, and FSO_3, and Dairy farms from ~47 ha to ~85 ha.

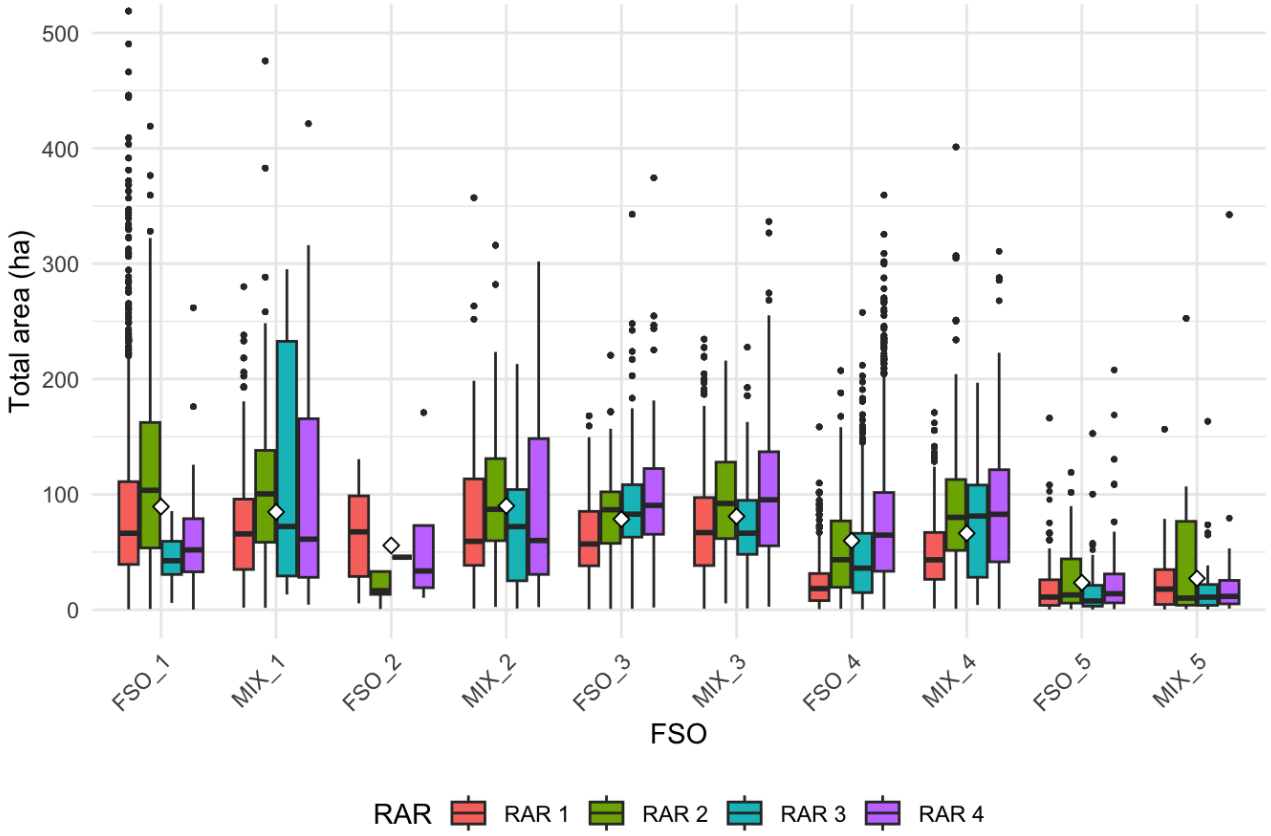


Figure 142 - Farm size distribution compared across FSO group and Regrouped agricultural regions (RAR). The means are indicated by white squares, and the median by black lines.

Economic farm size - Gross Value of Production [€] - Figure 143: Economic farm size is approximated here by the (standardized) *Gross Value of Production* (GVP) recorded by the public administration which is the sum across all of a holding's productions of each production's quantity multiplied by its standard (reference) gross output coefficient aggregated from all sectorial productions in the region. By construction it is an additive, profile-weighted measure: more land or more livestock adds more terms to the sum, so GVP rises with physical size, but each hectare or animal contributes according to its attached economical value. Across the retained population, GVP correlates strongly with utilized area (Pearson's correlation ≈ 0.85), and the relationship holds within almost every FSO group (within-group r ≈ 0.85-0.91), the only exceptions being the small, mixed sheep-and-goat systems (FSO_5/MIX_5, r ≈ 0.5-0.6), where holdings are too small and heterogeneous for either area or herd size to predict standard output well. In these small grazing systems neither area nor herd size do explain GVP well. Dairy systems (FSO_3/MIX_3) post the highest median GVP (mean ≈ 270-300 k€ on ~65-70 ha, i.e. ≈ 3,700-4,100 €/ha); arable systems (FSO_1/MIX_1) sit in the middle (~225 k€ on the largest holdings, ~75 ha, ≈ 2,700 €/ha); extensive beef herds (FSO_4) generate comparatively modest GVP (~130 k€ on ~48 ha); and the small grazing systems for sheep and goats (FSO_5/MIX_5) show both the smallest area (~17 ha) and the lowest absolute GVP (~60-95 k€).

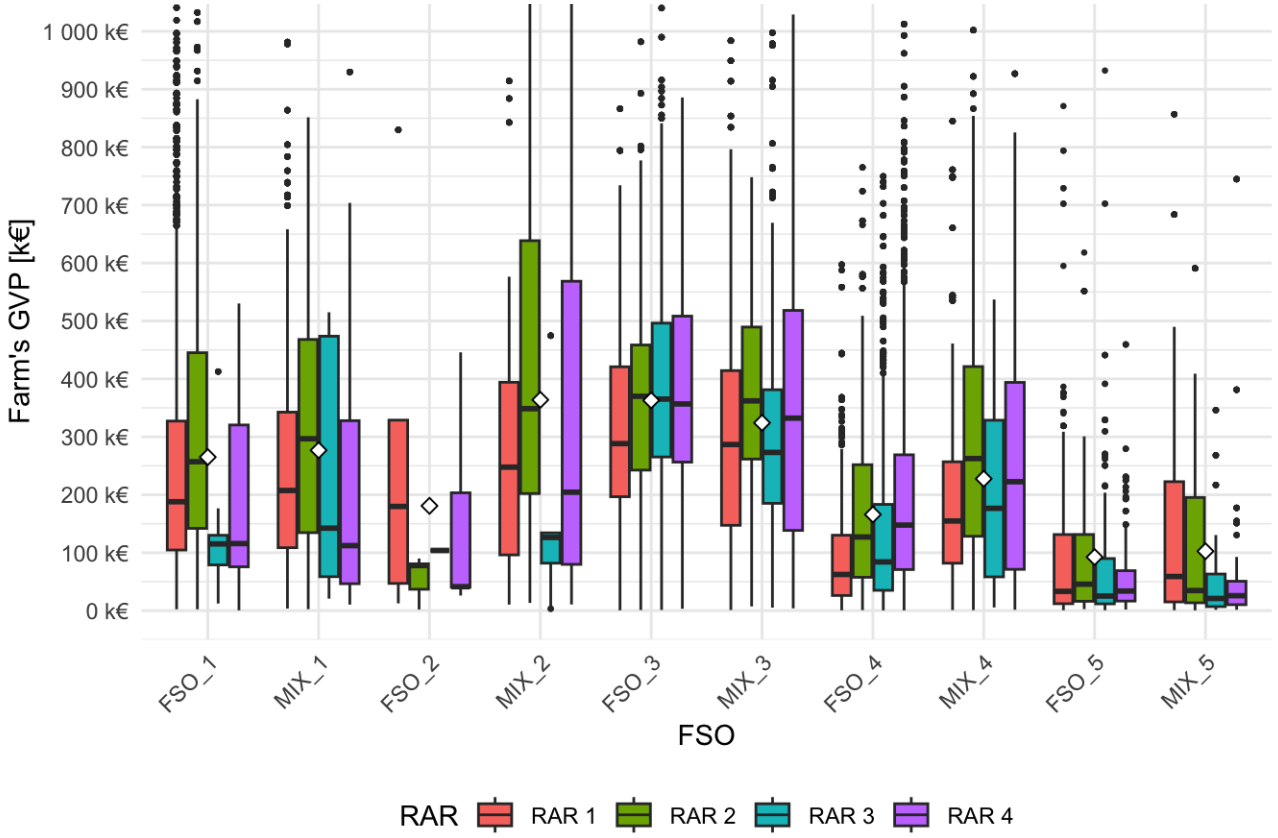
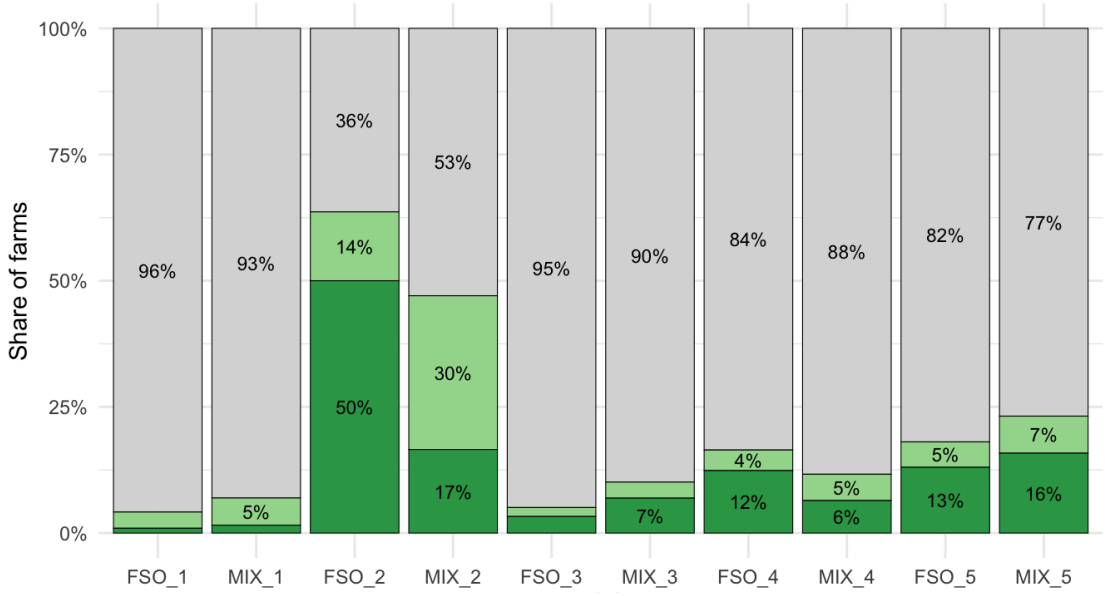


Figure 143 - [Standardized] Gross values of production of farms per FSO and Regrouped agricultural regions (RAR) ; obtained by aggregating the economic values of each speculation based on regional reference (standardized GVP)..

Share of certified organic farms [%] - Figure 144: Levels of organic adoption are particularly high in FSO_2 (Poultry, grains and seeds) - about 64% of its farms are fully or partly organic (50% fully organic) and ~56% of its land is under organic management[127] ; and attached mixed systems MIX_2 (~47% of farms, of which 30% mixed-status). Other FSO stay below ~23%, the lowest uptake being in the conventional arable and dairy groups FSO_1, MIX_1 and FSO_3 (≤7% of farms). Across regions, organic shares rise markedly from the intensive silty north (RAR 1) towards the grassland-dominated Ardenne (RAR 3-4): organic farms in FSO_4, for instance, climb from ~5% (RAR 1) to ~20% (RAR 3-4), and FSO_2 reaches ~86% fully organic in RAR 4. The very small sample of FSO_2 (n≈22) makes its regional figures sensitive to individual farms.



[127] It is important to notice that those figures do not reflect regional statistics on the share of organic poultry production, as the scope of the farm population has been reduced before performing the clustering and archetype analysis.

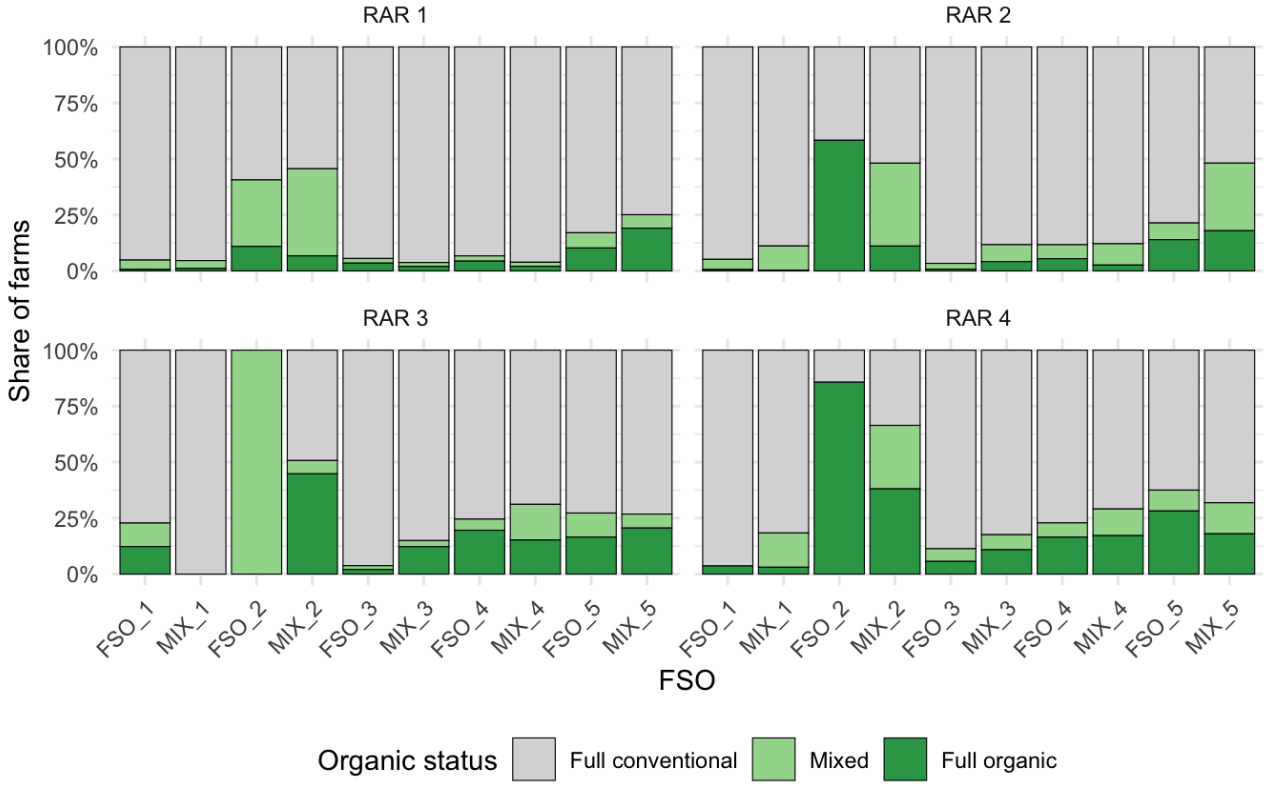


Figure 144 - Share of farms partly or fully certified under organic certification compared across FSO group defined and regrouped at (above) regional (i.e. Walloon); and (below) subregional (i.e. RAR) scales.

Livestock unit density [LU/hectare] - Figure 145: Density is near zero in the arable groups FSO_1 (0.20 LU/ha) and FSO_2 (0.23), and highest in the grassland-livestock groups FSO_3 - Dairy (2.20) and FSO_4 - Beef (1.95), with mixed systems intermediate (1.0-1.8). The most striking regional contrast is found in Beef farming (suckler herds), where density is found roughly twice as high in the intensive northern regions (≈3.5 LU/ha in RAR 1-2) as in the Ardenne (≈1.5-1.7 in RAR 3-4), whereas dairy FSO_3 stays high but more uniform across regions (2.1-2.4).

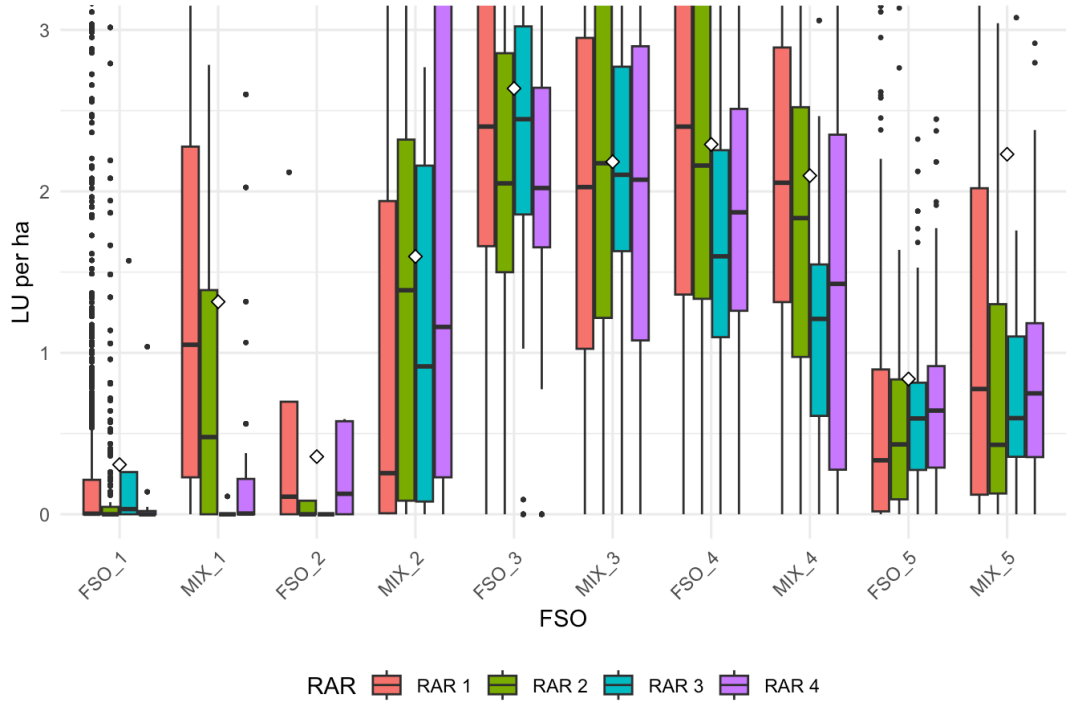


Figure 145 - Livestock density distribution compared across FSO group and Regrouped agricultural regions (RAR) of Wallonia

Share of grasslands [%] - Figure 146: Grassland share mirrors the livestock gradient. It is lowest in the arable groups FSO_1 (7%) and FSO_2 (11%), and highest in the grazing groups FSO_4 - Beef (44%), MIX_5 (44%), MIX_4 (35%) and FSO_5 - Sheep and Goats (33%). Within most groups the share of grasslands increases following the gradient Northwest towards South-east. FSO_5, for example, rises from ~27% (RAR 1) to ~53% (RAR 4) : while arable FSO_1 remains uniformly low across regions (~7-8%).

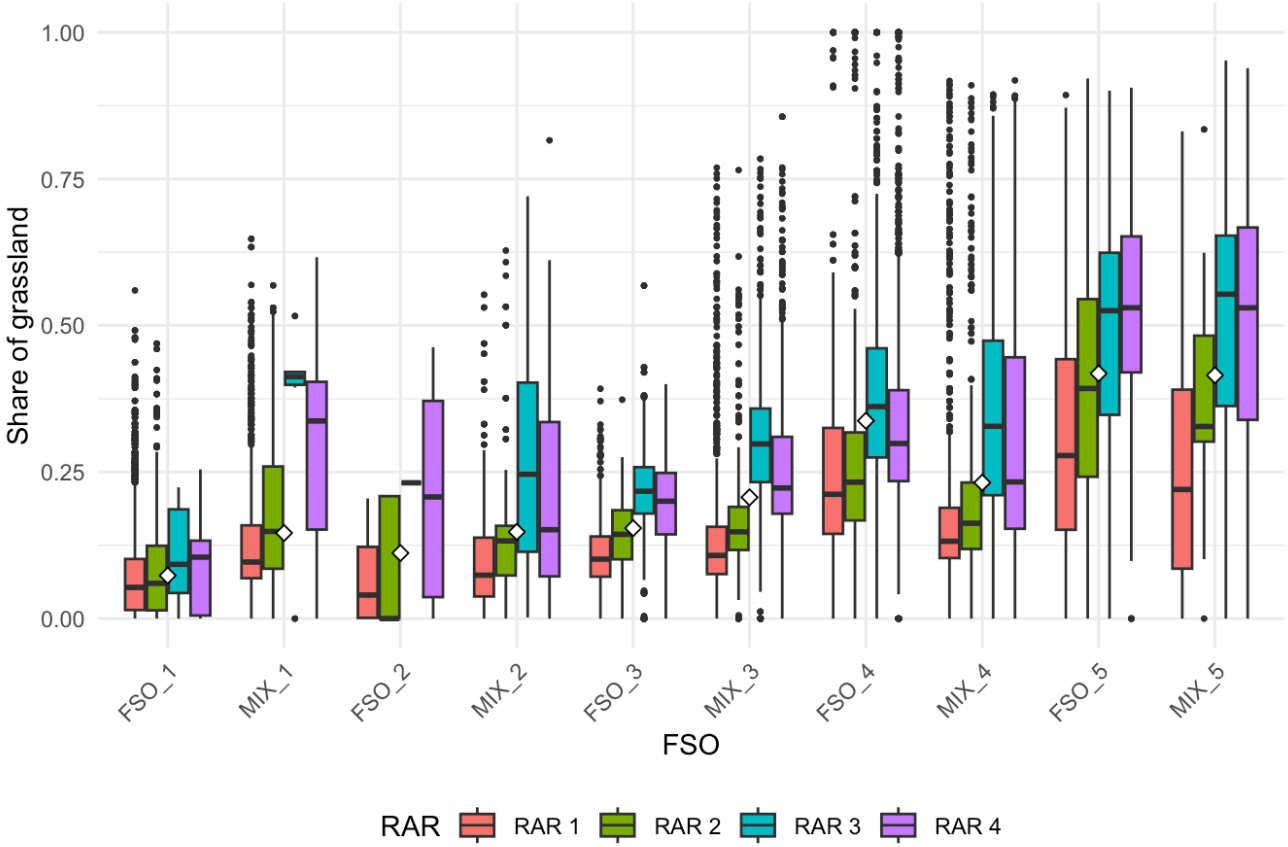


Figure 146 - Share of grassland in farm production mixes compared across FSO group defined and regrouped at regional (i.e. Walloon) scale

Share of legumes [%] - Figure 147: Legumes remain marginal overall (group means ≤12%) and are strongly tied to the organic-leaning groups. FSO_2 again leads (≈12% on average, with a median box reaching ~25%), followed by MIX_2 (~6%) and dairy FSO_3 (~3%, with high individual outliers up to 100% of crop area); all other groups average ≤2%. The signal is essentially concentrated in FSO_2/MIX_2, consistent with nitrogen-fixing crops in organic rotations; regional differences are minor and driven by a handful of farms (e.g. FSO_2 ≈24% in RAR 4 vs ≈10% in RAR 1).

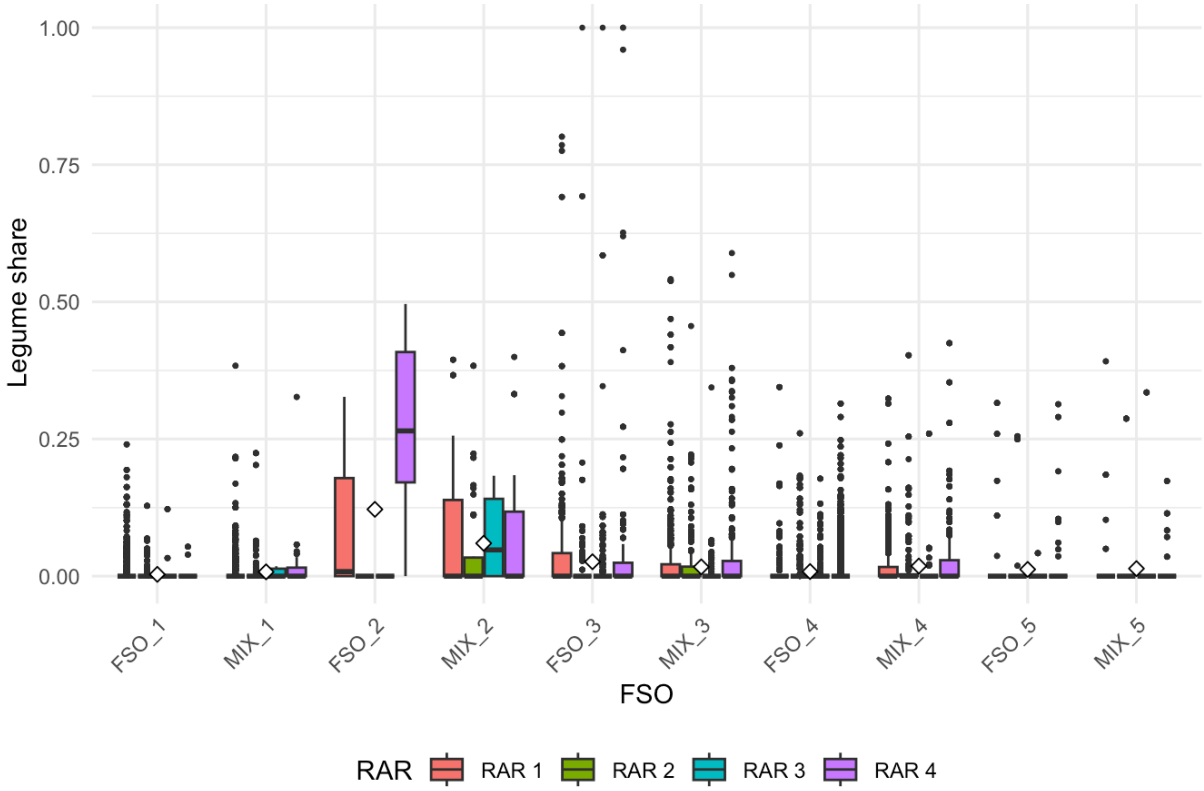


Figure 147 - Share of legume in production mixes (including dry legume seeds and legume forage crops such as clover and alfalfa) in farmland compared across FSO group and Regrouped agricultural regions (RAR) of Wallonia.

Share of non-productive elements [%] - Figure 148: Shares are low throughout (group means <5%). The crop-oriented and organic groups retain the most non-productive area: FSO_2 (4.2%), MIX_2 (3.1%) and FSO_1 (2.6%) : while the grazing-livestock groups show the least (FSO_4 0.2%, MIX_5 0.3%, FSO_5 0.5%), where permanent grassland itself dominates land cover. Regional contrasts are modest, with slightly higher shares in the northern arable regions.

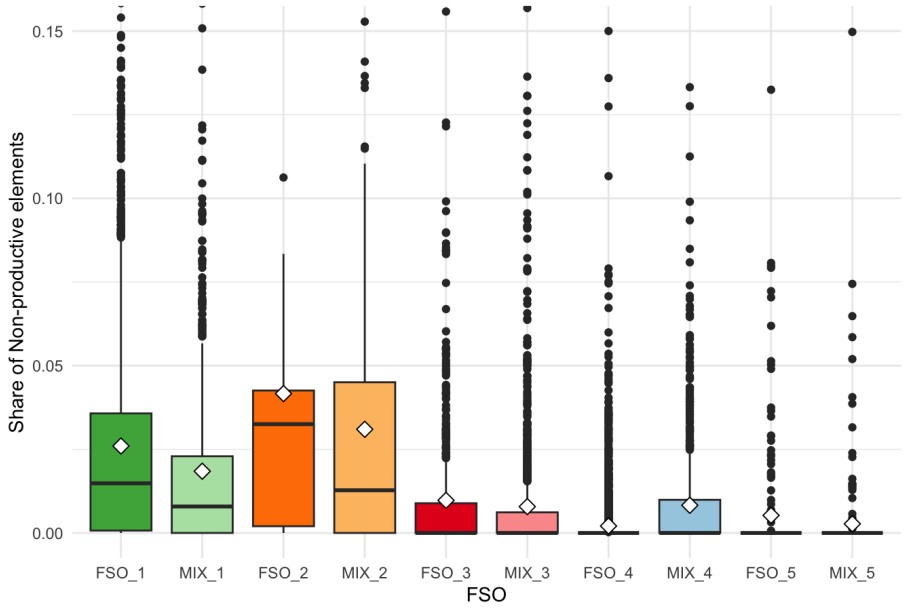


Figure 148 - Share of Non-productive elements (e.g., hedges, grass strips, fallow land) in farmland compared across FSO group defined for Wallonia.

9.3 Farming system orientations and sampling in Saxony-Anhalt

The method applied for the clustering is based on a quali-quantitative approach, since it does not only include main economic data but also qualitative data describing more the behavioural component influencing the farmers' decisions.

A study about the possible farmers' (from Eastern Germany) perspective on their role in the future, identified three main perspectives [53]:

- *Perspective 1: a strong focus on food production and rather traditional view on farmers' role in supporting rural communities.*
- *Perspective 2 farmers propagating a vision of agriculture driven by knowledge gains and technological progress. Less focused on the socio-economic contributions to their regions, farmers in this group believe in the feasibility of combining environmental protection with food production on the same land but tend to favour intensive systems and technological solutions to achieve this balance.*
- *Perspective 3: has strong focus on keeping animals with high welfare- and environmental standards. This group includes sense of care for the community and sense of care for the environment. This group advocates extensive agriculture to reach environmental sustainability.*

The sampling strategy was developed to capture the heterogeneity of farming systems in Saxony-Anhalt. The identification of different farming systems was based on IACS data, in close collaboration with the methodology developed for Wallonia.

Besides the identification of pre-typologies, based on the clustering exercise, *purposive* sampling for selecting farmers to be interviewed, based on previous information about their interest/knowledge or not about AE and AF in particular was combined with *saturation* sampling to make sure that most of the main criteria/variables are included in the sample. The aim is to include all relevant dimensions of heterogeneity and make sure these are all represented. Besides the above-mentioned interest and commitment towards AE and/or AF, the main dimensions included in our sampling are age, gender, political affiliation, company legal structure, production type (arable-only vs. mixed farming), organic certification status.

The pre-typology was defined following the shared workflow described in Section 9.1.3: *hierarchical clustering on principal components* (HCPC) and *archetypal analysis* (AA), crossed and merged into newly defined Farming System Orientations (FSO). The results obtained for the Saxony-Anhalt IACS population are presented below [128].

[128]The outcoming spatial distribution is first shown here crossed with the *Agrozones* framework introduced in **4.2.3**, and replicated along the *BKR* framework in Appendix **12.3.3.**

Clustering process on structural factors of productions (HCPC)



Figure 149 - Description of the 4 clusters using their paragons defined at regional level using the HCPC algorithm on restrained Saxony-Anhalt IACS. Production factors (animal and crop productions) were aggregated into 19 categories. Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.

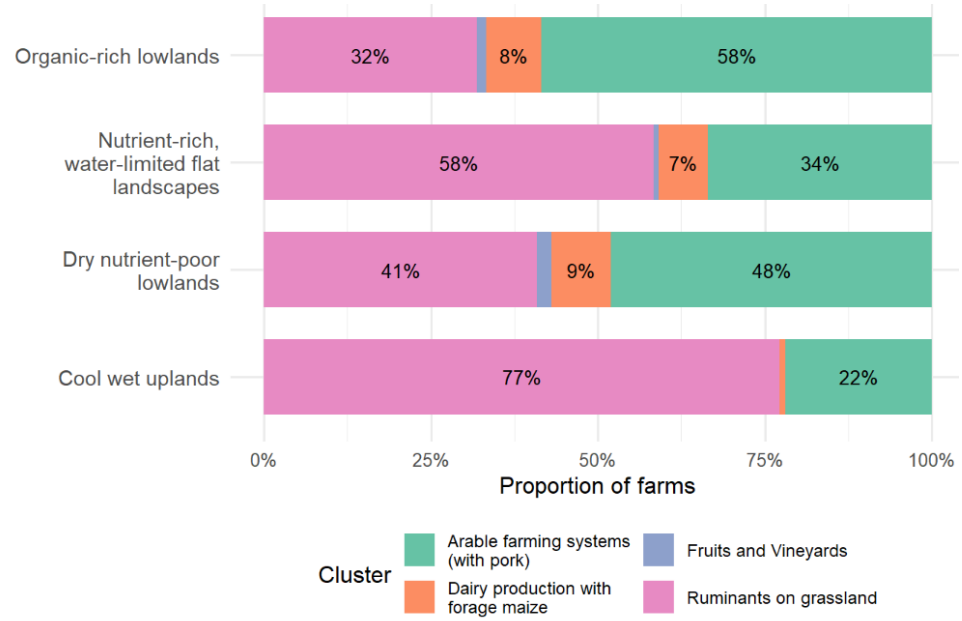


Figure 150 - Distribution of Saxony-Anhalt farms - registered in the regional IACS - into clusters across regions (AEZ). Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.

Archetypal Analysis (AA)

AA is an unsupervised dimensionality reduction method that characterizes a dataset through a set of k archetypes — extreme, prototypical observations lying on or near the convex hull of the data cloud. Unlike clustering methods that assign each observation to a single group, AA represents each observation as a convex combination of archetypes, and each archetype as a convex combination of the original observations, thereby preserving interpretability in the original variable space. The method minimizes the residual sum of squares between observed data points and their archetype-based reconstructions, solved iteratively via an alternating least-squares algorithm with simplex constraints. The number of archetypes k is typically selected by inspecting the elbow of the reconstruction error curve as a function of k. AA is particularly suited to datasets where the structure of interest lies at the boundaries of the data distribution rather than at its center, making archetypes more interpretable than cluster centroids in contexts characterized by mixed or gradient-like profiles. Its implementation in R is provided by the archetypes package (Eugster & Leisch, 2009). Variables with the highest coefficients were used to identify the dominant production characteristics of each archetype. Based on these characteristic patterns, descriptive labels were assigned reflecting the main crop and livestock components represented by each archetype. For example, the archetype characterized by a strong contribution of other forage crops combined with beef production was labelled as "Other forage crop-based beef systems", whereas an archetype dominated by dairy production and forage maize was labelled as a dairy farming system.

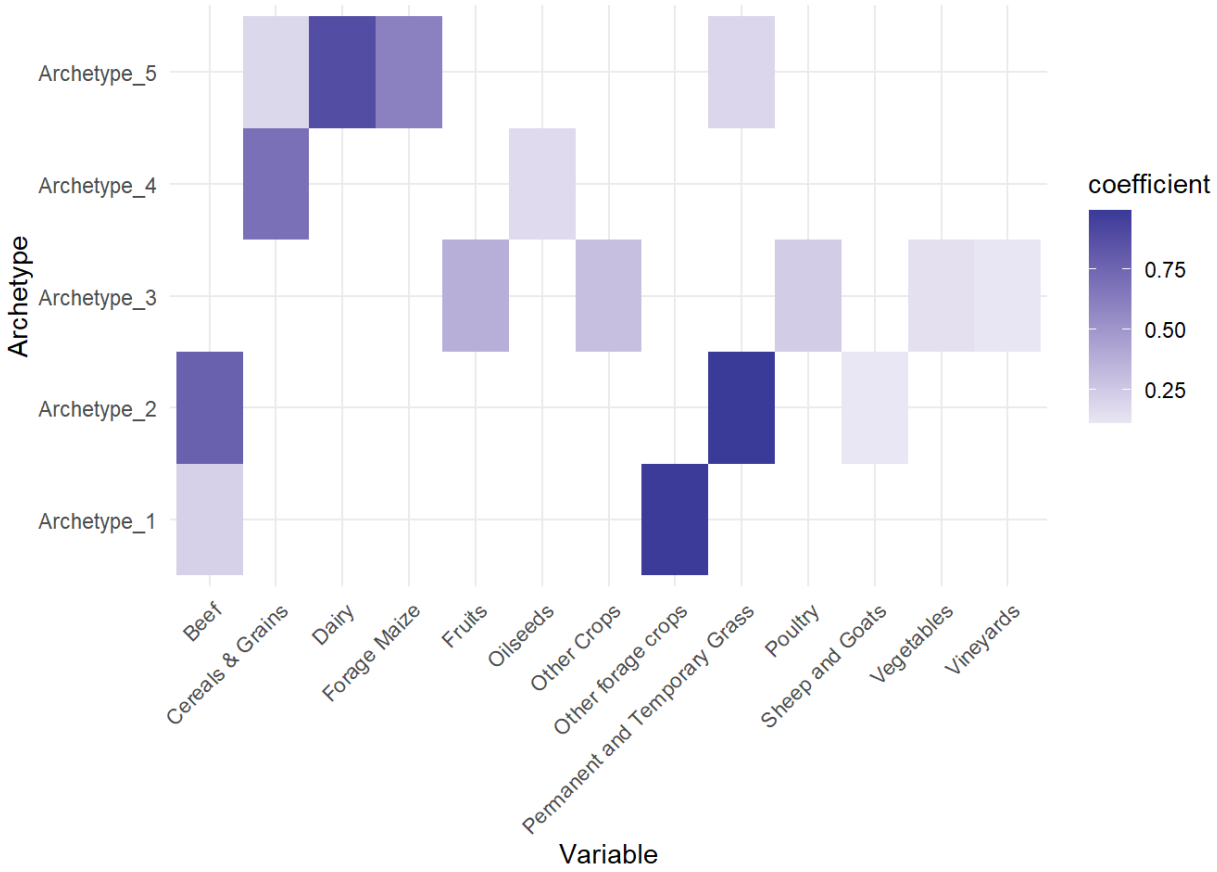


Figure 151 - Heatmap of archetype coefficients defining the production profiles of the identified archetypes. Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.

To facilitate interpretation, radar charts were generated based on the mean production composition of farms assigned to each archetype (Figure 12). Unlike the archetype coefficients, which represent the location of the archetype centers in the transformed feature space, the radar charts display the relative distribution of original production variables among farms belonging to each archetype. Thus, they provide an intuitive representation of the typical production profiles associated with each archetype and complement the coefficient-based identification of dominant characteristics.



Figure 152 - Production profiles of the five archetypes and the undifferentiated group (bottom right) identified using archetype analysis based on Saxony-Anhalt IACS data. Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.



Figure 153 - Allocation of Saxony-Anhalt farms - registered in the regional IACS - into archetypes across regions (AEZ). Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.

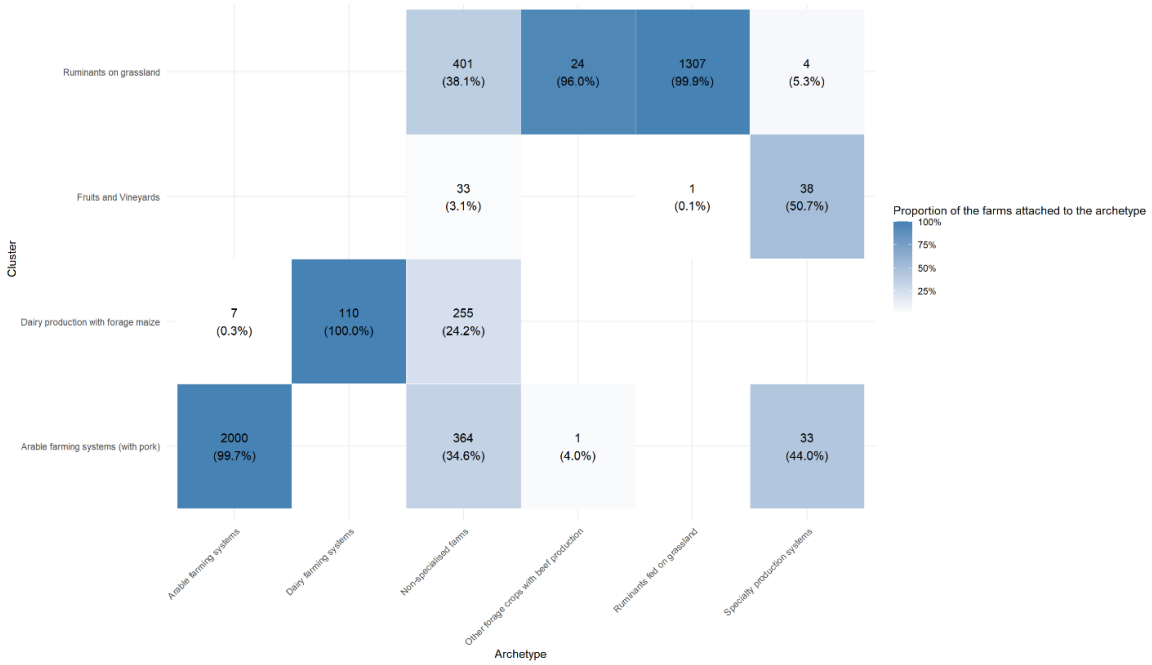
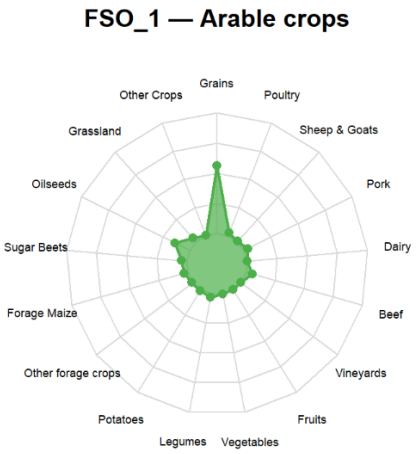
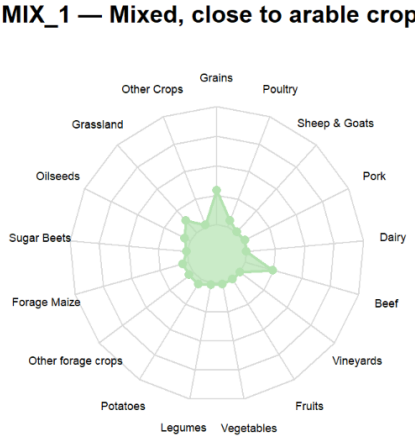
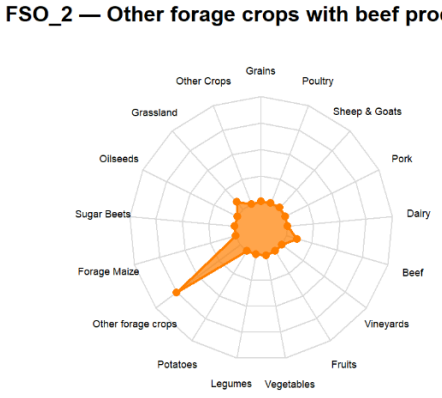


Figure 154 - Number of farms allocated to the 4 clusters and 5 archetypes, and grouping process into Farming System Orientations (FSO). Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.







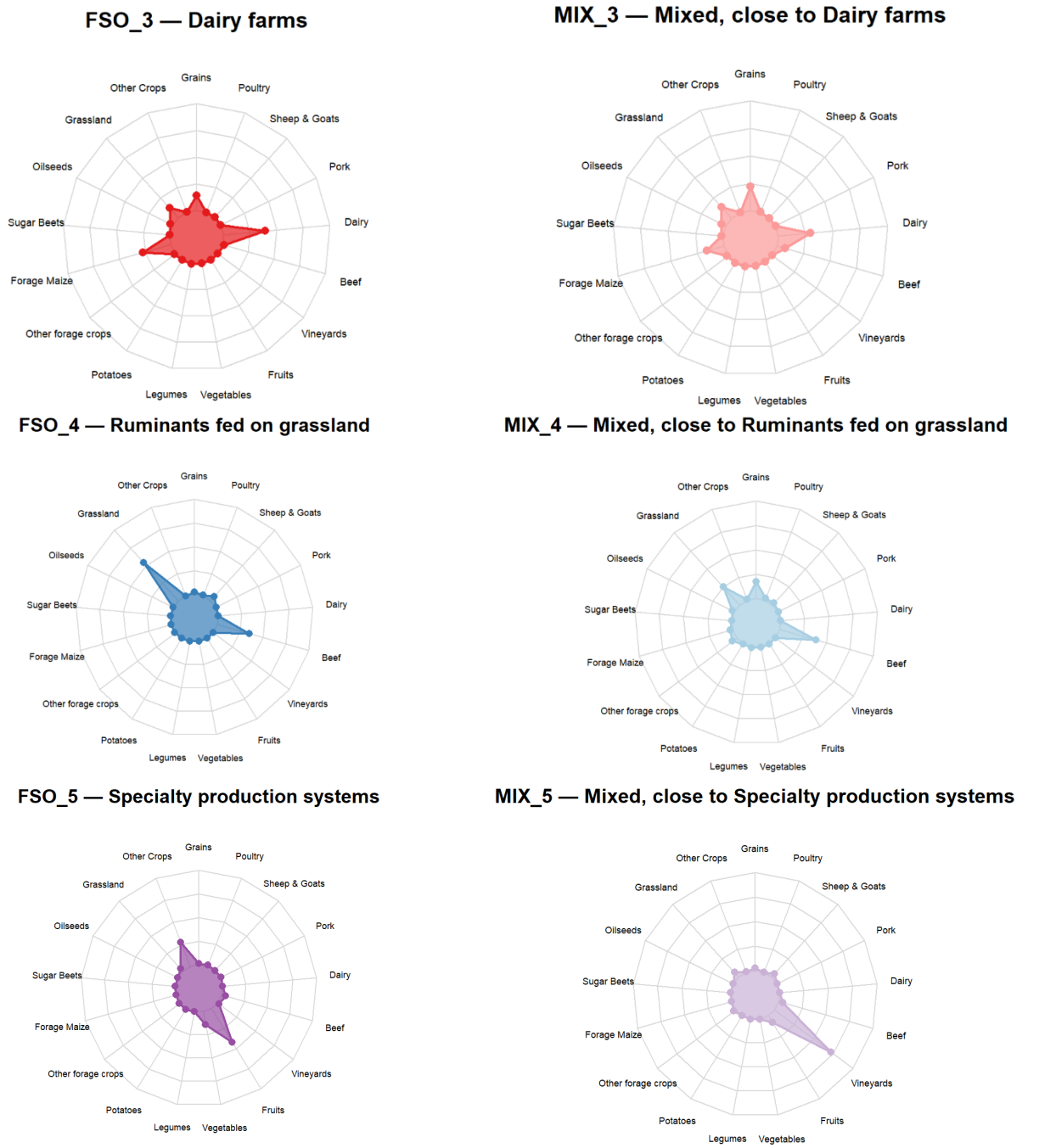


Figure 155 - Discriminating factors describing the 9 Farming System Orientations (FSO) after grouping clusters and archetypes attributions. Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.

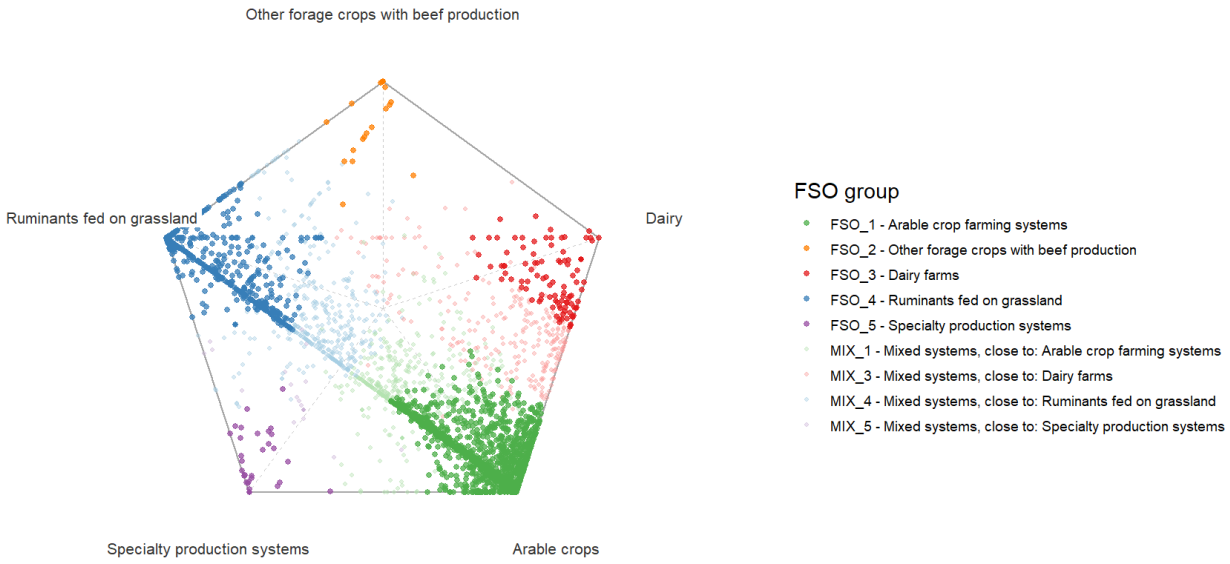


Figure 156 - Allocation of Saxony-Anhalt farms across archetypal and mixed Farming System Orientations (FSO) in a 5-dimension space. Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.

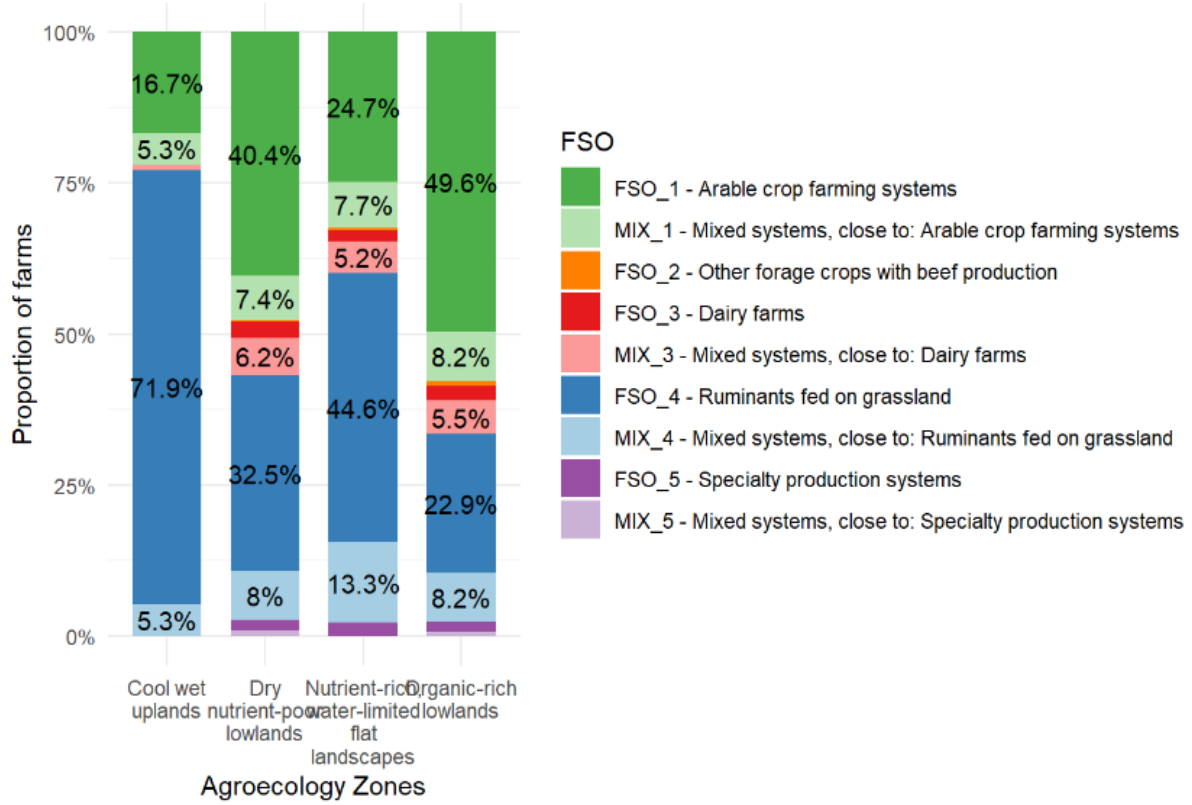


Figure 157 - Distribution of farms registered in the Saxony-Anhalt IACS across Farming System Orientations (FSO) consolidated based on the crossed allocation between clusters and archetypes. Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.

Relying on the population-level IACS dataset, it is possible to observe a set of complementary descriptive statistics on farm management characteristics refining the image of each FSO group:

Farm size (Total area) [hectares] - Figure 18: Farm size showed clear differences between farming system groups and AEZs. The largest farms were associated with arable and dairy-oriented systems, while grassland-based ruminant and specialty production systems had smaller farm structures.

Arable systems (FSO_1) were generally characterised by large farms, especially in the lowland AEZs. Average farm sizes reached 363 ha in organic-rich lowlands and 330 ha in dry nutrient-poor lowlands, compared with only 158 ha in nutrient-rich, water-limited flat landscapes. Mixed arable systems (MIX_1) followed a similar pattern, with relatively large farms across AEZs (257-379 ha).

Other forage crops with beef production (FSO_2) represented the smallest ruminant-oriented farms, averaging only 26 ha across the territory (17-28 ha across AEZs). However, these values are based on only 25 farms and should therefore be interpreted with caution.

Dairy-oriented systems showed the largest farm structures overall. FSO_3 farms averaged 527 ha, with particularly large farms in nutrient-rich, water-limited flat landscapes (766 ha) and organic-rich lowlands (545 ha). This pattern was even stronger for MIX_3, where farms averaged 664 ha and exceeded 900 ha in nutrient-rich, water-limited flat landscapes (997 ha).

Grassland-based ruminant systems were generally smaller, although AEZ differences were pronounced. FSO_4 farms were largest in cool wet uplands (113 ha) and smaller in organic-rich lowlands (44 ha) and dry nutrient-poor lowlands (57 ha). Mixed ruminant systems (MIX_4) showed larger structures, particularly in cool wet uplands (420 ha), while remaining around 180-230 ha in other AEZs.

Specialty production systems had the smallest farms overall. FSO_5 averaged 47 ha, with only minor variation between AEZs (29-55 ha), while MIX_5 represented very small-scale structures (13 ha on average).

Overall, AEZs influenced farm size patterns within farming systems, with lowland regions generally associated with larger farms in arable and dairy systems. However, the farming system type remained the main driver of structural differences, separating large-scale crop and dairy systems from smaller ruminant-based and specialized systems.

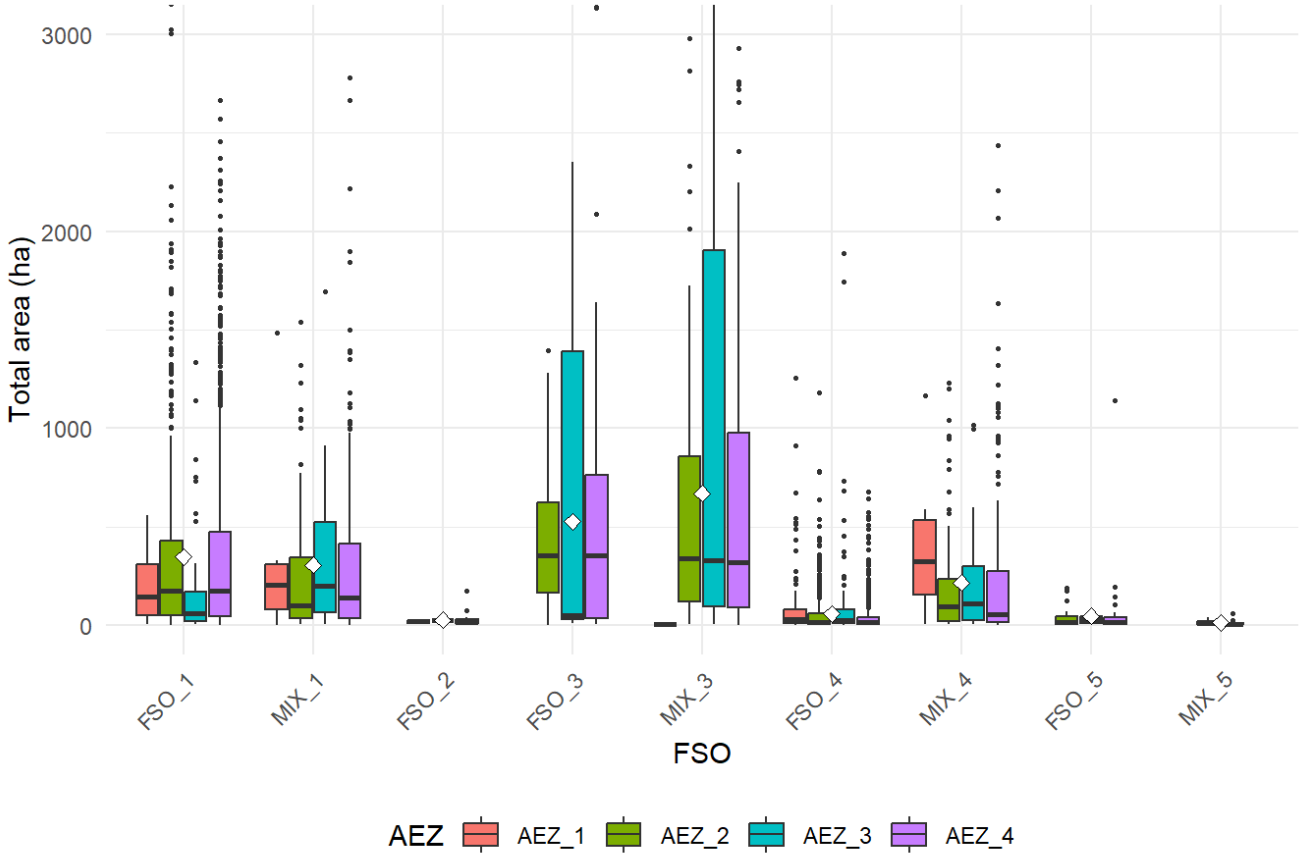


Figure 158 - Farm size distribution across farming system orientations (FSOs) and agroecological zone (AEZ). White squares indicate the mean, and black lines indicate the median. Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.

Share of certified organic farms [%] - Figure 19: The share of organic farming differed substantially between farming system groups and AEZs. Overall, mixed and specialty production systems showed higher organic shares than the main production-oriented systems, while arable and dairy systems had comparatively low levels of organic farming.

Arable farming systems (FSO_1) had relatively low organic shares, with 6.4% of agricultural land and 7.7% of farms being organic at territory level. The highest values occurred in organic-rich lowlands (6.8% organic land; 8.2% organic farms), whereas cool wet uplands showed lower organic land shares (3.4%). Mixed arable systems (MIX_1) showed consistently higher organic participation, reaching 10.5% of organic land and 15.9% of organic farms at territory level. Organic farm shares were particularly high in nutrient-rich, water-limited flat landscapes (23.8%), indicating a higher presence of organic farms despite moderate organic land shares (9.1%).

Other forage crops with beef production (FSO_2) showed relatively high organic shares compared with other specialized systems (FSOs), with 16.5% of land and 20.0% of farms being organic at territory level. The highest values occurred in dry nutrient-poor lowlands, where 49.6% of land and 50.0% of farms were organic. However, this pattern should be interpreted cautiously due to the small number of farms (25 farms).

Dairy-oriented systems showed the lowest organic shares. FSO_3 reached only 0.8% organic land and 0.9% organic farms at territory level, with no organic farms recorded in organic-rich lowlands or nutrient-rich, water-limited flat landscapes. Mixed dairy systems (MIX_3) showed slightly higher values (3.8% organic land; 5.1% organic farms), mainly driven by dry nutrient-poor lowlands (5.8% organic land; 8.0% organic farms).

Grassland-based ruminant systems showed intermediate organic shares. FSO_4 reached 8.1% organic land and 13.0% organic farms, with the highest organic farm share in dry nutrient-poor lowlands (15.1%). Mixed ruminant systems (MIX_4) showed higher organic participation, with 12.9% organic land and 23.7% organic farms at territory level. Particularly high organic farm shares were observed in nutrient-rich, water-limited flat landscapes (36.1%).

Specialty production systems (FSO_5) showed the highest organic shares among the main FSO groups, with 16.3% organic land and 18.7% organic farms at territory level. The highest organic land share occurred in dry nutrient-poor lowlands (21%). Mixed specialty production systems (MIX_5) showed similar but slightly lower values (12.0% organic land; 15.2% organic farms).

Overall, organic farming was most strongly represented in specialty production and mixed systems, as well as in FSO_2, while dairy systems showed very limited organic uptake. Across AEZs, dry nutrient-poor lowlands and organic-rich lowlands generally showed higher organic shares, whereas nutrient-rich, water-limited flat landscapes often had lower organic land shares but sometimes high proportions of organic farms. The differences between organic land share and organic farm share suggest that organic farms are often smaller than conventional farms, particularly in mixed systems.

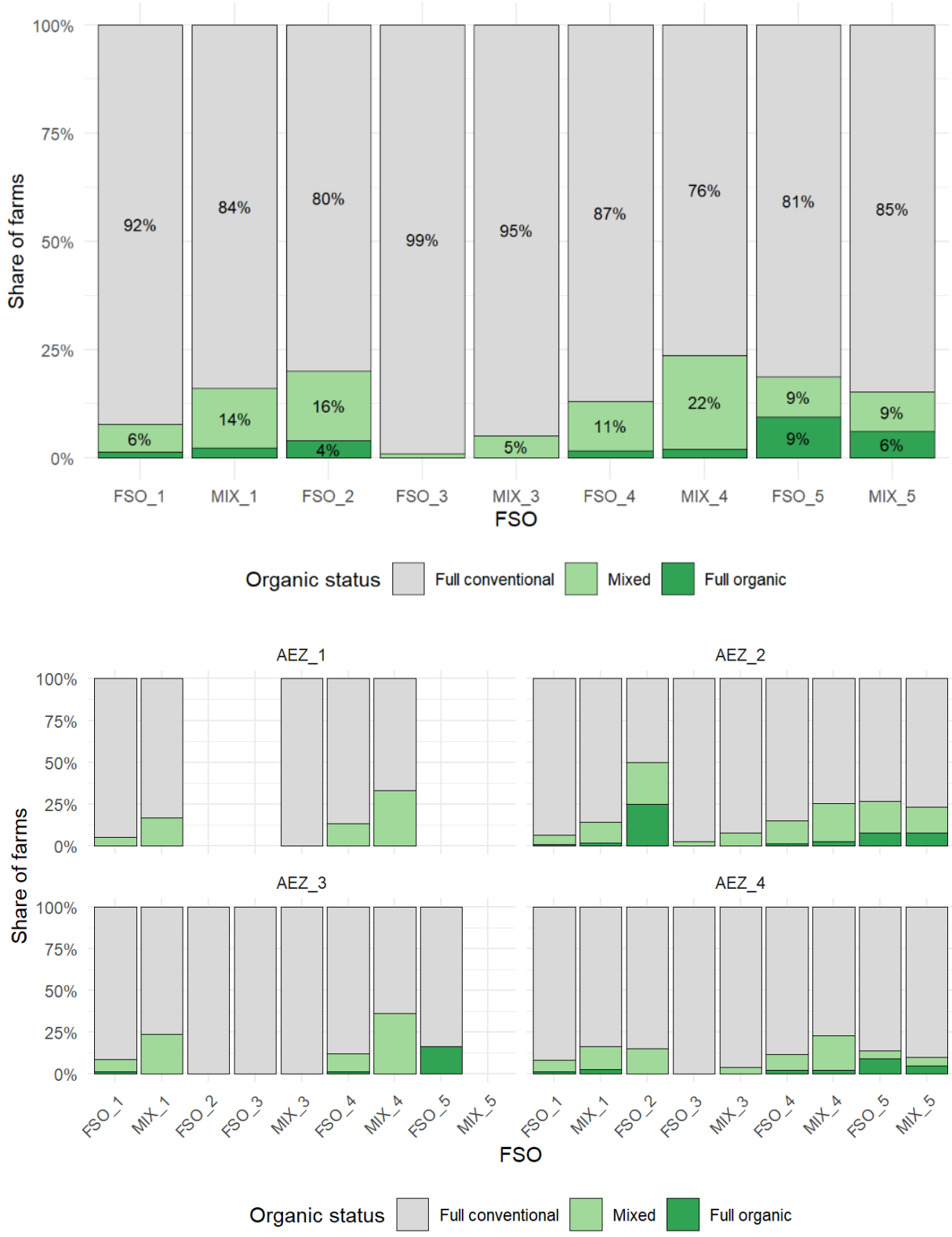


Figure 159 - Distribution of farms by organic certification status (full conventional, mixed, and full organic) across farming system orientations (FSOs) at the regional (top) and agroecological zone (AEZ; bottom) scales. Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.

Livestock unit density [LU/hectare] - Figure 20: Livestock density differed strongly between farming system groups and AEZs, reflecting the contrasting production orientations of the systems. Dairy-oriented and grassland-based ruminant systems showed the highest livestock densities, whereas arable and specialty production systems had very low livestock densities.

Arable farming systems (FSO_1) are characterized by very low livestock densities, with 0.21 LU/ha at territory level. Livestock density was highest in organic-rich lowlands (0.28 LU/ha), while nutrient-rich, water-limited flat landscapes showed almost no livestock presence (0.00 LU/ha).

Mixed arable systems (MIX_1) had slightly higher livestock densities (0.20 LU/ha) but remained largely crop-oriented across all AEZs.

Other forage crops with beef production (FSO_2) also showed low livestock densities (0.14 LU/ha at territory level), despite their classification as livestock-oriented systems. Values remained below 0.32 LU/ha across AEZs, indicating that these systems represented a relatively small livestock component compared with the dedicated ruminant systems.

Dairy systems showed substantially higher livestock densities. FSO_3 reached 0.82 LU/ha at territory level, with higher values in organic-rich lowlands (0.88 LU/ha) and dry nutrient-poor lowlands (0.79 LU/ha). Mixed dairy systems (MIX_3) showed the highest livestock densities overall, averaging 1.25 LU/ha. This was particularly pronounced in nutrient-rich, water-limited flat landscapes, where livestock density reached 5.0 LU/ha, although this value is based on a small number of farms.

Grassland-based ruminant systems also showed high livestock densities. FSO_4 reached 1.70 LU/ha at territory level, with the highest value in organic-rich lowlands (2.63 LU/ha). In contrast, mixed ruminant systems (MIX_4) had lower densities (0.71 LU/ha), with values ranging between 0.19 LU/ha in cool wet uplands and 1.02 LU/ha in organic-rich lowlands.

Specialty production systems had very low livestock densities, with FSO_5 averaging only 0.02 LU/ha and MIX_5 0.02 LU/ha, confirming their predominantly non-livestock-oriented character.

Overall, livestock density clearly separated the farming systems: dairy and grassland-based ruminant systems were associated with the highest livestock concentrations, while arable, specialty production systems, including their mixed counterparts, showed little livestock presence. AEZ effects were particularly visible for livestock-oriented systems, with organic-rich lowlands generally showing higher livestock densities, whereas nutrient-rich, water-limited flat landscapes showed contrasting patterns with very high densities in some mixed dairy systems.

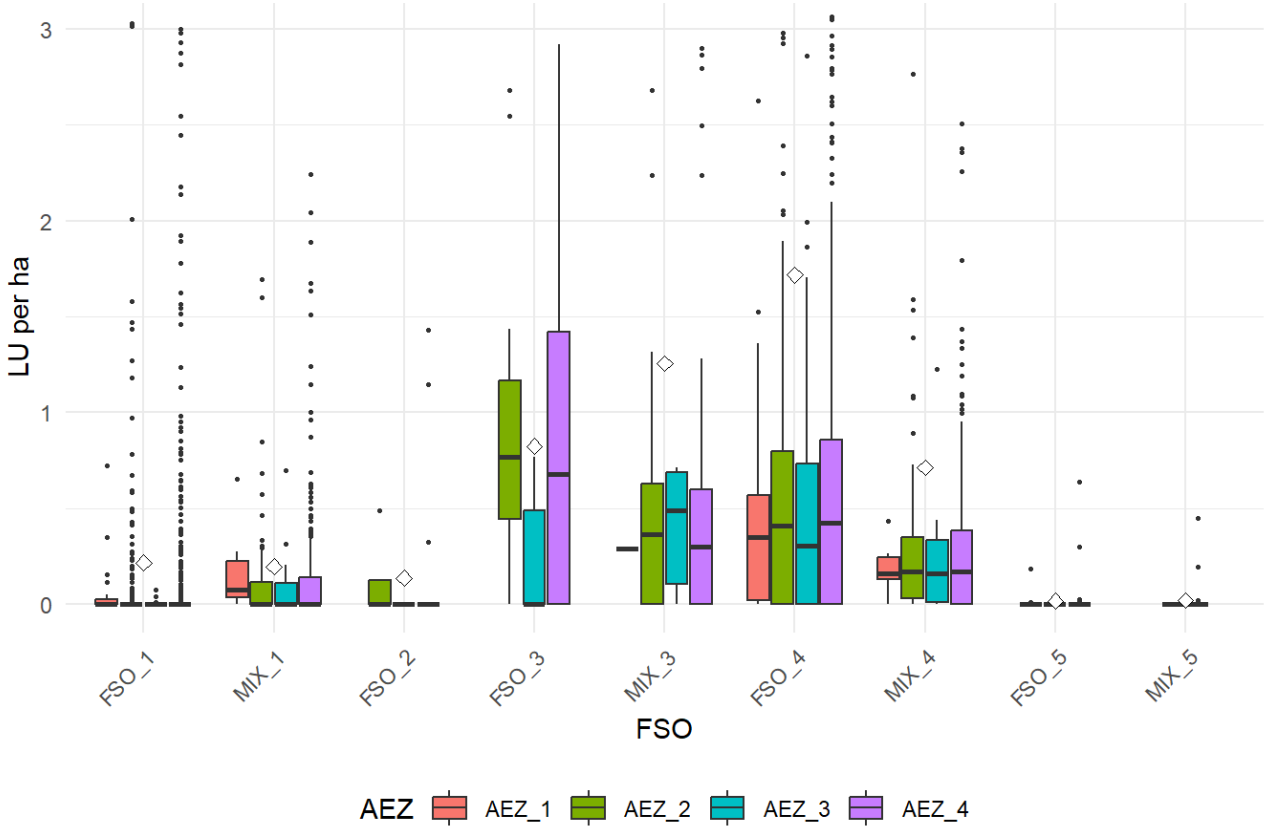


Figure 160 - Livestock density (LU ha⁻¹) across farming system orientations (FSOs) and agroecological zones (AEZs) in Saxony-Anhalt. Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.

Share of grasslands [%] - Figure 21: The share of grassland clearly reflects the production orientation of the farming systems and varies more strongly between farm system groups than between agroecological zones. As expected, FSO_4 (Ruminants fed on grassland) had by far the highest grassland shares, averaging 66.3% at the territory level and remaining consistently high across all AEZs (64.9-72.5%). The corresponding MIX_4 systems also showed high grassland shares (35.3%), although substantially lower than the specialized grassland systems. In contrast, arable farming systems (FSO_1) and specialty production systems (FSO_5) contained very little grassland, with territory averages of 4.7% and 3.8%, respectively, while mixed arable systems (MIX_1) showed intermediate values (18.3%). FSO_2 (Other forage crops with beef production) also showed relatively low grassland shares (9.9%). Dairy-oriented systems also exhibited moderate grassland shares, reaching 11.0% for FSO_3 and 14.6% for MIX_3 at the territory level.

Across AEZs, grassland shares within a given farming system were generally stable. The largest variation occurred in MIX_3, where the grassland share reached 77.5% in the *Cool wet uplands*, compared with 12.8-17.7% in the other AEZs; however, this pattern is based on a single farm and should therefore be interpreted with caution. Otherwise, only moderate regional differences were observed, such as in MIX_4, where grassland increased from 32.8% in the *Cool wet uplands* to 40.1% in the *Dry nutrient-poor lowlands*. Overall, the production orientation of the farming systems explained the variation in grassland share much more strongly than the agroecological setting.

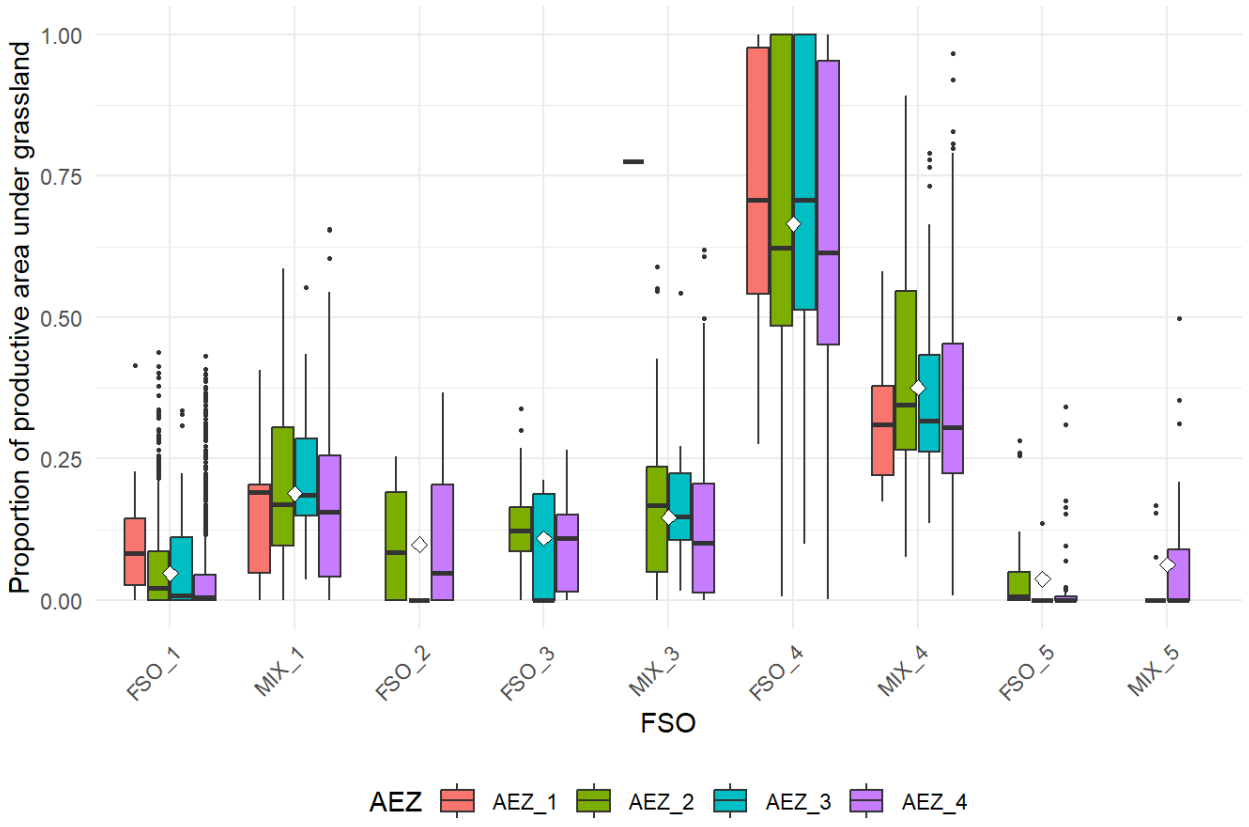


Figure 161 - Share of grassland across farming system orientations (FSOs) and agroecological zones (AEZs) in Saxony-Anhalt. Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.

Share of legumes [%] - Figure 22: The share of legumes differed markedly between farming systems and was generally highest in mixed farming systems. MIX_4 (Mixed systems close to: Ruminants fed on grassland) showed the highest territory-level share (11.2%), followed by MIX_1 (8.6%), whereas specialized grassland-based ruminant systems (FSO_4) and dairy farms (FSO_3) had comparatively low shares of 1.3% and 2.3%, respectively. Arable farming systems (FSO_1) showed intermediate values (5.1%). An exception was FSO_2 (Other forage crops with beef production), which exhibited exceptionally high legume shares (87.5% at the territory level and 80-100% across AEZs). However, this farming system comprised only 25 farms and covered 0.1% of the agricultural land, so these values should be interpreted with caution. Across agroecological zones, regional variation was relatively small for most farming systems. Mixed systems tended to have slightly higher legume shares in the nutrient-rich and dry lowland zones. For example, MIX_1 increased from 8.2% in the *Cool wet uplands* and *Organic-rich lowlands* to 12.1% in the *Nutrient-rich, water-limited flat landscapes*, while MIX_4 reached 10.9-11.6% across all lowland AEZs. Overall, differences between farming systems were more pronounced than differences between agroecological zones.

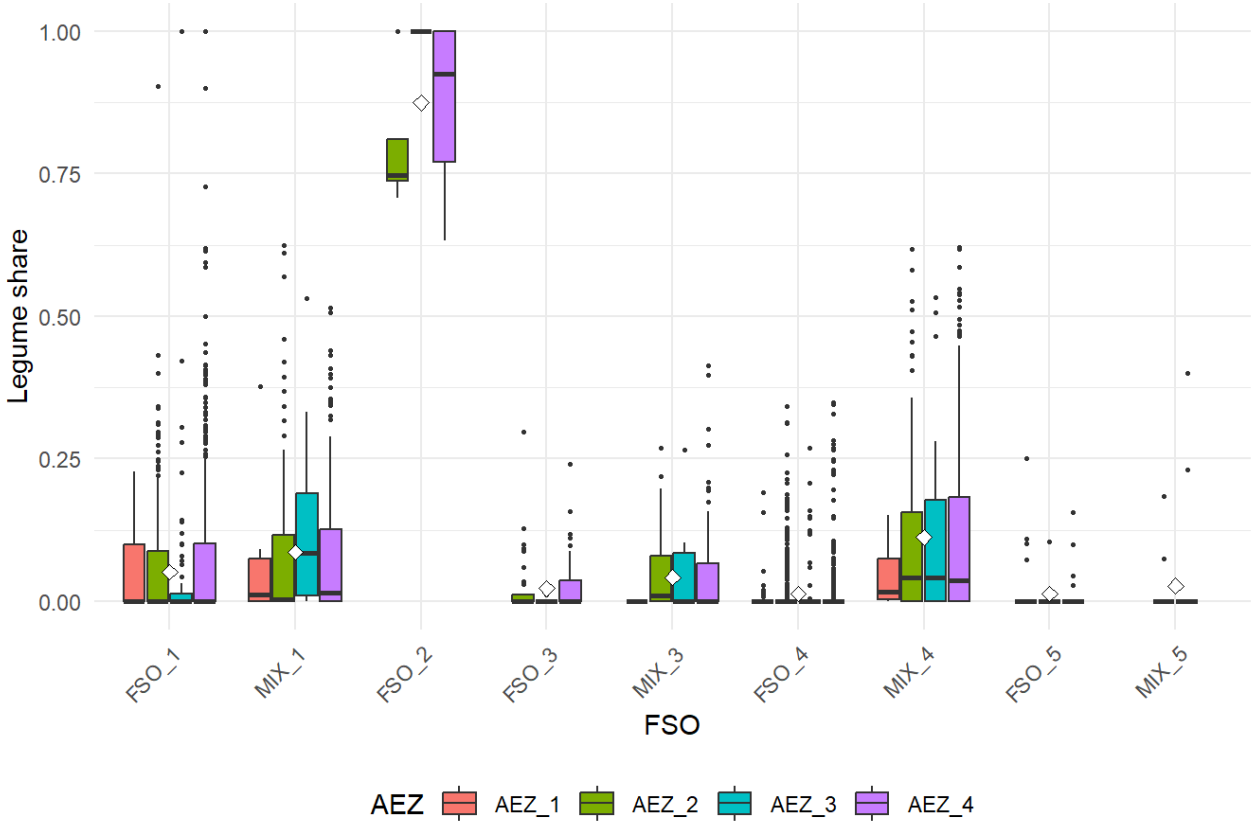


Figure 162 - Share of legume (including dry legume seeds and legume forage crops such as clover and alfalfa) across farming system orientations (FSOs) and agroecological zones (AEZs) in Saxony-Anhalt. Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.

Share of non-productive elements [%] - Figure 23: The share of non-productive elements (NPEs) follows a pattern similar to that observed for legumes, with mixed farming systems generally exhibiting higher values than their corresponding specialized systems. At the territory level, MIX_5 shows the highest mean share of non-productive elements (7.4%), followed by MIX_1 (5.6%) and MIX_4 (5.2%). Specialized arable farming systems (FSO_1) have intermediate values (4.5%), while the ruminant-oriented systems FSO_3 and FSO_4 reach 4.0-4.1%. The lowest shares are observed for FSO_2 and FSO_5 (both 3.4%). Differences between AEZs are generally moderate. Higher shares of non-productive elements are frequently found in the dry nutrient-poor lowlands and the nutrient-rich, water-limited flat landscapes (e.g. 6.5% for MIX_1), while particularly high values occur for FSO_5 in the organic-rich lowlands (8.8%). The lowest values are found for small, specialized farming systems, such as MIX_5 in the organic-rich lowlands (0.3%) and FSO_2 in the nutrient-rich, water-limited flat landscapes (0%), although these are based on very few farms and should therefore be interpreted with caution. Overall, mixed farming systems tend to maintain a higher share of non-productive elements than specialized farming systems.

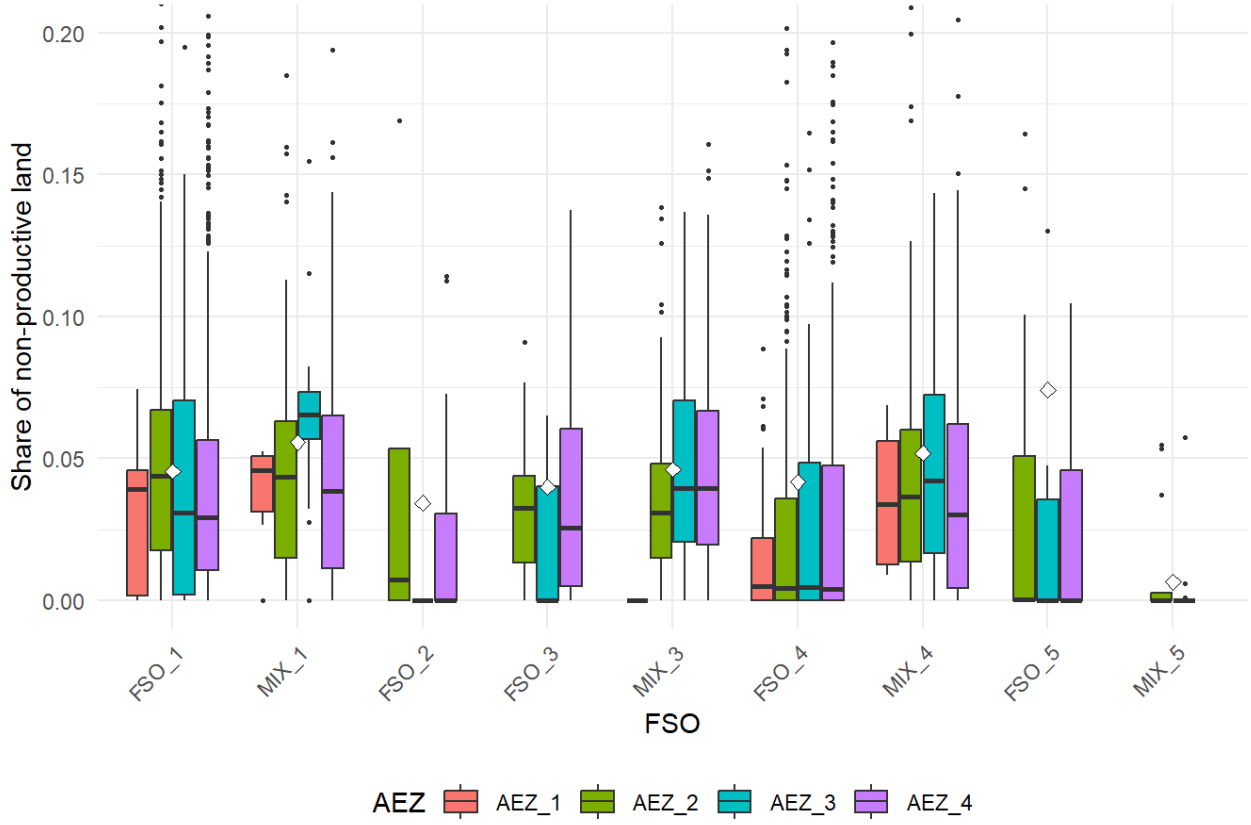


Figure 163 - Share of non-productive elements (e.g., hedges, grass strips, fallow land) across farming system orientations (FSOs) and agroecological zones (AEZs) in Saxony-Anhalt. Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.

9.4 Farming system orientations and sampling in Valais

The pre-typology for Valais was built following the shared workflow described in Section 10.2 - hierarchical clustering on principal components (HCPC) and archetypal analysis (AA), crossed and merged into Farming System Orientations (FSO) - applied to the cantonal IACS extracts (crop parcels, animal productions and official farm typology).

For the sub-regional stratification, four regions were used, based on the official classification of agricultural zones of the Swiss Federal Office for Agriculture (OFAG, “Limites des zones agricoles”, geodata identifier 149) [252]: the *plain* region, the *hill* region, the *mountain region* (grouping mountain zones I to IV) and the *summering* region.

This official zoning grades production conditions by climatic situation, accessibility and terrain configuration, and underpins Swiss agricultural policy instruments. Within the Valais IACS population, farms distribute as follows across zones: mountain zone III (590 farms), mountain zone II (505), plain zone (490), mountain zone IV (420), hill zone (154) and mountain zone I (149); 35 farms without valid coordinates were left unassigned.

As for Wallonia, the study perimeter was first restricted using the official farm typology (Agroscope, Typologie des exploitations S4 DC2015) [253]. Processing-oriented types (OTE 411, 412, 413 - in the Valais dataset, only poultry, 412, is present) were discarded, as were the plain-oriented field-crop and special-crop specializations (OTE 110, 122, 123, 124 - field crops, arboriculture, viticulture and other special crops), while market gardening (OTE 121) was retained (Figure 164).

Processing-oriented types (OTE 411, 412, 413 - in the Valais dataset, only poultry, 412, is present) were discarded, as were the plain-oriented field-crop and special-crop specializations (OTE 110, 122, 123, 124 - field crops, arboriculture, viticulture and other special crops), while market gardening (OTE 121) was retained (Figure 164).

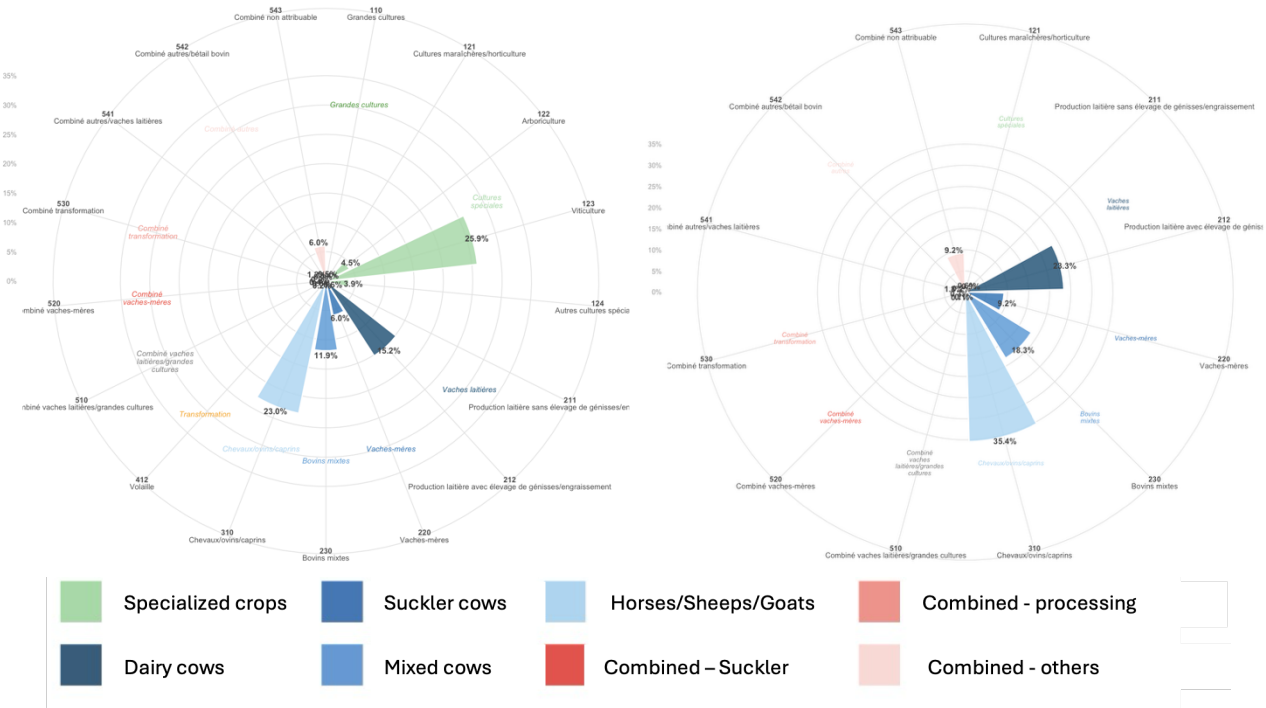


Figure 164 - [LEFT] Distribution of the cantonal farm population in Valais registred in the IACS across the Technical-Economic Orientations (TEO); [RIGHT] Restrained population kept within the sampling perimeter.

From this restrained perimeter (Figure 164), the HCPC algorithm identified five clusters, and five archetypes were retained in line with the workflow applied in the other territories (the elbow criterion alone would have suggested seven). Crossing both allocations (archetypal attachment

threshold $\alpha \geq 0.64$) yielded five archetypal Farming System Orientations (FSO) and five mixed systems, i.e. 1,525 farms classified as follows:

- **FSO_1 -** Dairy and beef cattle on grasslands: 828 farms (54.3%), plus MIX_1 mixed systems close to this orientation (47 farms, 3.1%);
- **FSO_2** - Sheep and goats on grasslands: 510 farms (33.4%), plus MIX_2 (50 farms, 3.3%);
- FSO_3 - Dairy cattle on grains and other forage crops (including maize): 38 farms (2.5%), plus MIX_3 (37 farms, 2.4%);
- FSO_4 - Beef cattle, pork and field crops: 3 farms (0.2%), plus MIX_4 (3 farms, 0.2%);
- **FSO_5 -** Poultry and dairy cattle; fruits and vineyards: 2 farms (0.1%), plus MIX_5 (7 farms, 0.5%).

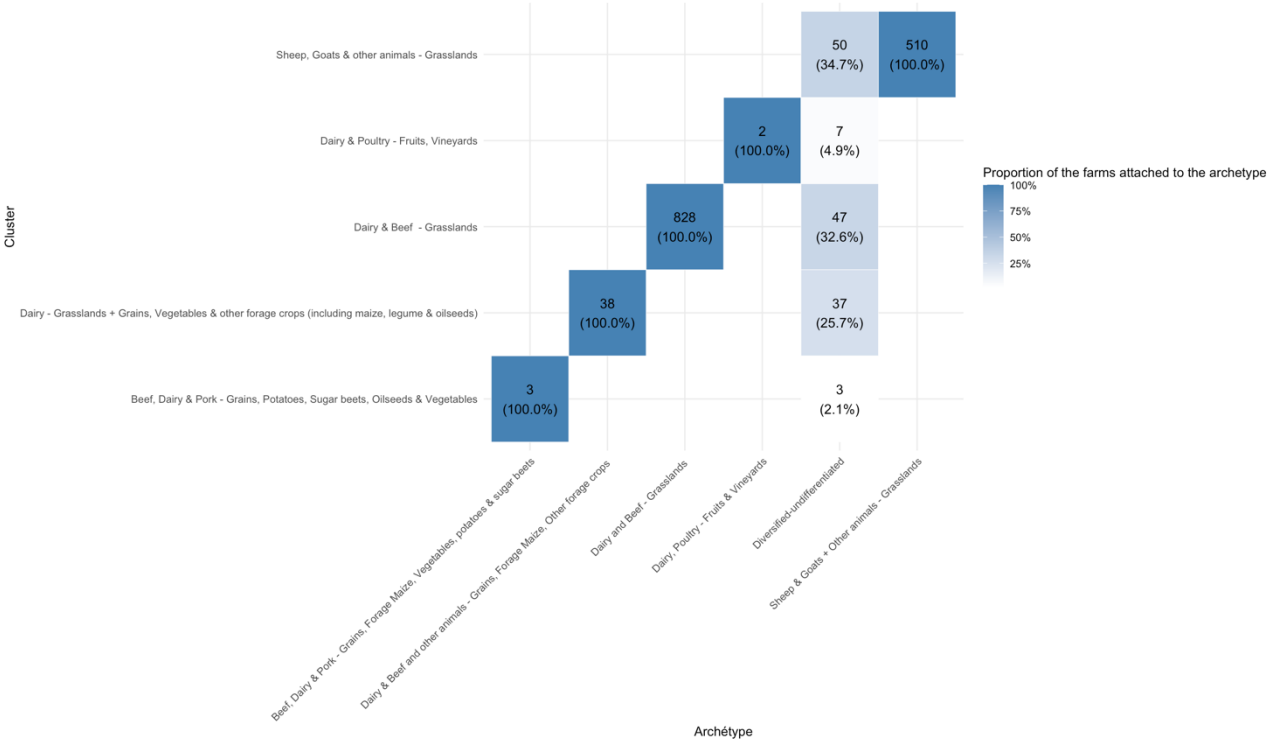


Figure 165 – Distribution of farms in Valais across the 5 clusters and 5 archetypes created from the IACS dataset.

The picture is thus structured by five distinct Farming System Orientations, of which the last two are anecdotal (five farms in total for FSO_4 and FSO_5), consistent with the exclusion of the plain-oriented crop specializations from the study perimeter. Grassland-based ruminant systems dominate the classified population (FSO_1/MIX_1 and FSO_2/MIX_2 together account for about 94% of farms), in line with the overwhelming share of grasslands in the cantonal UAA.



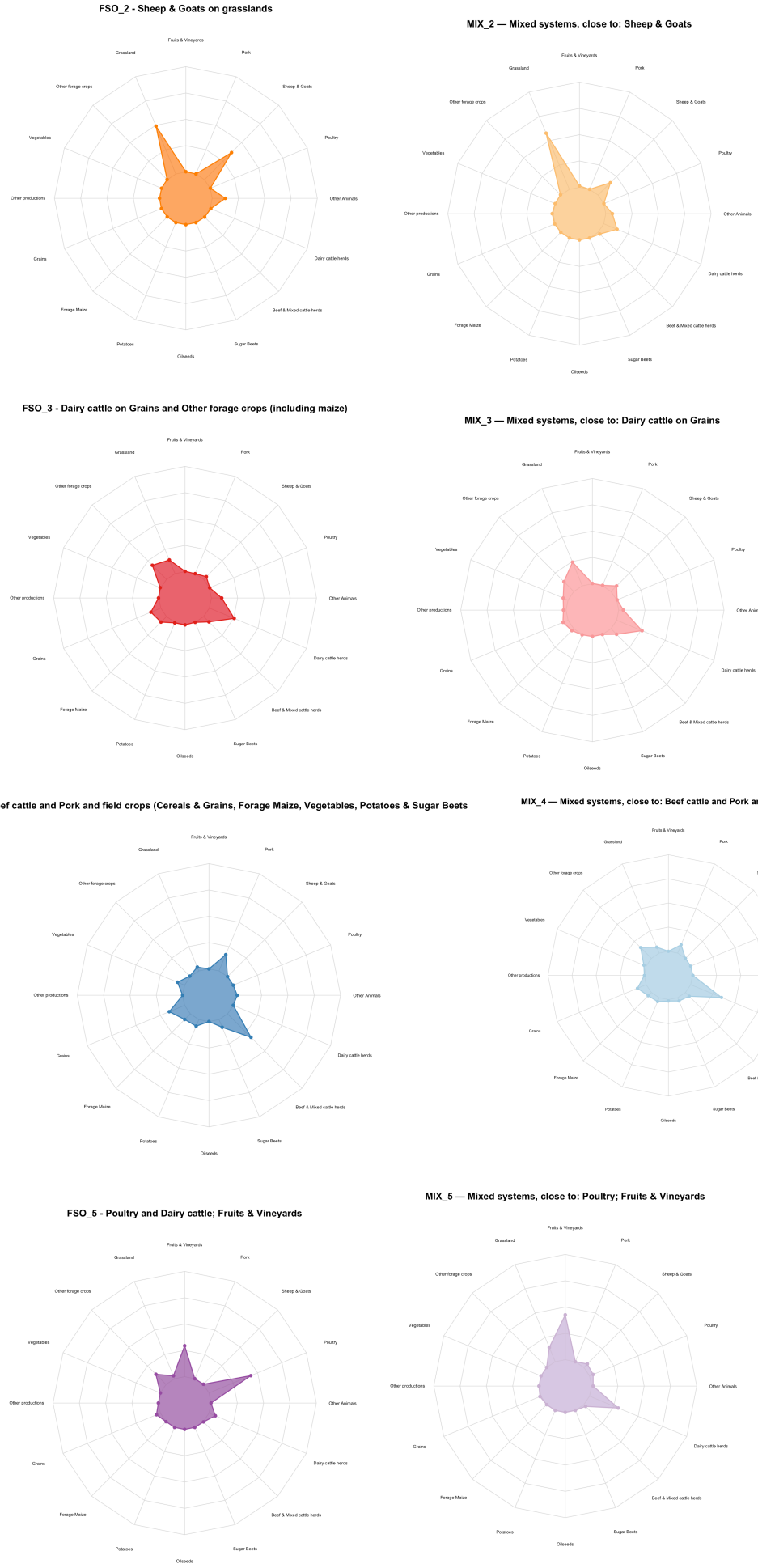


Figure 166 - Discriminating factors describing the 10 Farming System Orientations (FSO)

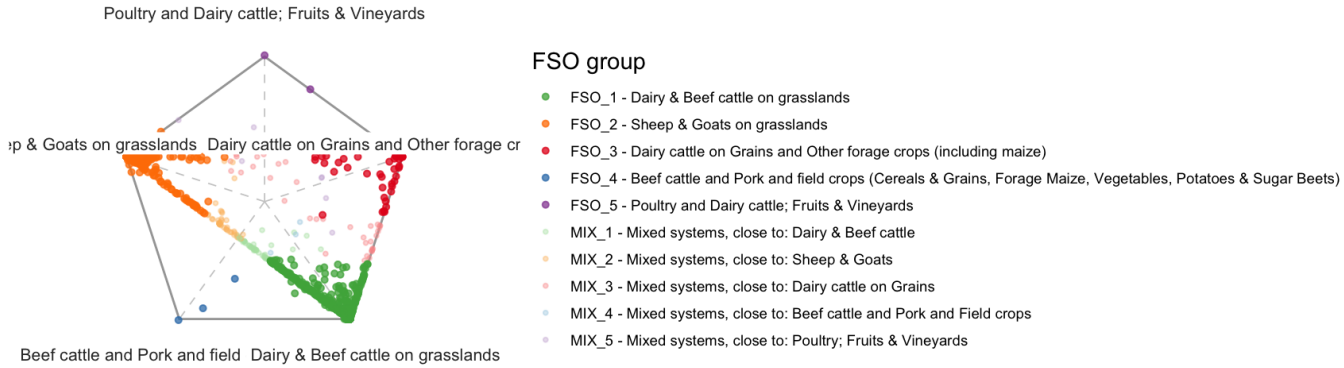


Figure 167 - Allocation of farms in Valais across archetypal and mixed Farming System Orientations (FSO) in a 5-dimension space.

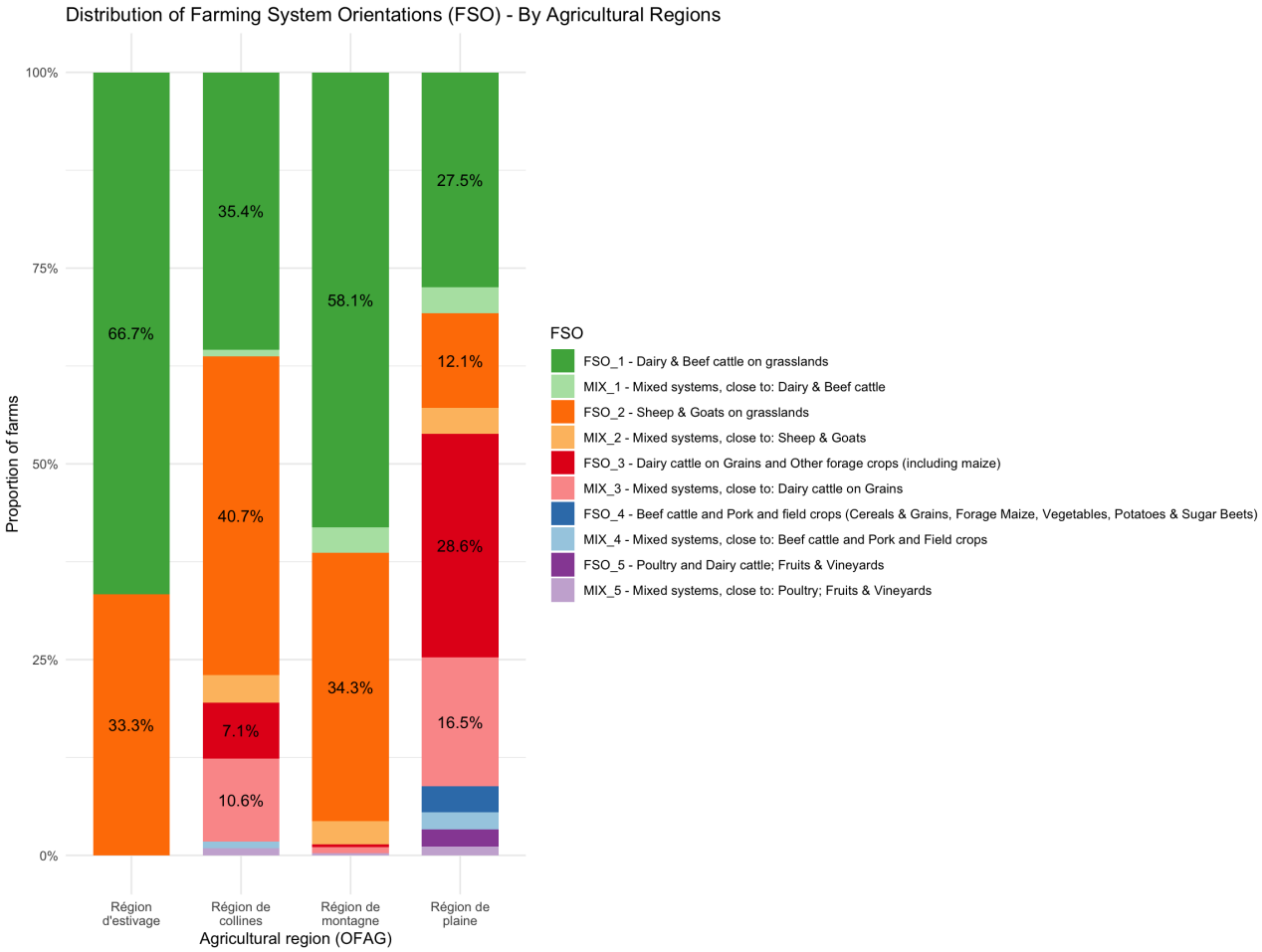


Figure 168 - Distribution of farms in Valais subregions across Farming System Orientations (FSO)

Relying on the population-level IACS dataset, a set of complementary descriptive statistics refines the image of each Farming System Orientation, both at the regional (cantonal) scale and across the agricultural regions:

As expected from the dominance of grassland-based ruminant systems (FSO_1 and FSO_2 together account for about 94% of the classified farms), the figures below contrast the livestock-oriented orientations, associated with higher livestock-unit densities and grassland shares, with the smaller arable, specialty and mixed orientations. Farm size (Figure 168), the share of organic farms (Figure 169), livestock-unit density (Figure 170), and the shares of grassland (Figure 171), legumes (Figure 172) and non-productive elements (Figure 173) are reported for each FSO at the cantonal scale and across the four agricultural regions; the anecdotal orientations FSO_4 and FSO_5 (five farms in total) should be read with caution.

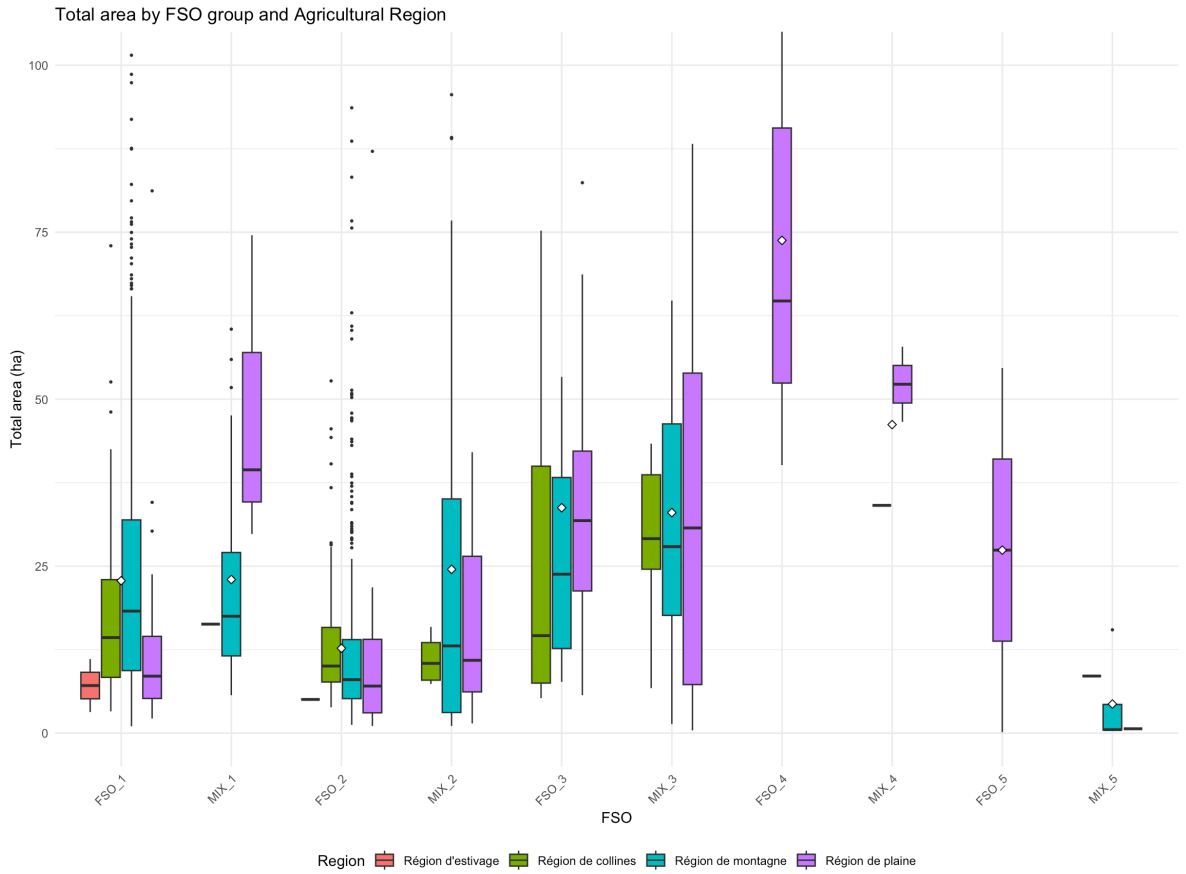
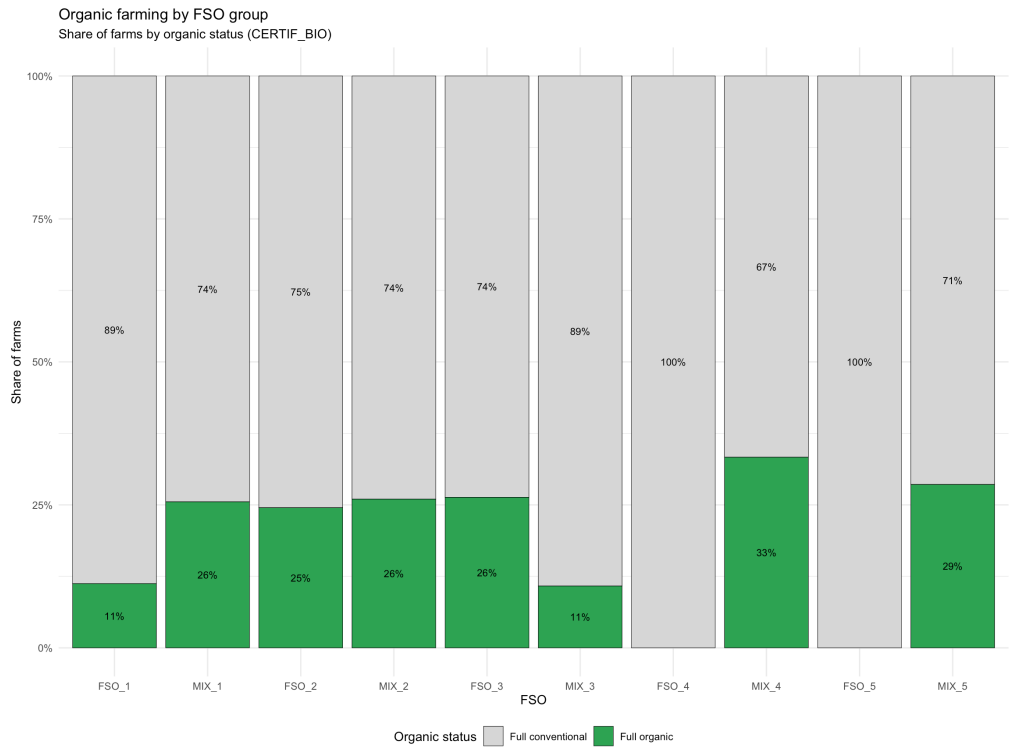


Figure 169 - Farm size (total area) across Farming System Orientations (FSO) at the regional (top) and agricultural-region (bottom) scales in Valais.



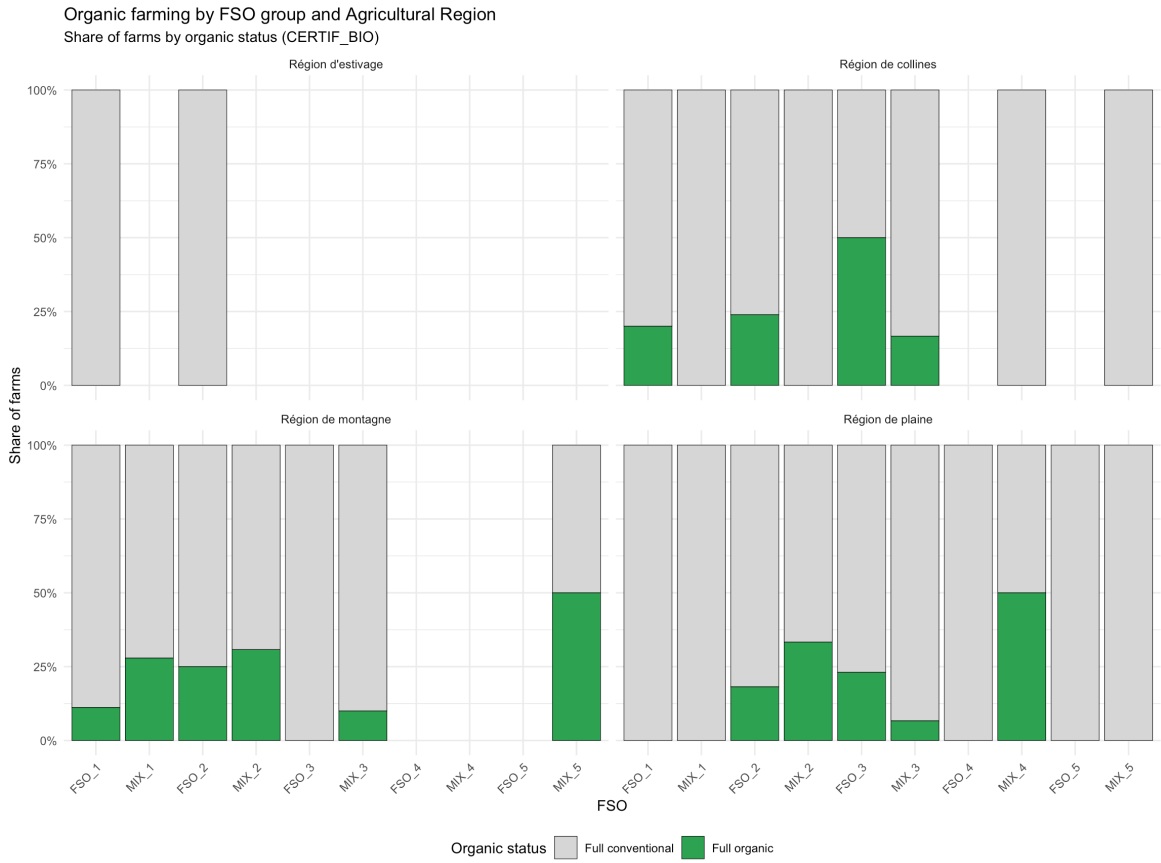


Figure 170 - Share of farms partly or fully certified under organic farming across Farming System Orientations (FSO) and agricultural regions in Valais.

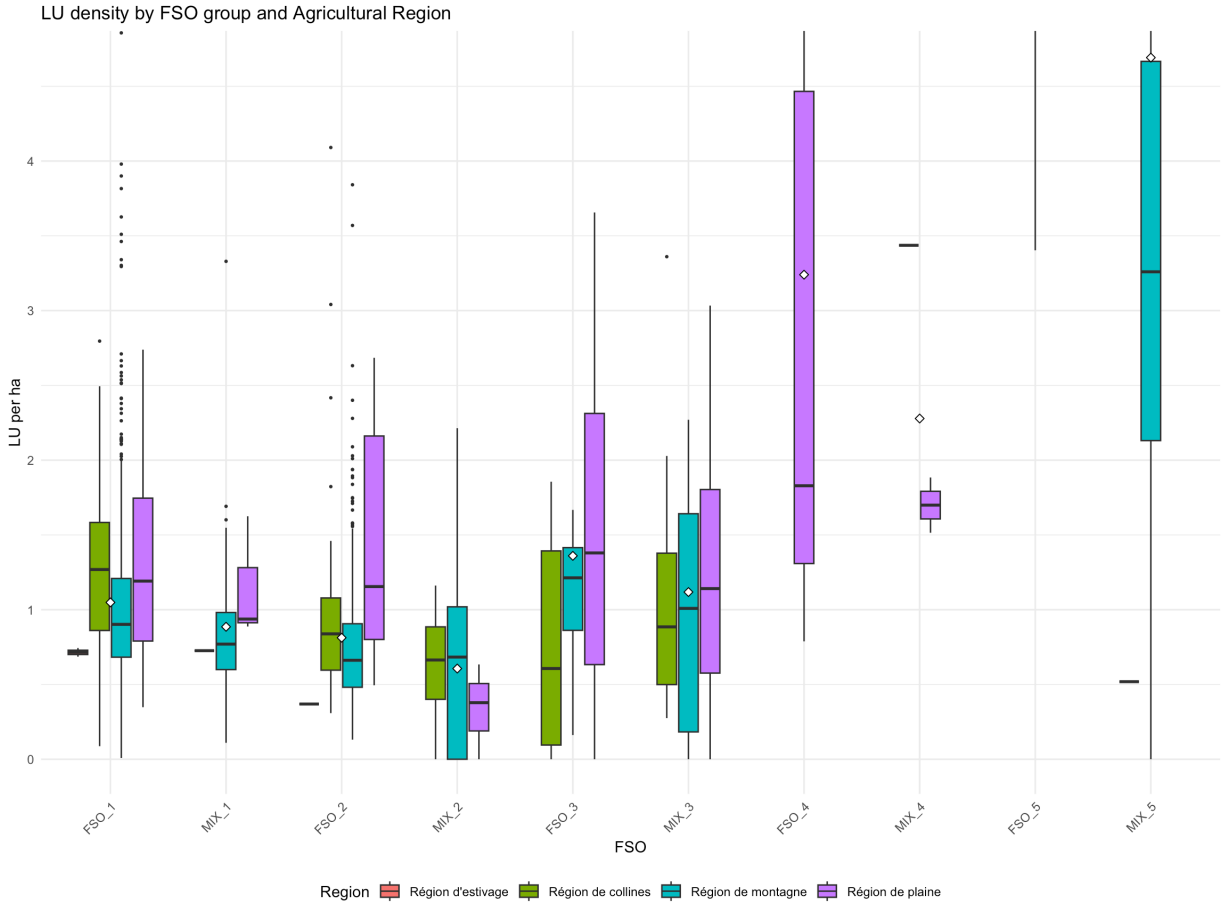


Figure 171 - Livestock unit density (LU/ha) across Farming System Orientations (FSO) and agricultural regions in Valais.

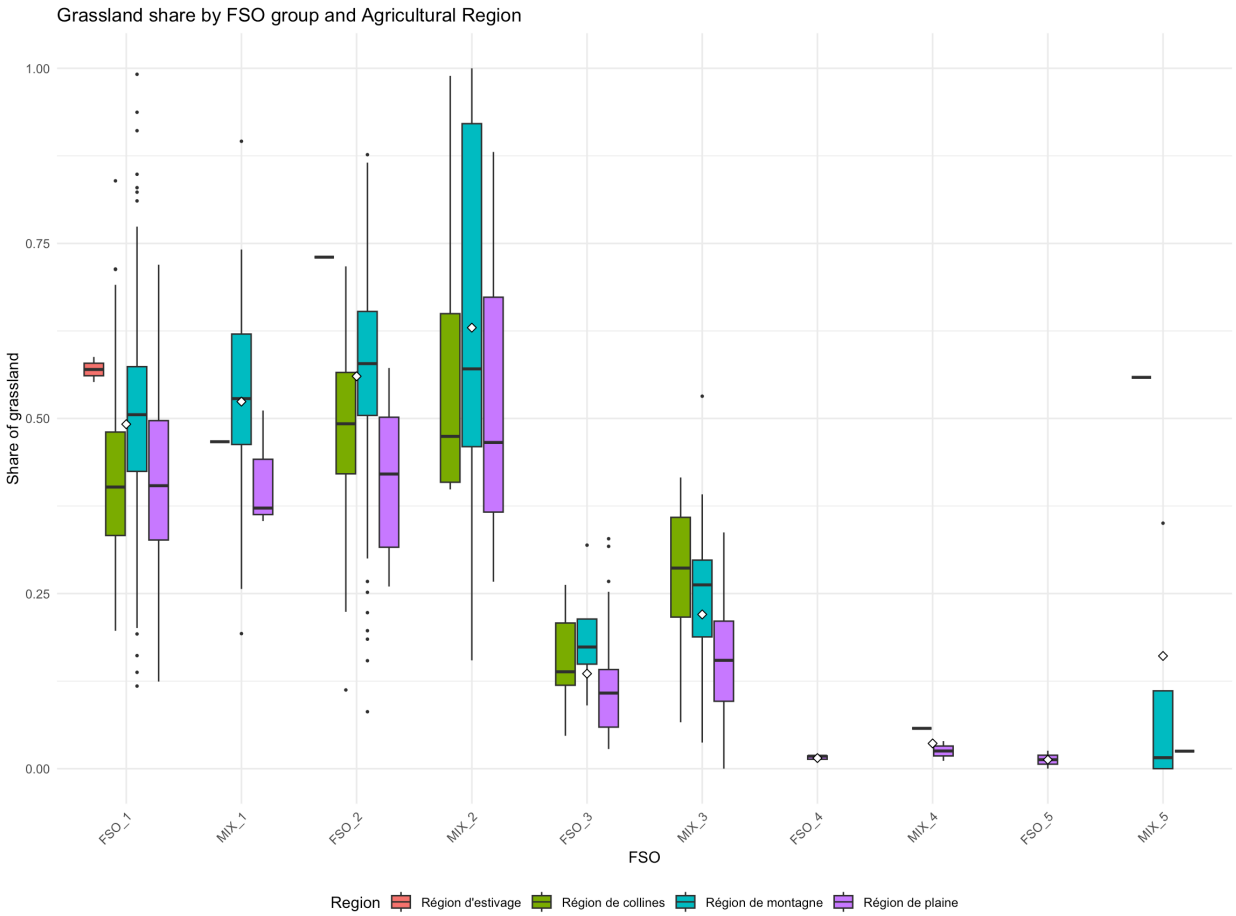


Figure 172 - Share of grassland in farmland across Farming System Orientations (FSO) and agricultural regions in Valais.

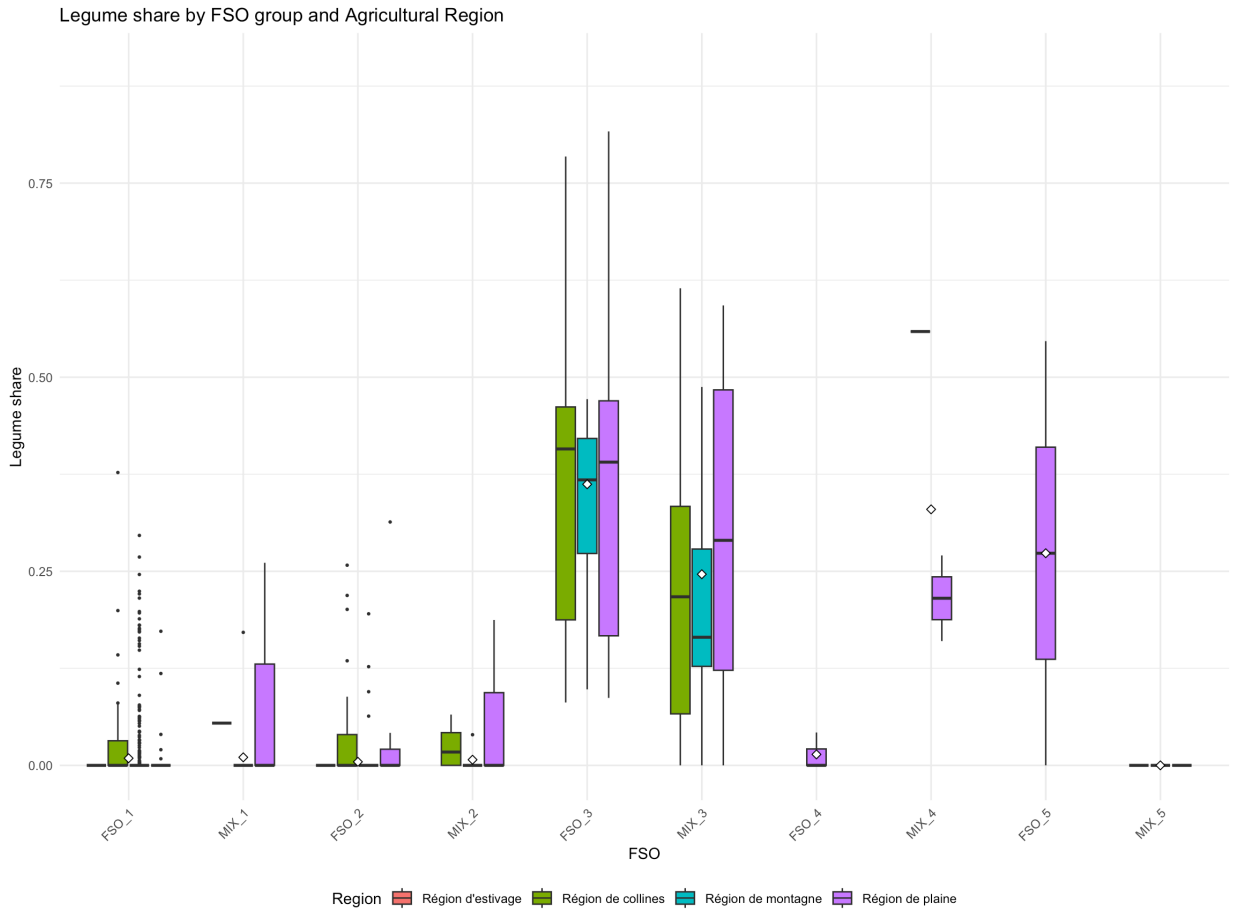


Figure 173 - Share of legumes in farmland across Farming System Orientations (FSO) and agricultural regions in Valais.

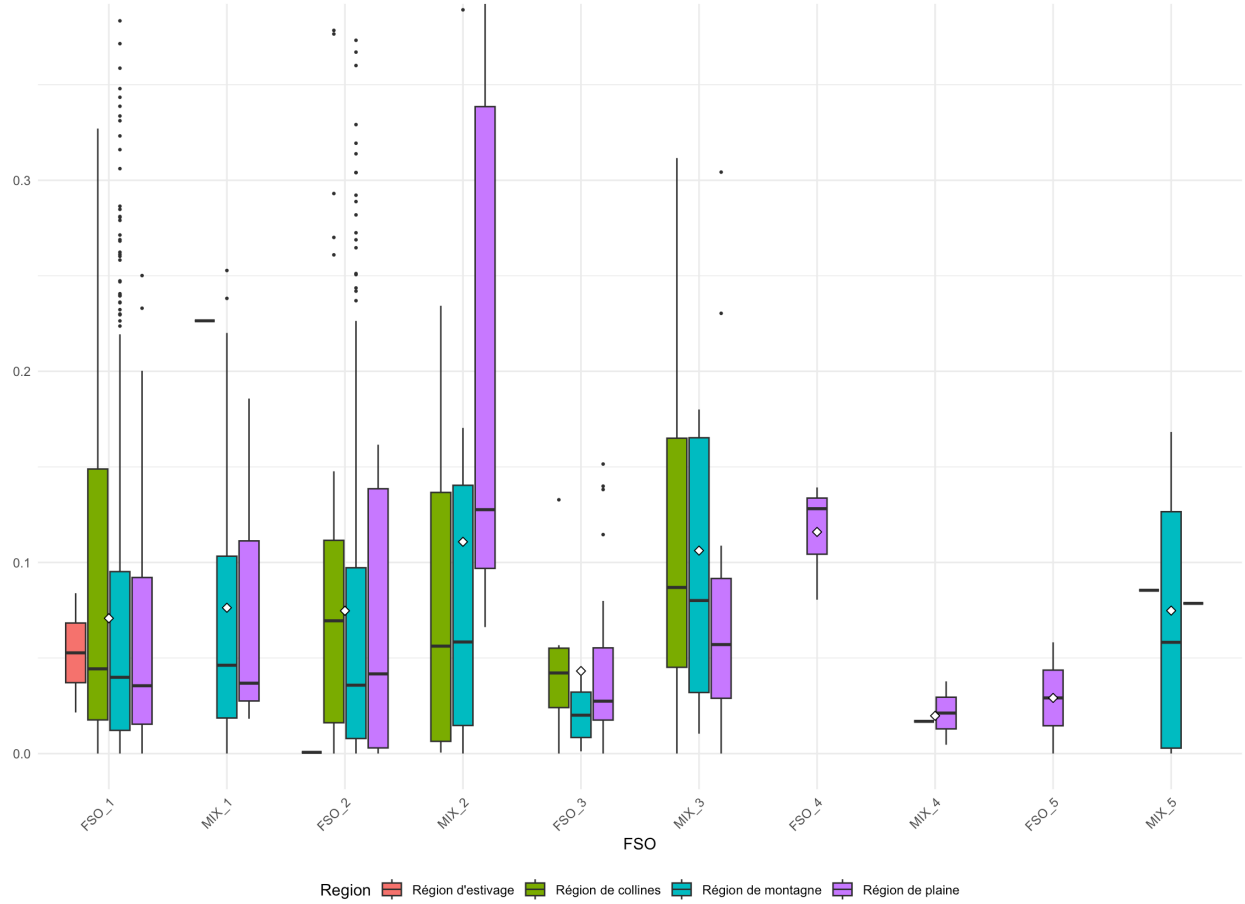


Figure 174 – [y-axis] Share of non-productive elements (e.g. hedges, grass strips, fallow land) ; across Farming System Orientations (FSO) and agricultural regions in Valais[x-axis].

9.5 Farming system orientations and sampling in Lazio

The pre-typology for the Lazio Region (NUTS 2 level-ITI4) was built following the shared workflow described in Section 10.2 – hierarchical clustering on principal components (HCPC) and archetypal analysis (AA), crossed and merged into Farming System Orientations (FSO) – applied to the 2018 Graphical Crop Plan (Piano Colturale Grafico, PCG), the most up-to-date structural dataset available on crop and livestock production. The Lazio Region covers about 17,242 km² and had roughly 5.7 million inhabitants in 2024. The 2018 PCG identified 38,931 farms across the region. The analysis focused on seven representative agroecosystems, jointly comprising 16,366 farms (about 42% of the regional farm population). This choice aligns with the ongoing regional agricultural-territorial planning process, in which the Lazio team is involved as a consulting partner, offering an opportunity to embed agroecological-transition measures into broader land-use strategies (Figure 175).

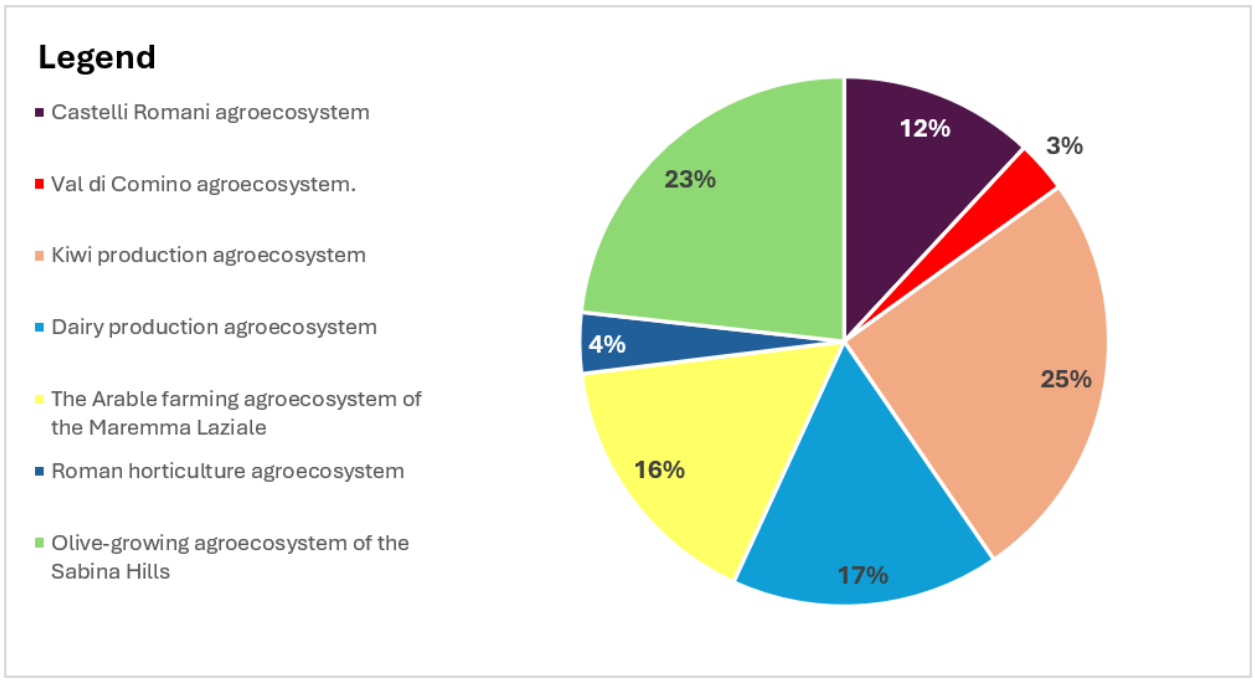
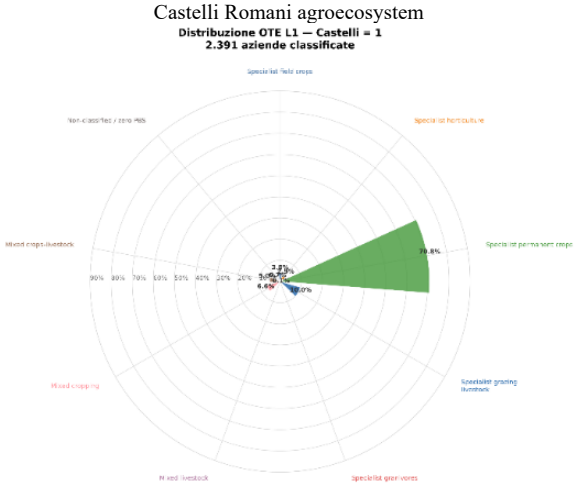


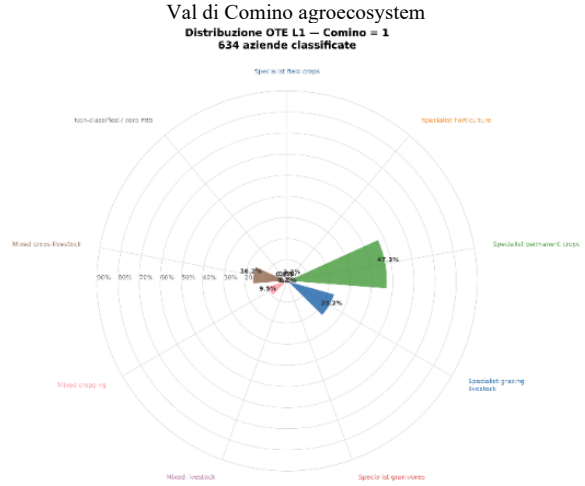
Figure 175 - Distribution of the selected farm population registered in the 2018 Graphical Crop Plan (PCG) across the seven studied agroecosystems of the Lazio Region.

Within the selected population, the predominant Technical-Economic Orientation (TEO) was specialist permanent crops (about 50.1% of farms), followed by specialist grazing livestock (16.7%), specialist field crops (9.3%), mixed crops–livestock (8.9%), mixed cropping (8.3%) and specialist horticulture (6.0%); granivores and mixed livestock farms together accounted for less than 1%. The TEO composition of each agroecosystem is reported in Figure 176.

Castelli Romani agroecosystem

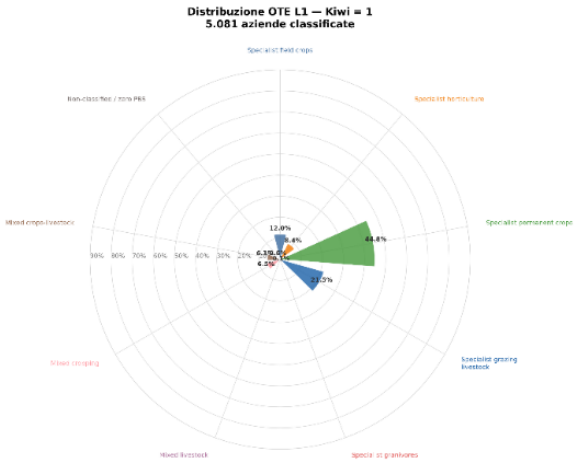


Val di Comino agroecosystem

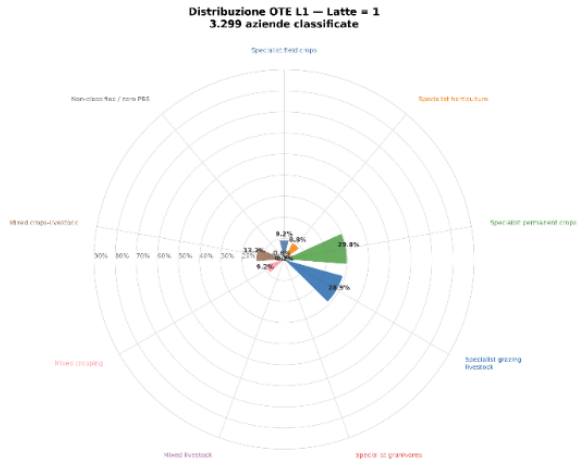


Kiwi production agroecosystem

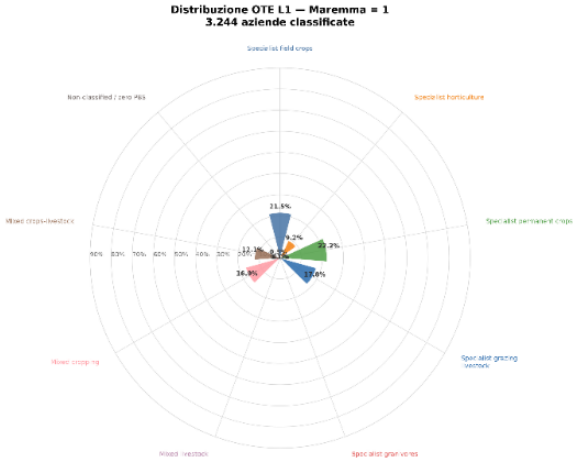
Dairy production agroecosystem



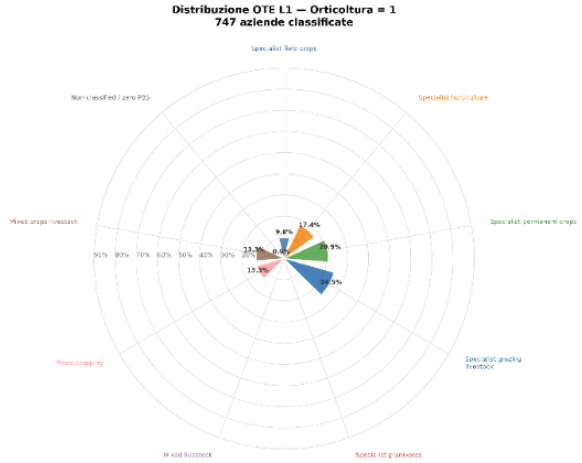
Arable farming agroecosystem of the Maremma Laziale



Roman horticulture agroecosystem



Olive-growing agroecosystem of the Sabina hills



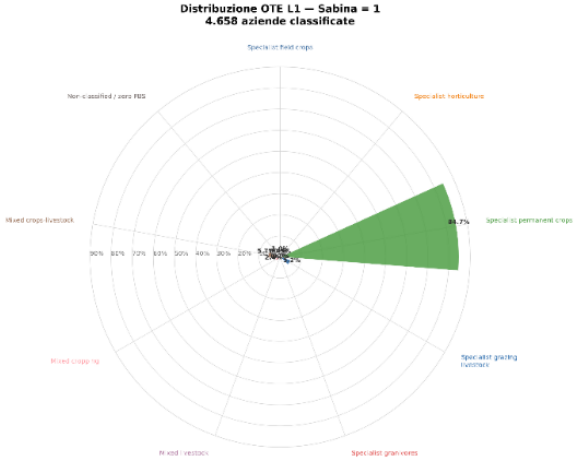


Figure 176 - Distribution of farms registered in the 2018 Graphical Crop Plan (PCG) across the Technical-Economic Orientations (TEO) within each of the seven studied agroecosystems of the Lazio Region.

For the sampling, a target of at least 100 holdings was set, including farms belonging to the CIA network (Aziende evolute, AeV) as well as farms affiliated with other professional agricultural associations, selected within the boundaries of the identified agroecosystems. The sampling strategy combined convenience sampling – based on cold contacts drawn from existing lists and farmer networks – with snowball sampling within the agroecological and conventional networks identified at local and regional levels. During the iterative refinement of the sample, additional adjustment criteria were considered, including organic certification and farm size, together with feedback from interviewers, with the aim of maximising the diversity of farming-system orientations and farm models, including conventional management systems.
At the target-population level, HCPC identified a set of clusters summarising the main structural gradients of the PCG data (Figure 177); their distribution across the agroecosystems is shown in Figure 178.

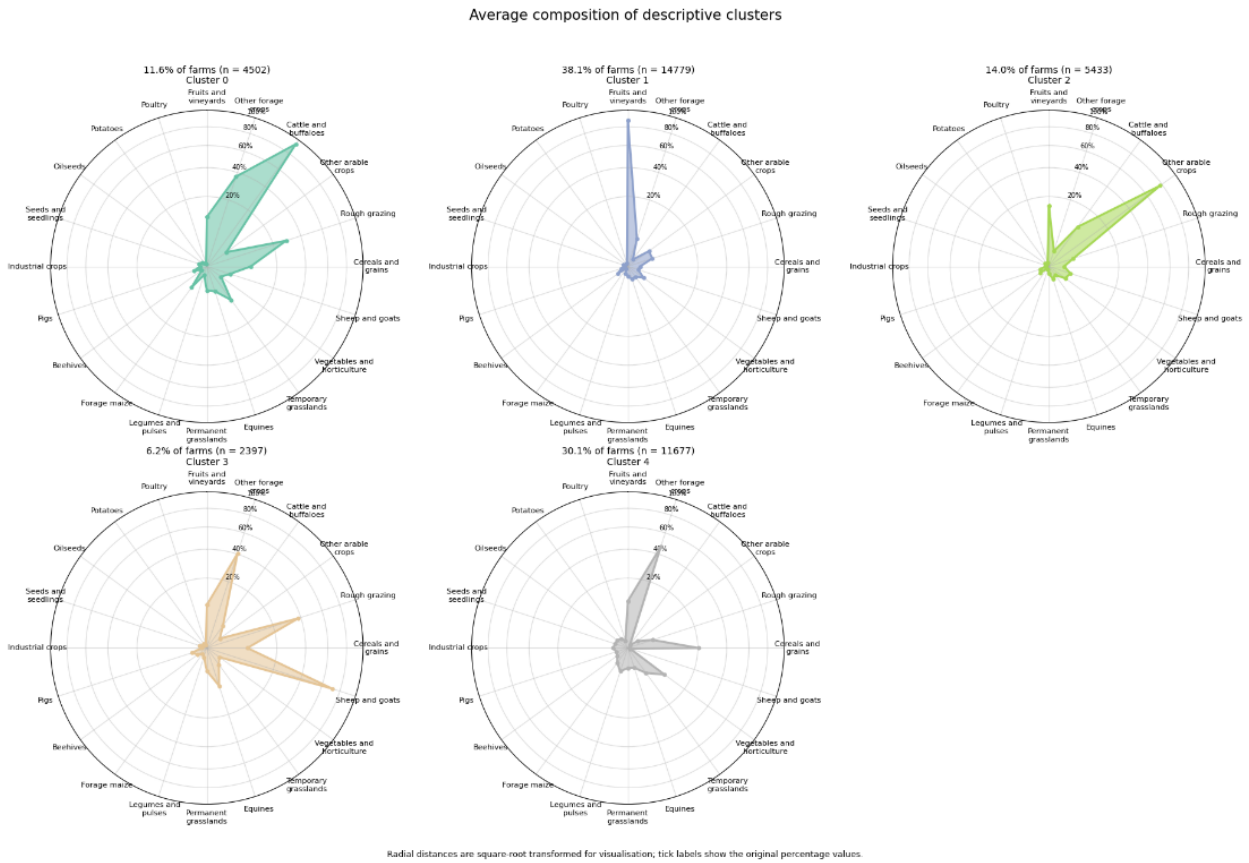


Figure 177 - Description of the clusters defined at regional level using the HCPC algorithm on the restrained Lazio Region PCG population.

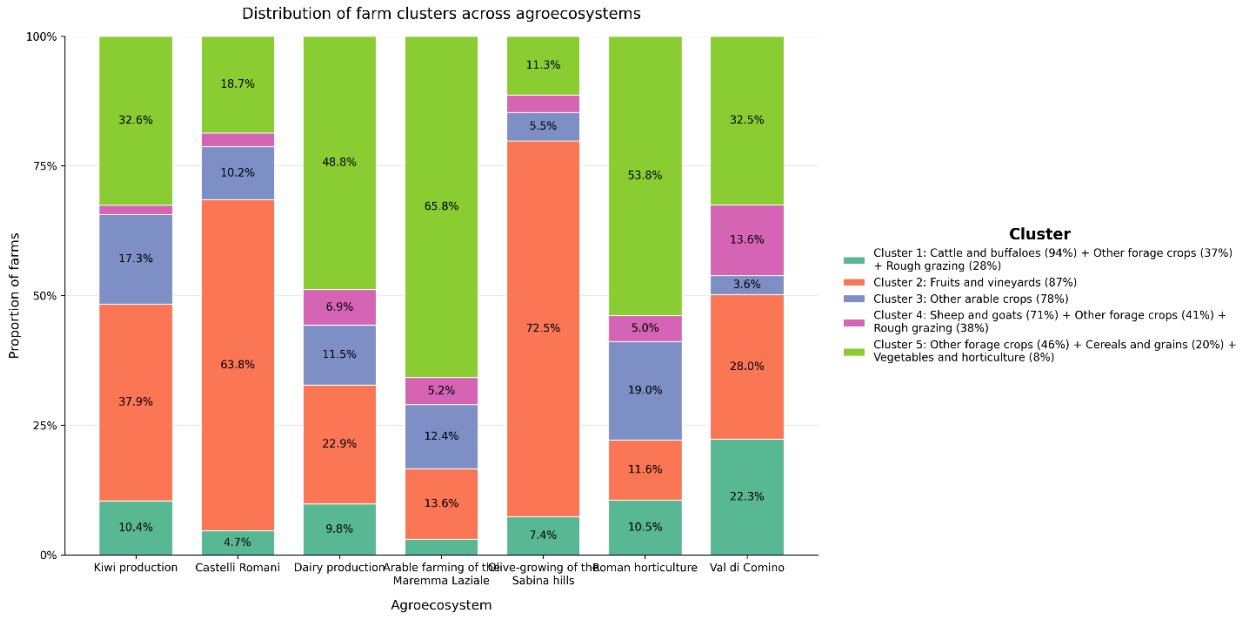


Figure 178 - Distribution of Lazio Region farms – registered in the regional PCG – into clusters across agroecosystems.

Archetypal analysis then characterised the population through a set of extreme, prototypical profiles: six archetypes plus an undifferentiated group were retained (Figure 179), and each farm was allocated to the archetypes across the agroecosystems (Figure 180).

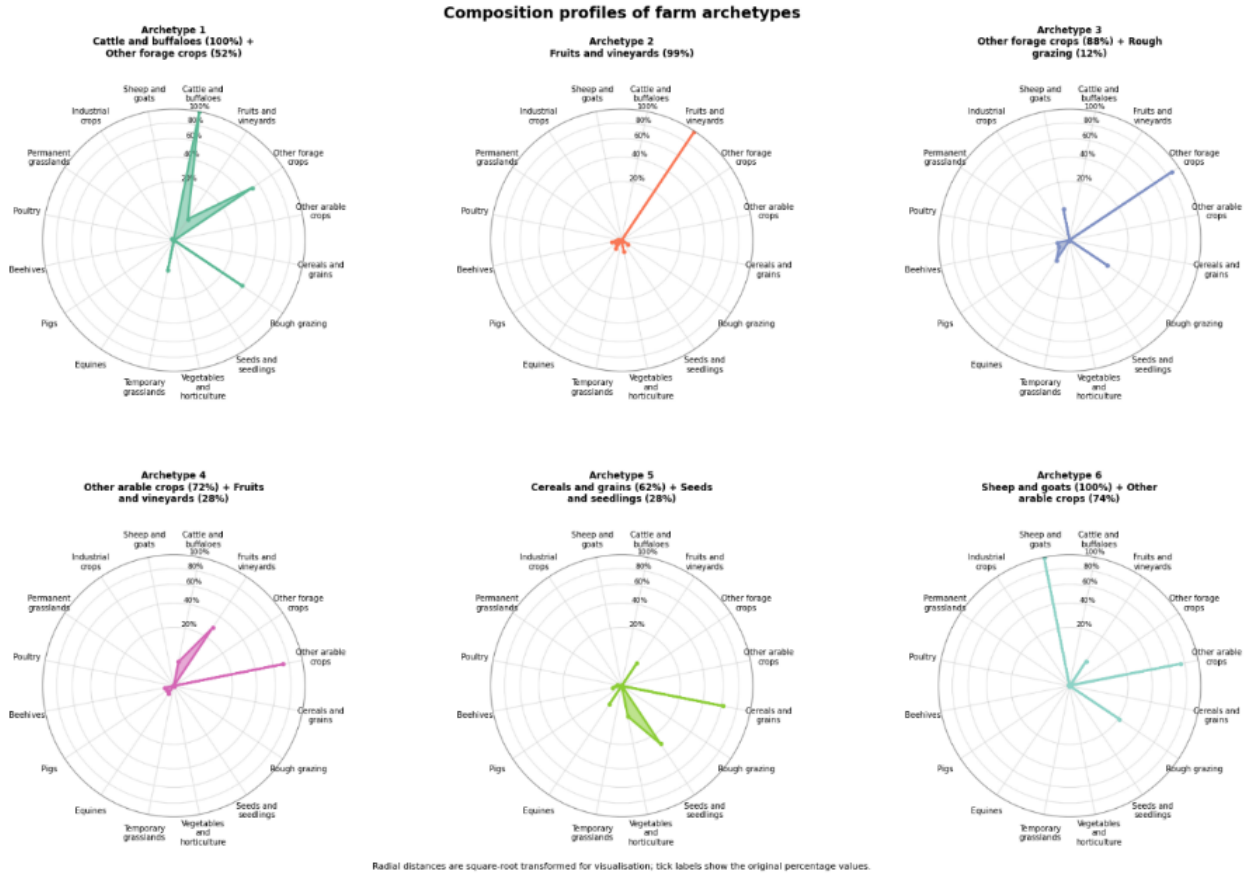


Figure 179 - Description of the six archetypes and the undifferentiated group (bottom-right corner) defined at regional level using Archetypal Analysis on the Lazio Region PCG population.

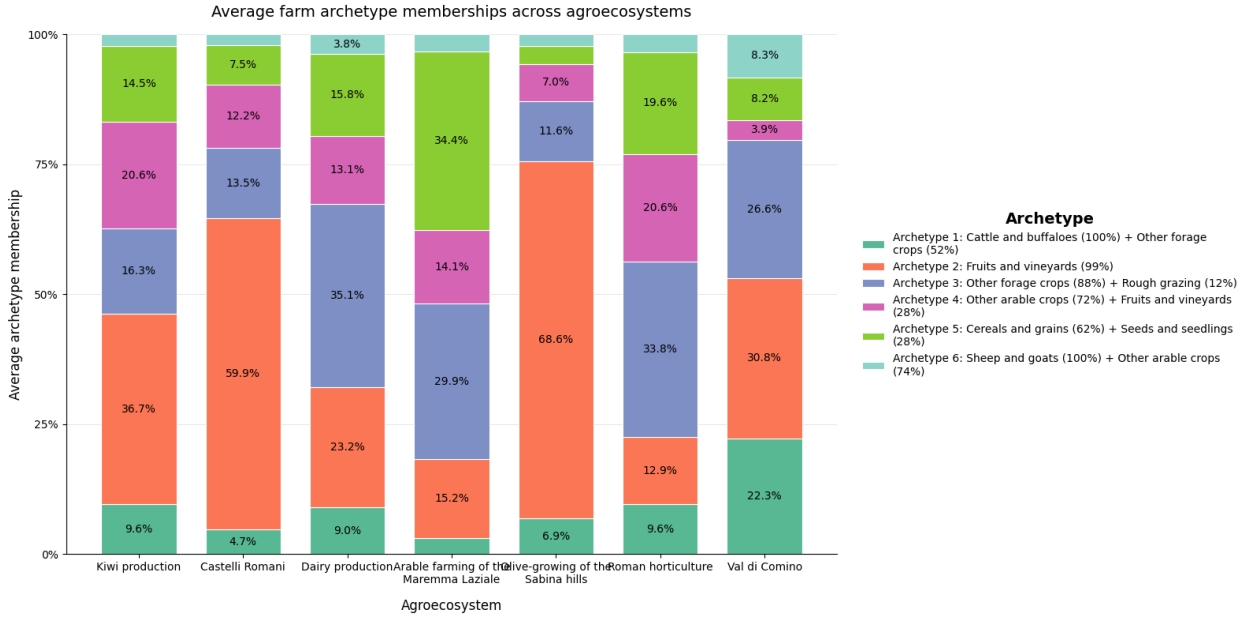


Figure 180 - Allocation of Lazio Region farms – registered in the regional PCG – into archetypes across the defined agroecosystems.

Following the shared cross-allocation rule (archetypal attachment threshold $\alpha \geq 0.64$), farms significantly associated with a single archetype formed five core Farming System Orientations (FSO_1 to FSO_5), while farms below the threshold were reallocated to the HCPC cluster to which they were structurally closest, generating five mixed groups (MIX_1 to MIX_5) representing intermediate profiles. This produced ten Farming System Orientations in total (Figure 181).

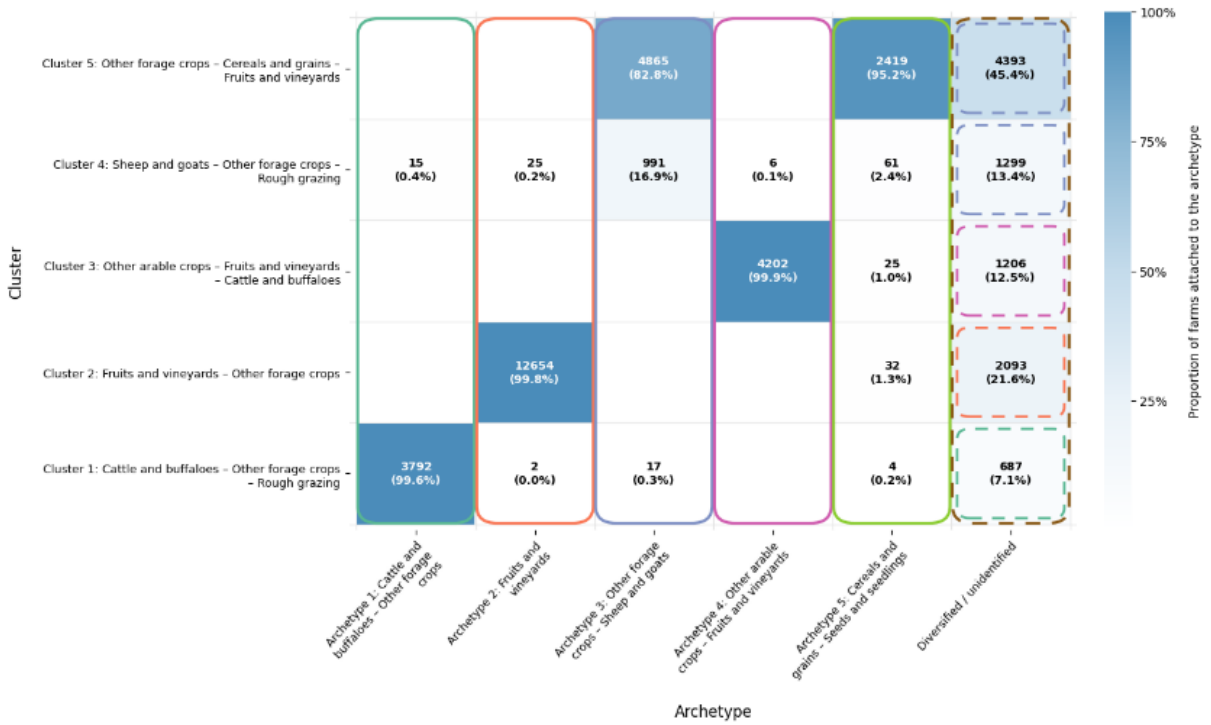
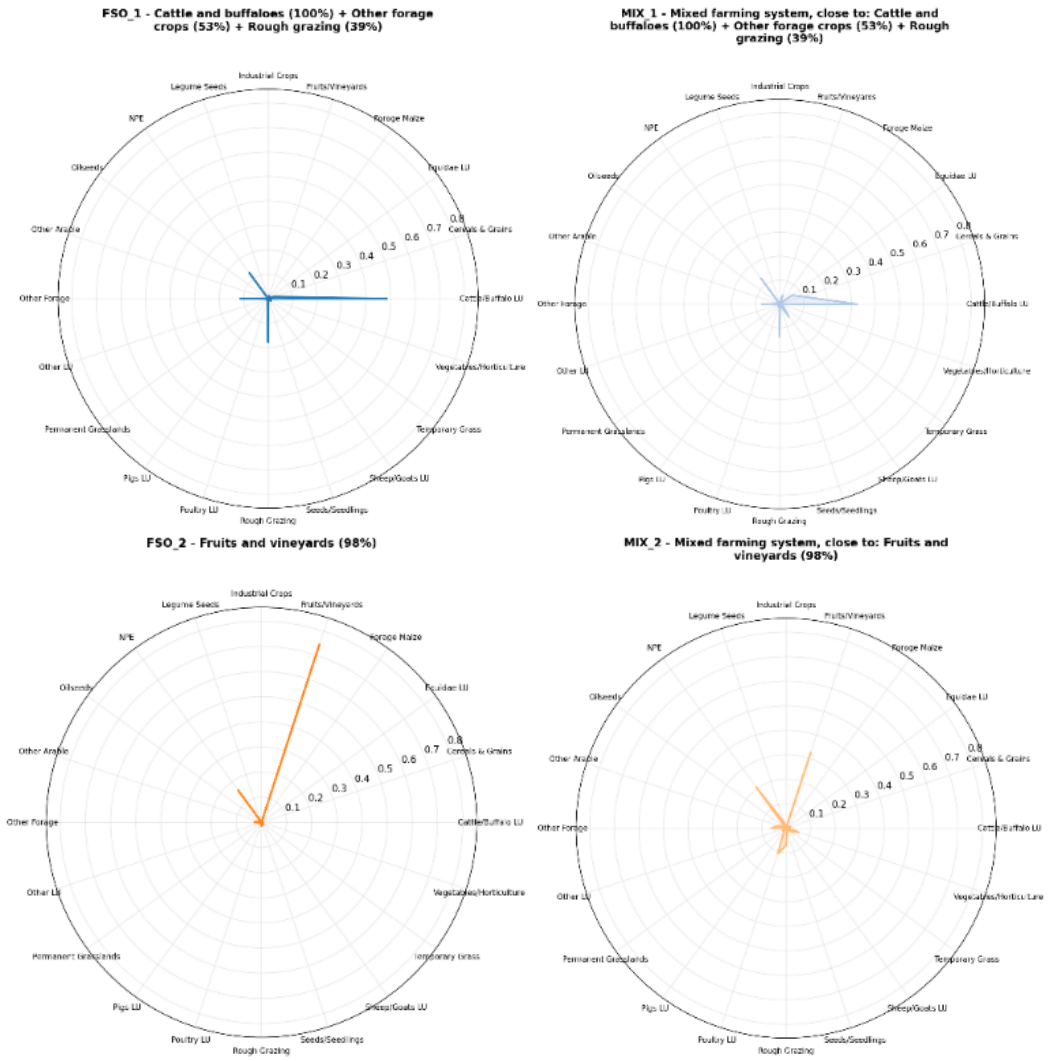


Figure 181 - Number of farms allocated to the clusters and archetypes, and grouping process into Farming System Orientations (FSO) in the Lazio Region.

The aggregated profile of each FSO group was then recalculated on the basis of the main discriminating factors (Figure 182), its its position within the five-dimensional archetypal space represented (Figure 183), and distribution across the agroecosystems examined (Figure 184, Figure 185).



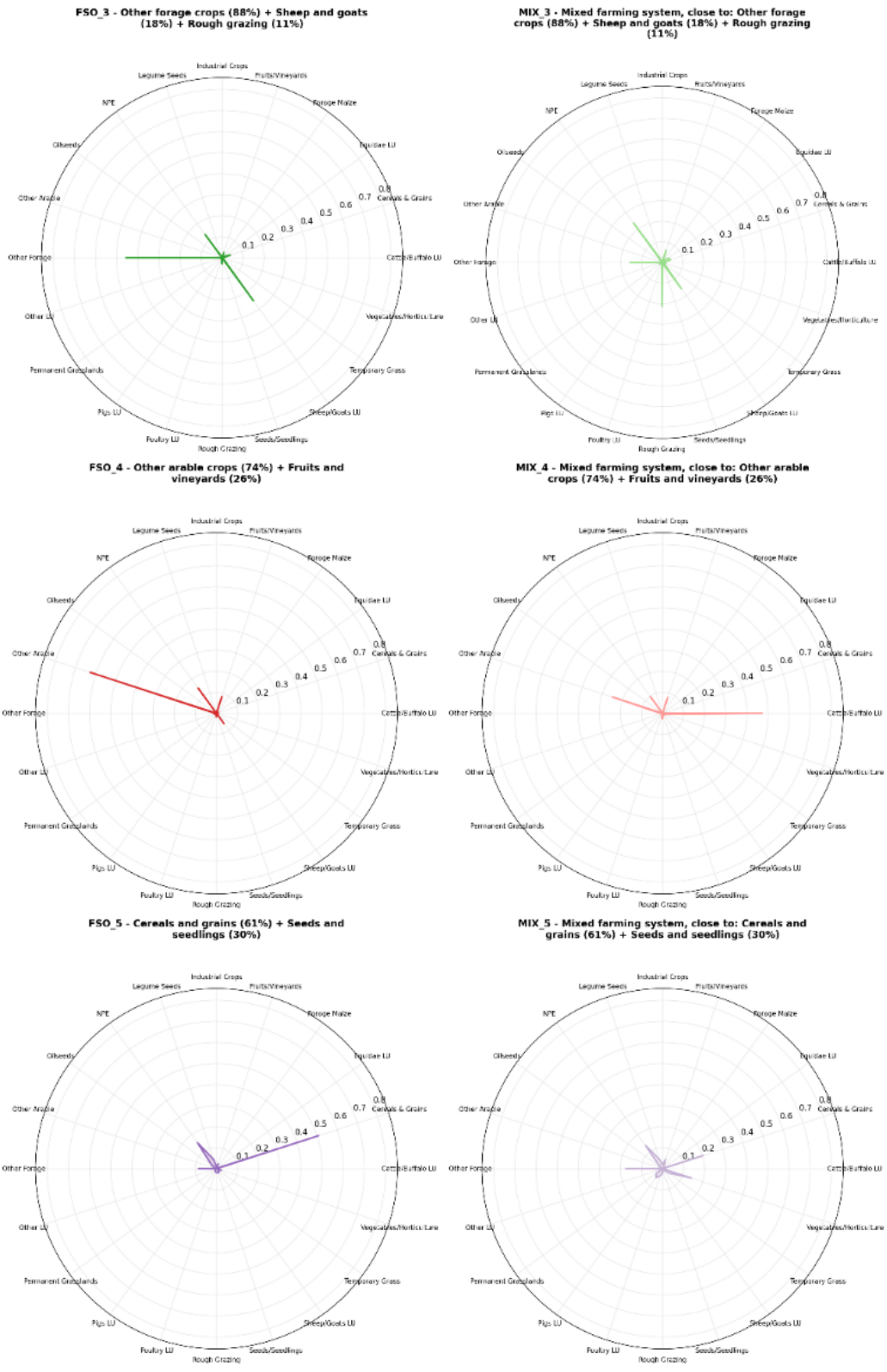


Figure 182- Discriminating factors describing the 10 Farming System Orientations (FSO) after grouping clusters & archetypes attributions

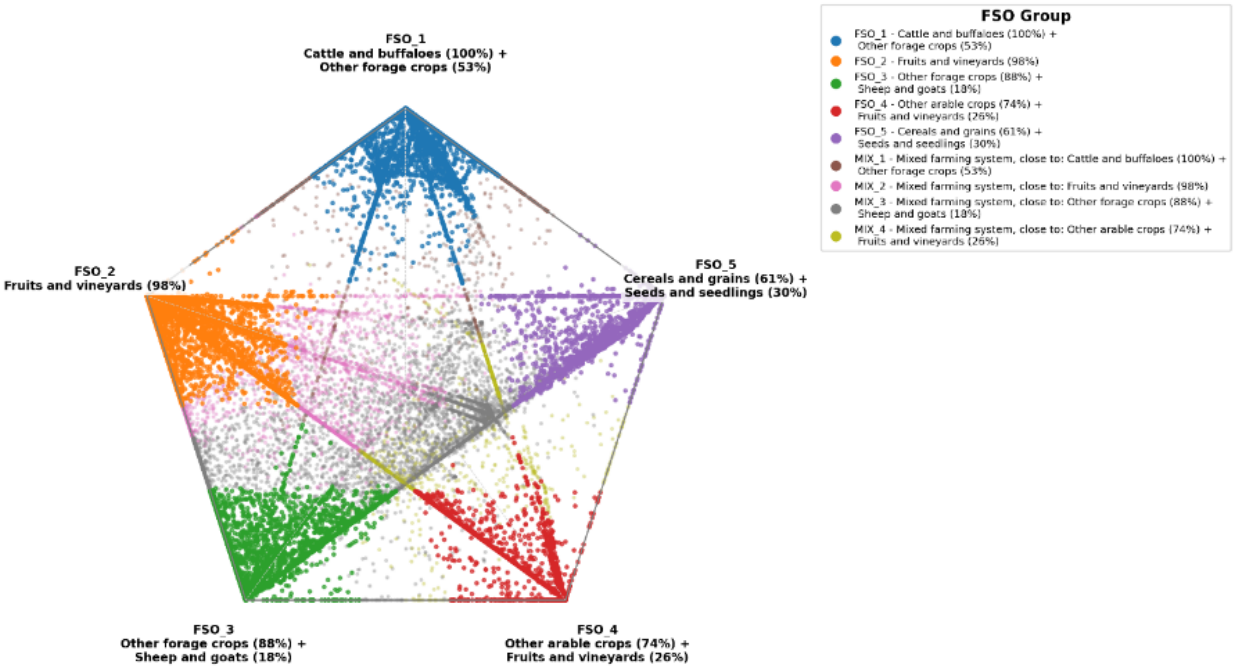


Figure 183 - Allocation of Lazio Region farms across archetypal and mixed Farming System Orientations (FSO) in a five-dimensional space.

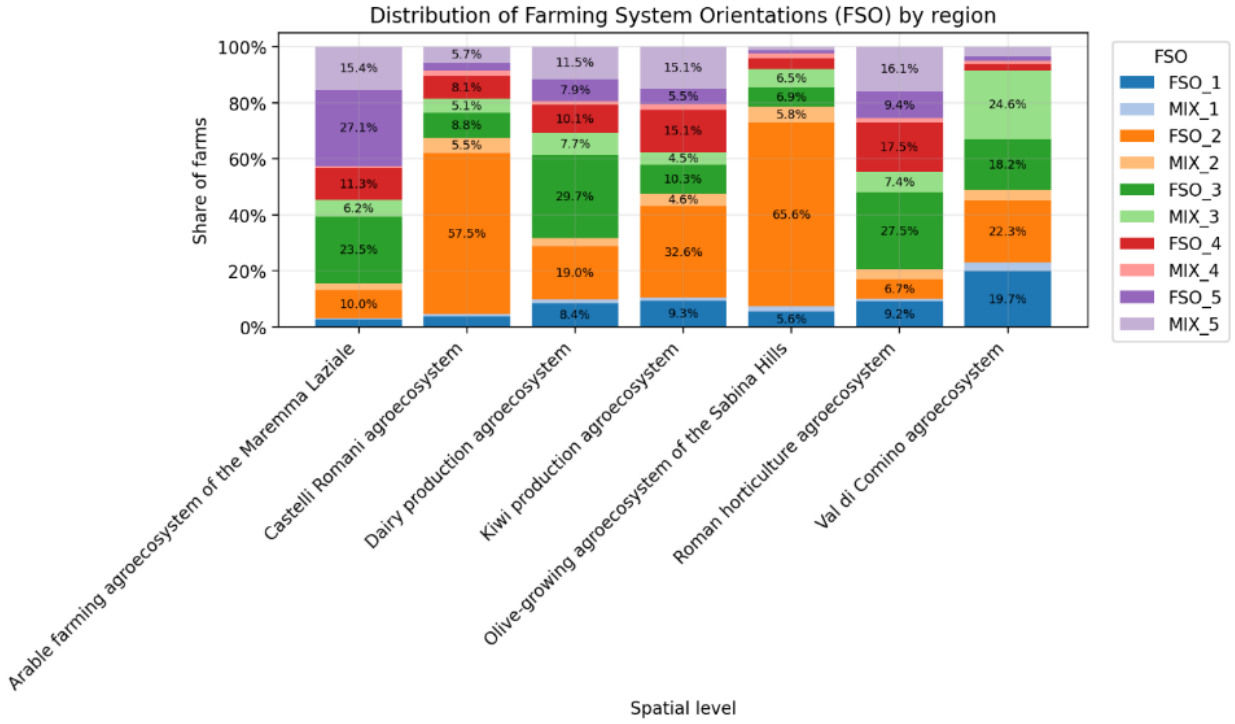


Figure 184 - Distribution of farms registered in the Lazio Region PCG across Farming System Orientations (FSO) and agroecosystems.

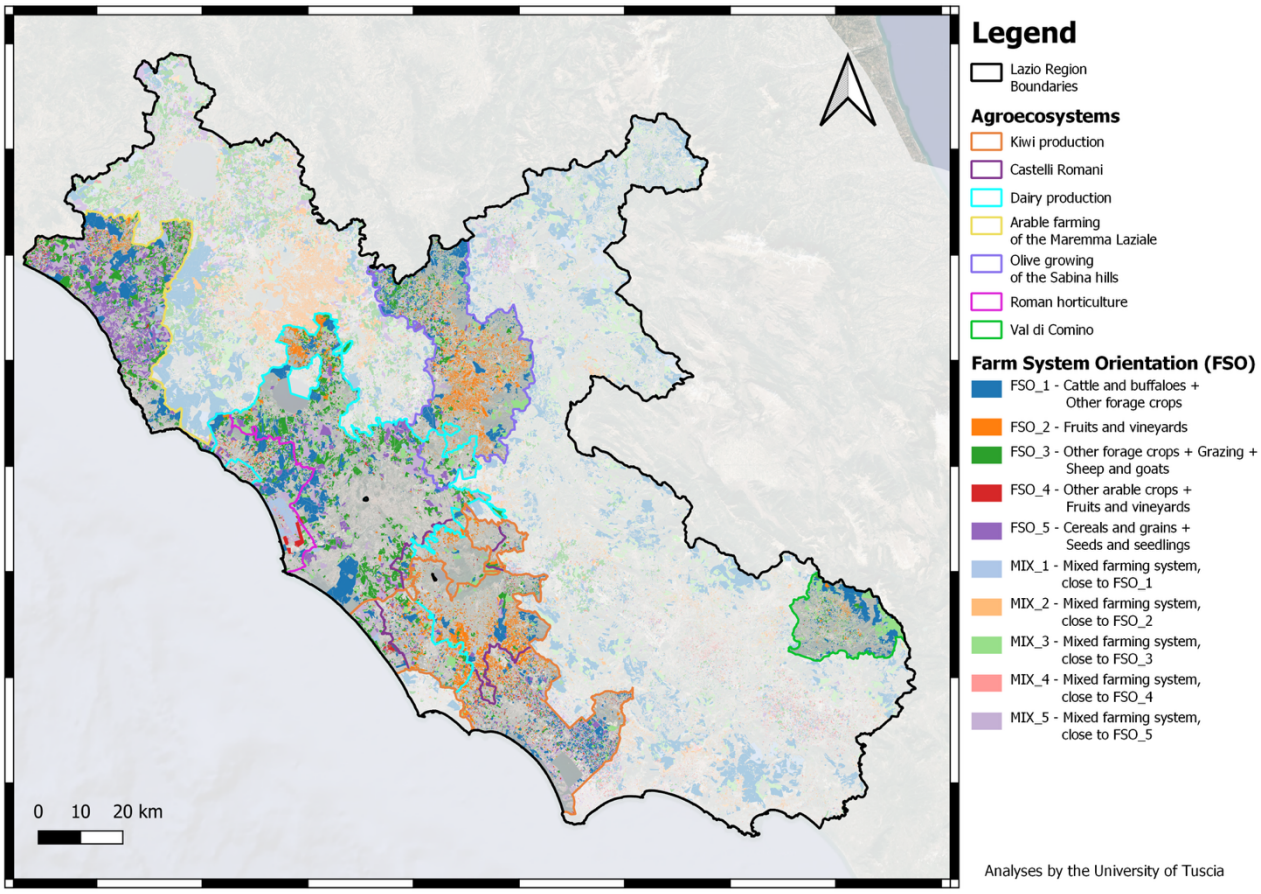


Figure 185 – Spatialized distribution of FSO attributions in Lazio across the different agroecosystems (UNITUS, 2026)

Then, relying on the population-level PCG dataset, a set of complementary descriptive statistics refines the profile of each FSO group, both at the regional scale and across the agroecosystems. As the distributions are strongly right-skewed for most variables – the mean typically exceeding the median owing to a limited number of very large farms – the median and interquartile range are the more representative measures.
Farm size (total area) varies substantially across FSO groups (Figure 185). FSO_1 comprises the largest farms (median ≈ 21 ha, mean ≈ 86 ha) and the largest total area (≈ 327,000 ha), whereas FSO_2 and FSO_4 are dominated by very small farms (median ≈ 3 ha). Classification as a mixed system does not systematically imply a larger area. Territorial context matters: FSO_1 farms are largest in the Lazio Maremma, while Val di Comino is highly heterogeneous, partly owing to extensive collectively owned and civic-use land. The spatial distribution of farms by size class is mapped in Figure 186.

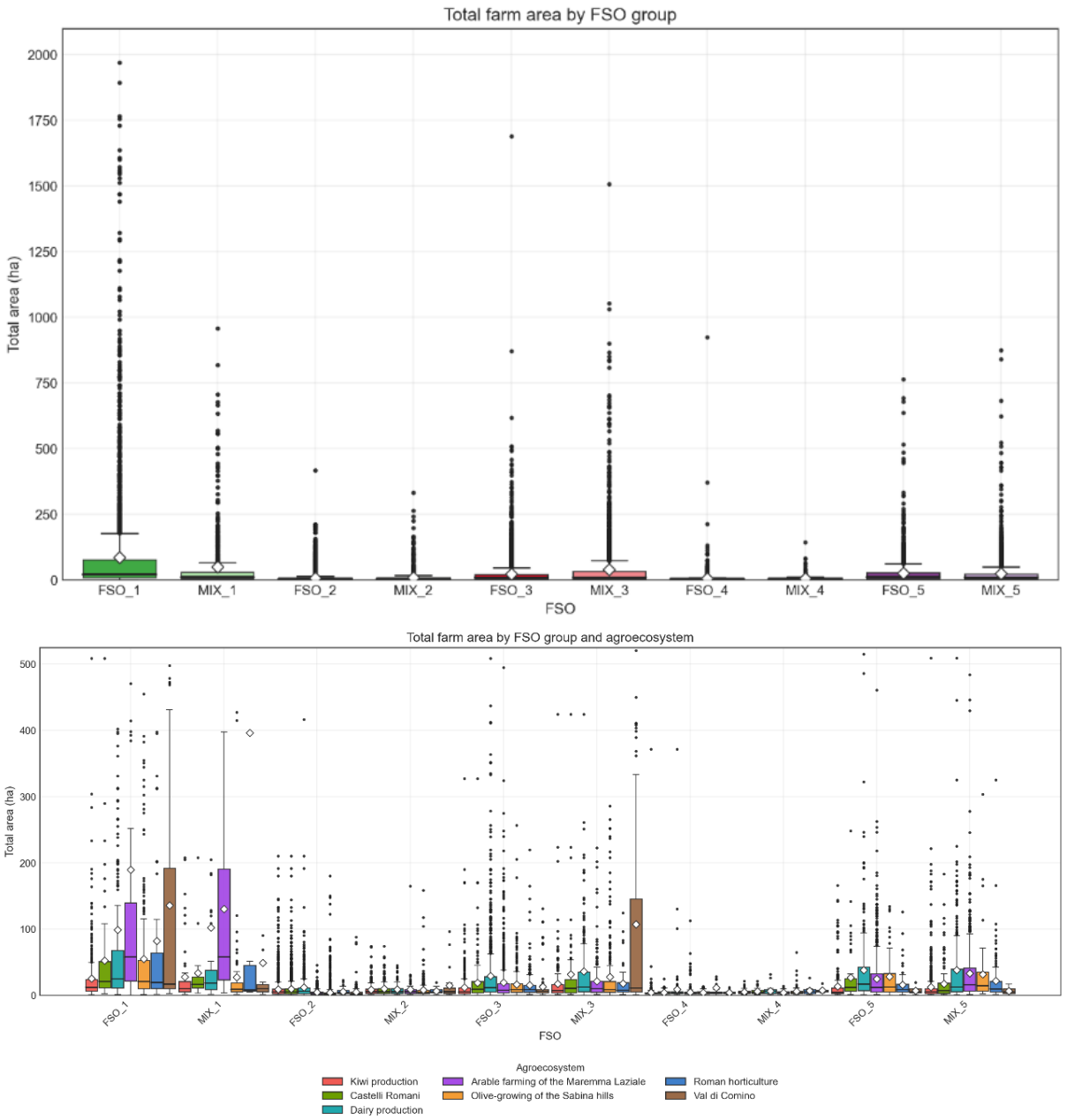


Figure 186 - Farm size (total area) distribution compared across Farming System Orientations (FSO) at the regional (top) and agroecosystem (bottom) scales in the Lazio Region.

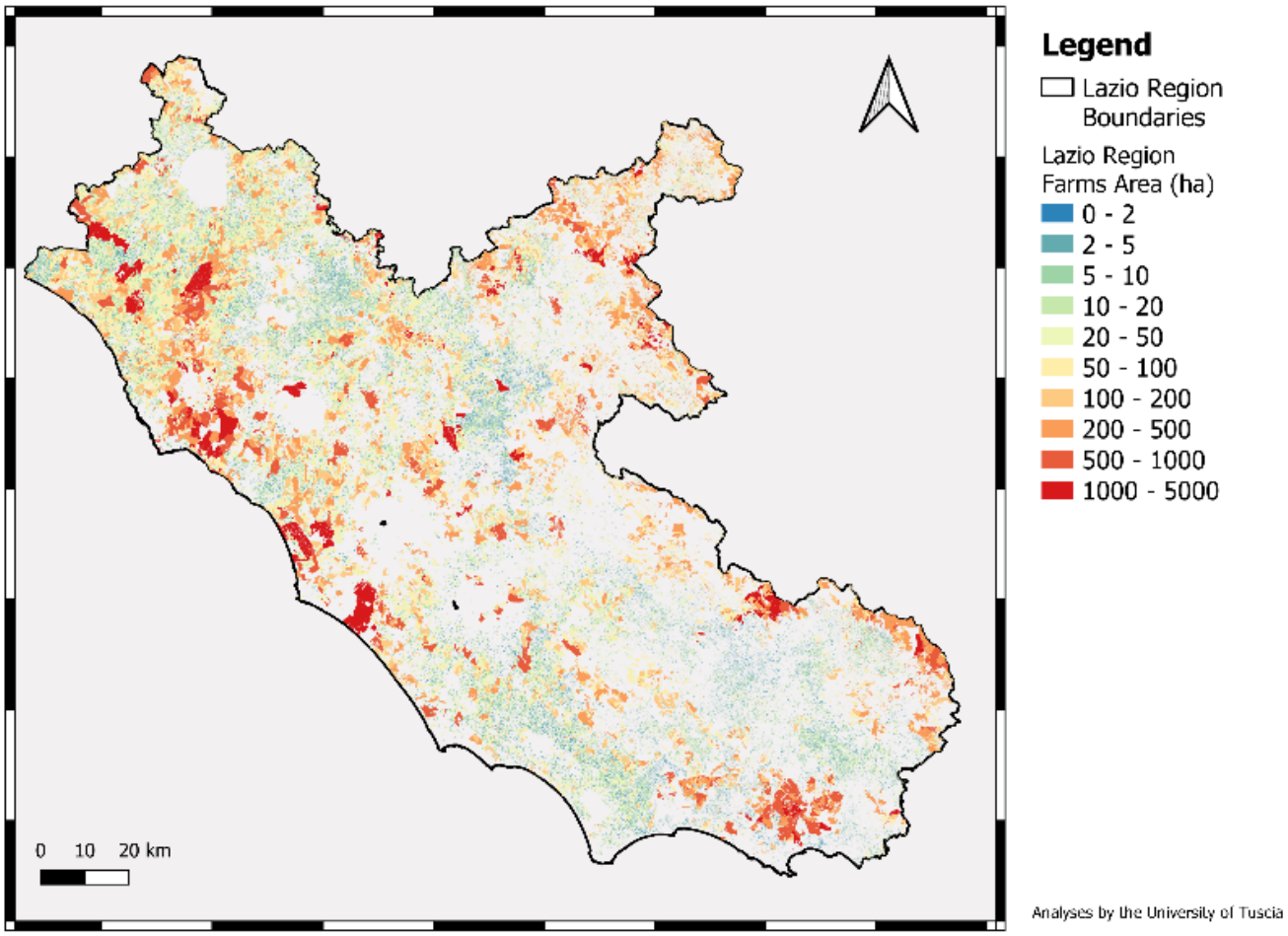


Figure 187 - Map of the distribution of farms in the Lazio Region by farm-size class.

Economic size, approximated by the Gross Value of Production (GVP), is generally highest in FSO_1 (median ≈ €41,000–€92,000) and lowest in FSO_4 (median below ≈ €13,000); the MIX groups often show a higher GVP than their corresponding FSO groups, suggesting that greater diversification is associated with a larger economic size (Figure 187).

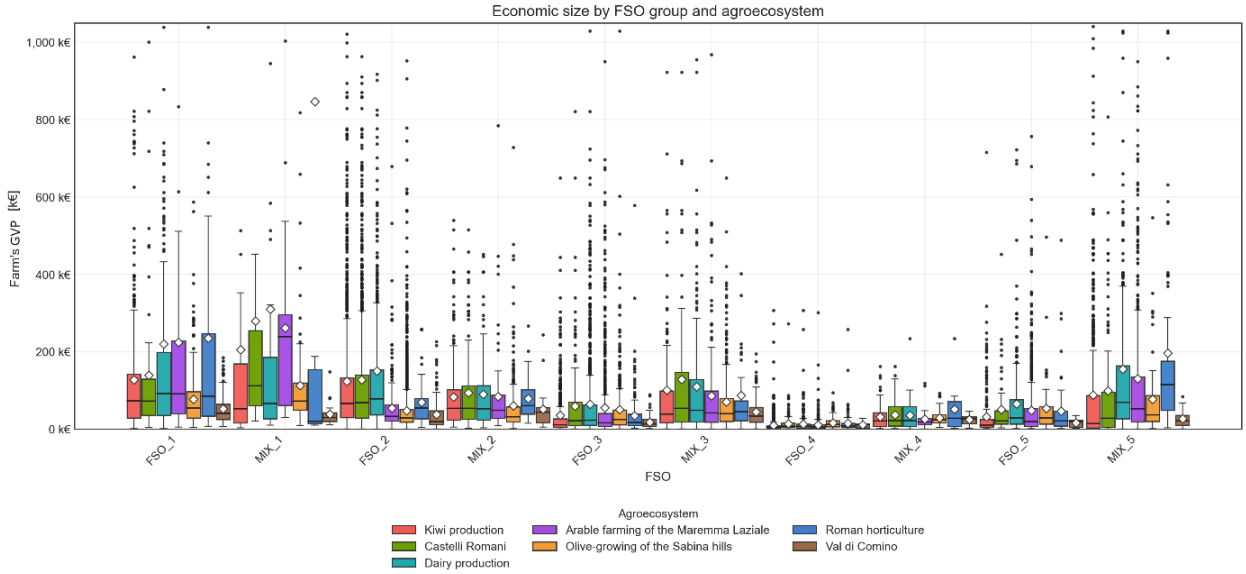


Figure 188 - Gross Value of Production (GVP) across Farming System Orientations (FSO) determined at agroecosystem level in the Lazio Region.

The prevalence of organic certification varies markedly (Figure 188). FSO_1 shows the highest share of fully organic farms (≈ 39%), followed by MIX_3 (≈ 35%) and MIX_1 (≈ 32%), while FSO_4 and MIX_4 are the least organic (≈ 5%). Shares are highest in the Lazio Maremma and Val di Comino and lowest in the kiwi-production and Roman-horticulture systems.

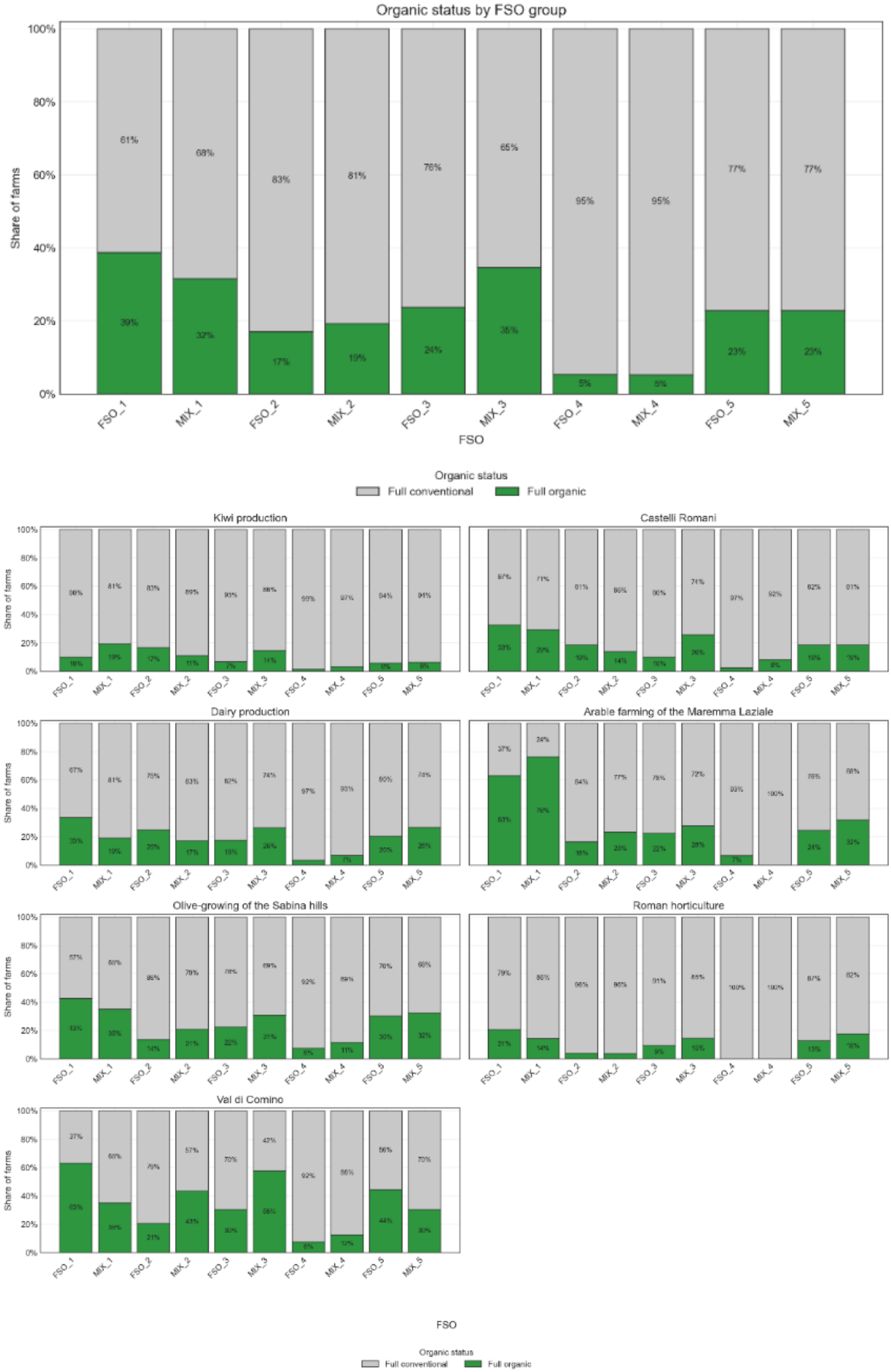


Figure 189 - Share of farms partly or fully certified under organic certification compared across Farming System Orientations (FSO) and agroecosystems in the Lazio Region.

Livestock density is concentrated in a minority of groups (Figures 189 and 190). FSO_1 and MIX_1 show the highest typical values (median ≈ 0.55 and 0.52 LU/ha), whereas in most other groups at least three-quarters of farms report no livestock; MIX_4 stands out for a substantial livestock component confined to part of its farms.

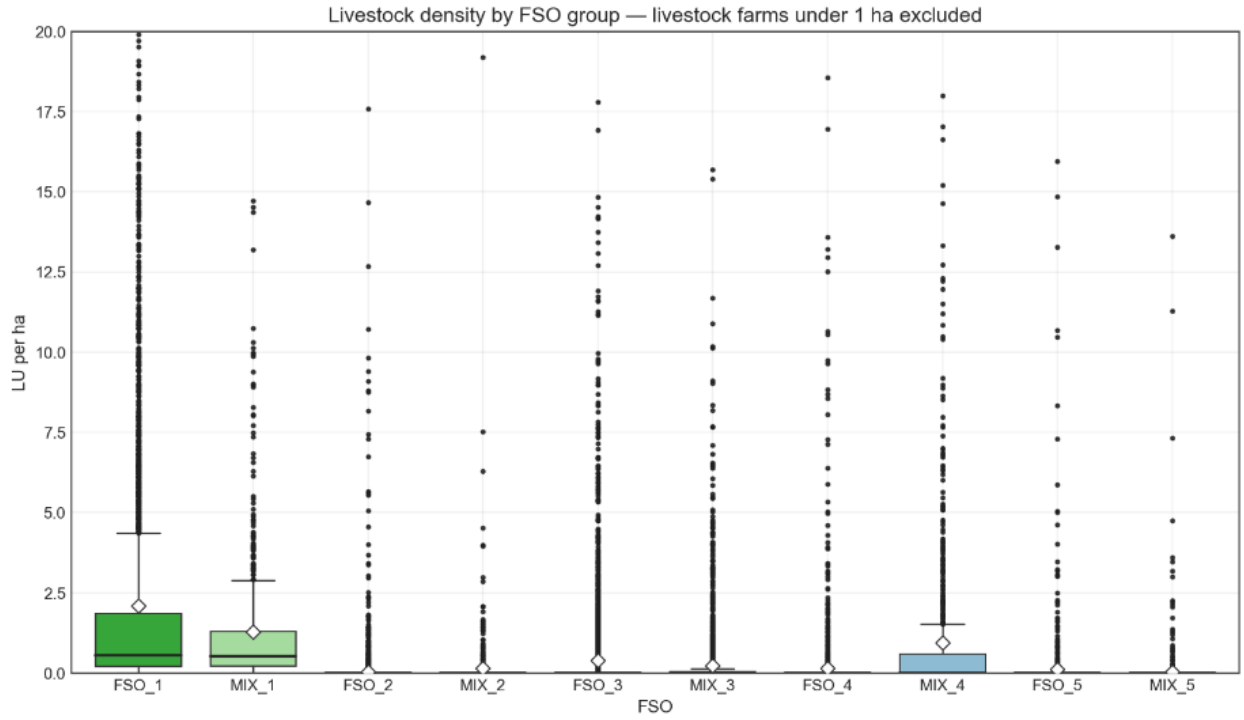


Figure 190 - Livestock unit density (LU/ha) distribution compared across Farming System Orientations (FSO) at the regional scale in the Lazio Region.

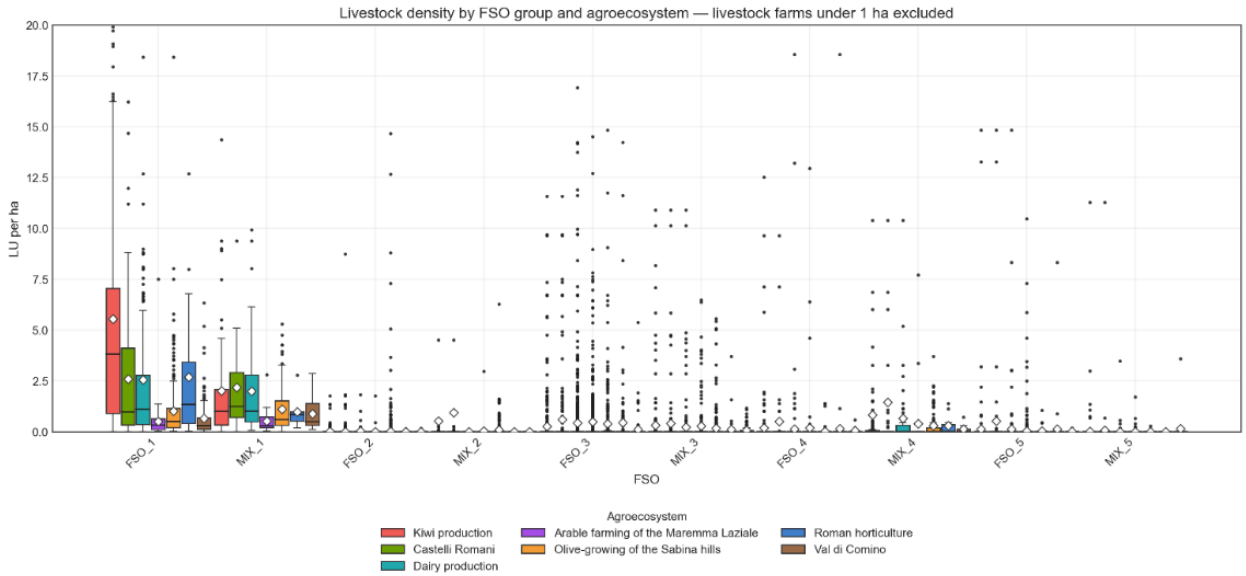


Figure 191 - Livestock unit density (LU/ha) distribution compared across Farming System Orientations (FSO) and agroecosystems in the Lazio Region.

The share of grassland and pastures is highest in FSO_1 (median ≈ 14%, mean ≈ 24%) and, with the exception of MIX_1, tends to be higher in the mixed groups than in their corresponding FSO groups, indicating a greater integration of grassland within diversified systems (Figure 191).

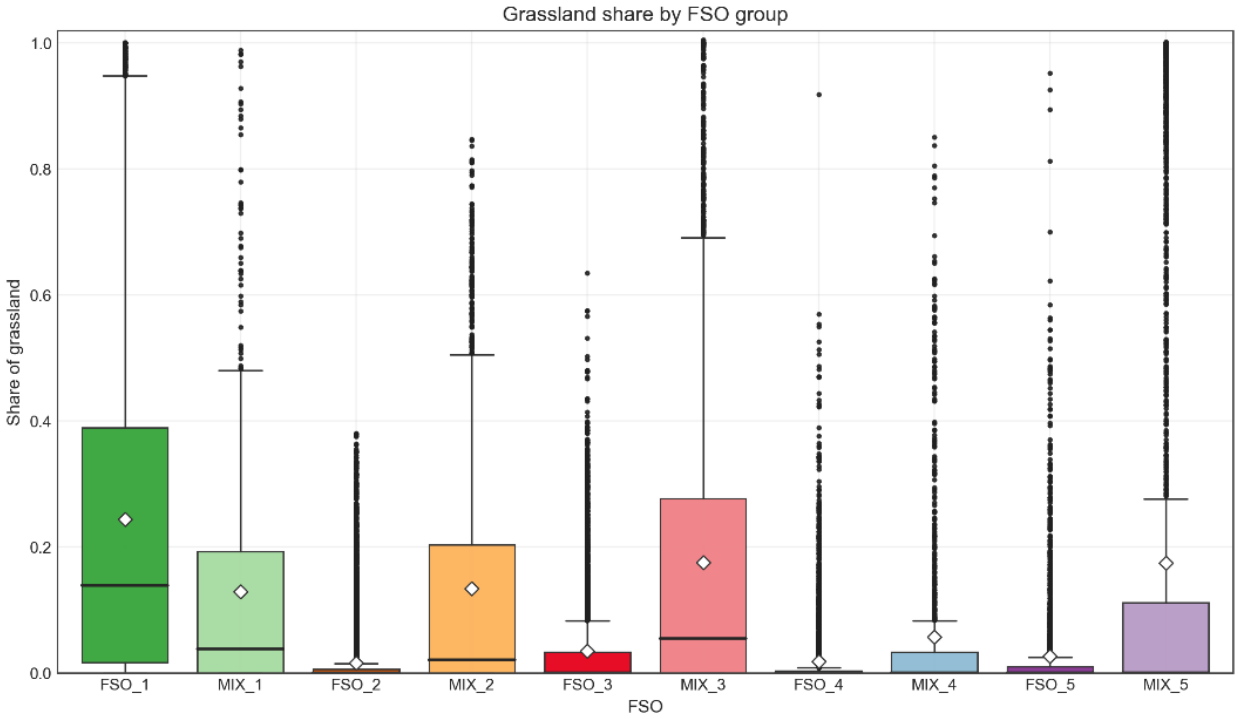


Figure 192 - Share of grassland in farmland compared across Farming System Orientations (FSO) and agroecosystems in the Lazio Region.

The share of legumes is generally very low and confined to a minority of farms – the median and third quartile are zero in all groups – with the highest mean shares in MIX_5 (≈ 5%) and FSO_5 (≈ 2.9%) (Figure 192).

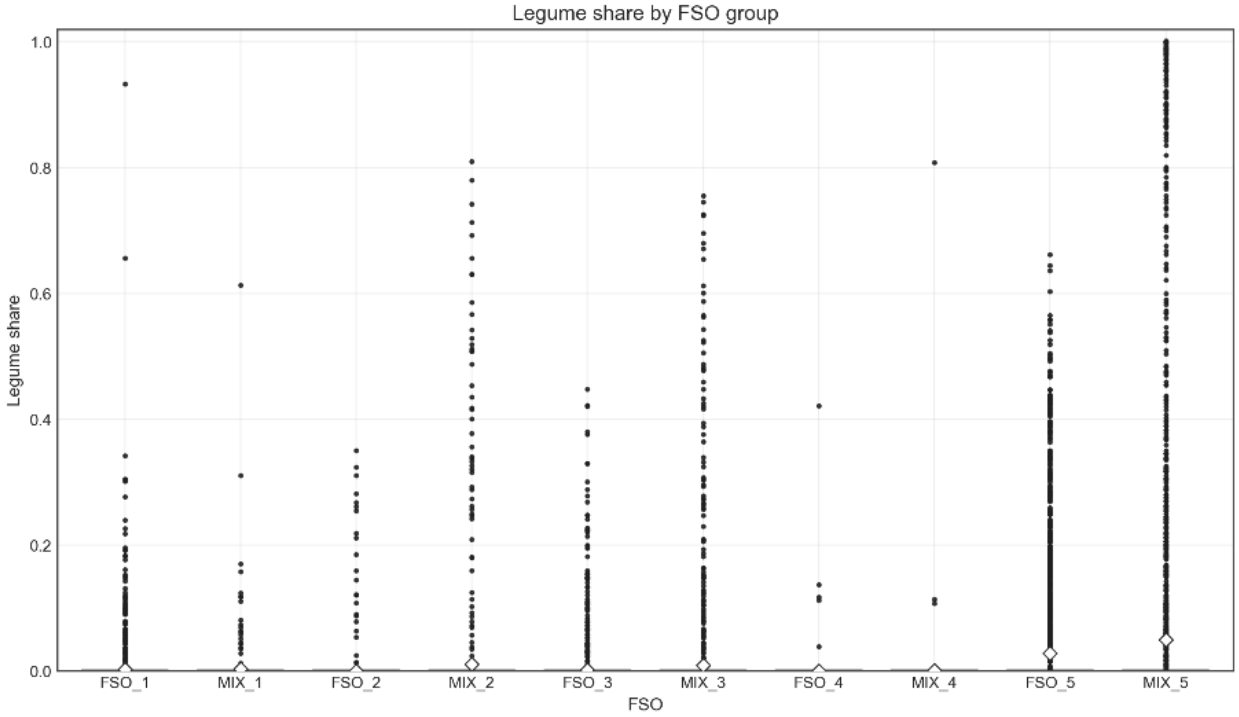


Figure 193 - Share of legumes (including dry legume seeds and legume forage crops such as clover and alfalfa) in farmland across Farming System Orientations (FSO) and agroecosystems in the Lazio Region.

Finally, the share of non-productive elements (e.g. hedges, grass strips, fallow land) ranges on average from about 10% to 20%, peaking in MIX_3 (mean ≈ 19.5%); mixed groups again tend to retain higher shares than their corresponding FSO groups (Figure 193).

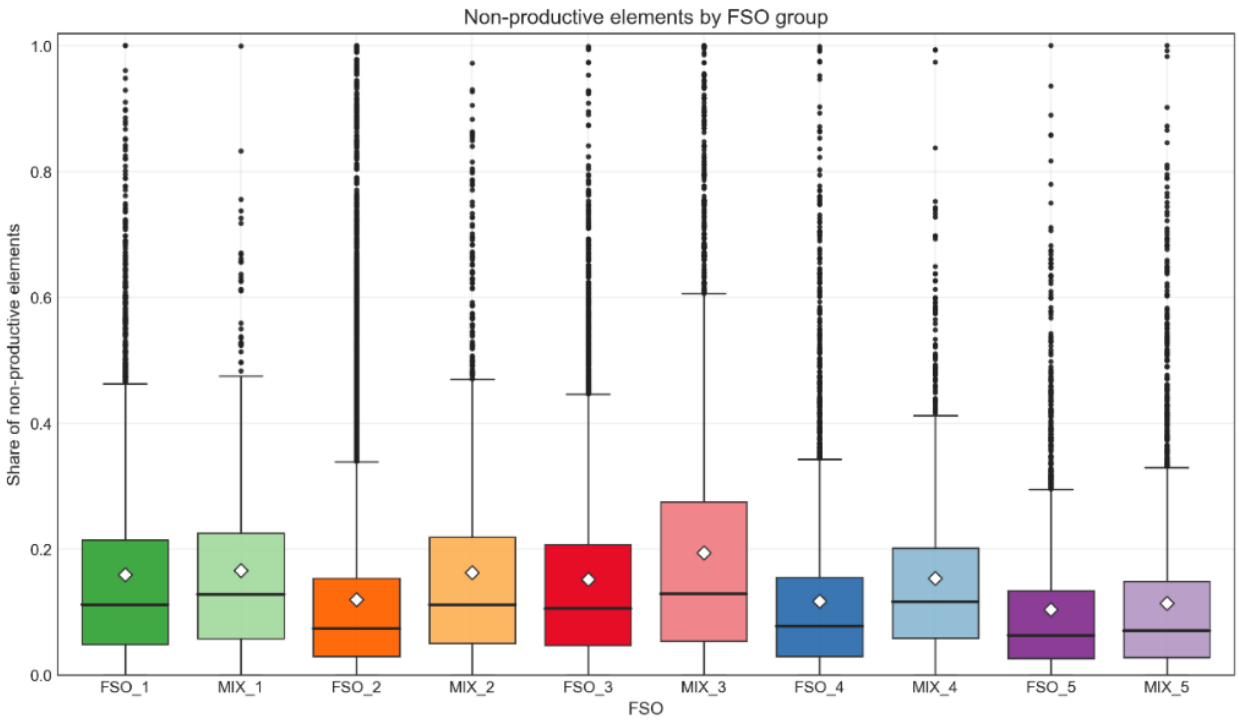


Figure 194 - Share of non-productive elements (e.g. hedges, grass strips, fallow land) in farmland compared across Farming System Orientations (FSO) and agroecosystems in the Lazio Region.

9.6 General quality of results & Validation

Resulting FSO distributions proved coherent with official regional statistics and pre-existing typologies, while adding a sub-regional spatial characterization (agricultural regions and zones) that available typologies rarely provide (see Section 11.2 for the validation elements).

The pretypology was initially developed for describing farming system heterogeneity in Walloon agriculture. It showed coherence with pre-existing reports describing the distribution of farming systems across its diversity of agricultural and natural context [15].

In Switzerland, earlier work had already sought to characterize Valais and surrounding mountain farming systems. Bagnoud (2022) [79], in a master's thesis on the potential and limits of permaculture for a strong-sustainability transition of Valais agriculture, provided a structural description of the cantonal farming system and its main production categories. Donadieu de Lavit et al. (2024) [254] assessed the resilience and sustainability of the regional food system of Valposchiavo, an innovative Swiss alpine valley, combining an extensive literature-based framework with fifty-one semi-structured stakeholder interviews across the agricultural, processing, retail and restaurant sectors. Both confirm that farming systems in Swiss mountain and pastoralist settings had previously been characterized, albeit through case-based, qualitative or survey-based approaches. The exploratory pretypology developed and applied for Valais here is consistent with this body of work while extending it: it moves from sample- or case-based characterizations to a systematic, population-level classification built on exhaustive IACS records, replicable across territories, and whose grassland-dominated Farming System Orientations align with the structural picture those studies described.

This exploratory statistical analysis developed (FSO) also proved to be consistent & complementary to Technical-Economic orientations (TEO) ; that were not as easily retrievable in all participating countries (except for Wallonia & Valais ; for which it allowed to better reframe the IACS population to the study perimeter).

While discriminating farming system at population level using the IACS allowed to build a consistent method replicable to all EU MS ; an iterative approach was used to match the sample collected with the groups predefined in the typology.

In Wallonia, not all farmers met agreed to share their geographical situation with precision (70 plot locations retrieved over 90). 41 over 70 GPS identifications retrieved were proved consistent with data communicated by farmers through the rest of the survey (e.g. organic certification, farm size). 17 additional farms were retrieved from additional desktop research and metadata collection on their farming context and matched with a FSO with a good level of certainty. In the end, 58 farms (two third of the sample) were successfully matched with a specific FSO, and 32 remain only with some gross indication of their specialization (crop farming / livestock farming / mixed system).

Validation of this matching procedure is ensured through exchanges with local experts and research expertise from TAPE referents. Previous typologies and characterizations developed in each region are useful to check if the product rendered is coherent with the image of agriculture in the territory, well-known by local partners.

Low rates of identification agreement (anonymized farmers) was a key issue for automatizing the matching process through GPS locations. In Switzerland, the PNA index allowed to collect useful information for the matching without need for GPS location.

9.7 Key lessons learned

The exploratory pretypology workflow replicated across four of the five European territories (Wallonia, Saxony-Anhalt, Valais, Lazio) presents several innovative features. First, the quality of the data mobilized: the analysis runs on population-level IACS administrative records - exhaustive at territory scale, parcel-resolved, updated yearly and including attributes such as organic certification - rather than on samples or accountancy networks. Second, replicability: a single scripted workflow (HCPC clustering crossed with archetypal analysis and merged into Farming System Orientations) was applied identically to the four territories, producing directly comparable outputs while preserving a territory-specific panorama of production systems.

Although the IACS dataset lies with some defaults (e.g. multiple farm declaration per functional units) ; it allowed to build consistent & coherent typologies of farms across 4 territories using a similar workflow. The methodology used in Troodos followed a different pathway to amend the TEO attribution with local observations & by including socio-demographic factors.

Among the other advantages identified in using the IACS for exploratory multivariate analysis are:

- Regarding data quality: an inclusive data source that is harmonized with certain neighboring countries, such as Switzerland. In some cases, this data proved easier to obtain from regional authorities and paying agencies than the technical and economic guidelines, or even the FADN.
- Advantage of territorializing production systems (subregions) - can be useful for refining representativeness in the case of large territories
- Advantage of systematizing and thus enabling comparability between territories that use the same dataset, while providing a specific overview of production systems in each territory.
- Timely (annual updates allowing for re-evaluation of the groups) and high spatial resolution (subregional characterization of groups found in each territory)

9.8 Main limitations of the statistical approaches used

Among the main factors that still limit the relevance and benefits of the methodology developed:

- The statistical limitations around production systems detection: some smaller or atypical groups remains undetected both by the clustering & the archetype analyses and thus adsorbed with other FSO's (such as *market gardeners & community farming* in Valais ; characterized by a

diversity of vegetables production on small plots that may have been hidden by the production categories).

- The number of discriminating factors remains limited (here, only production types are considered, while other technical and economic factors are included in the observations). A potential improvement could involve incorporating some of these factors as discriminating variables.
- Matching of farmers identified through the TAPE (as introduced in 9.6) : two methods are used-manual and automatic (based on GPS coordinates). Administrative inconsistencies sometimes limit automatic matching; manual identification requires the enumerator to have a good understanding of the farm's production context and the structure of each FSO group.
- The description of "mixed-diversified" group could also be further refined.
- A spatial visualization of the allocation by FSO is also being developed by UNITUS to fully leverage the precise spatial distribution of production allocations recorded in the IACS for the studied territories.
- Scope of the discriminating variables: in the clustering × archetypes methodology, farm production factors (crop and livestock structure) are the only discriminating variables, all other factors (farm size, organic certification, livestock density, workforce, age…) being observed ex post. The FAO guidelines suggest integrating a broader set of criteria into the differentiation itself. The Troodos case illustrates the point: in the pretypology constituted there, other factors - notably the age of farm managers - play a much more prominent role in differentiating farmers.

9.9 Alternative method used in Troodos

Project partners focusing on the Troodos context opted for an alternative semi-quantitative approach based on local statistics, including TEO, socio-demographic and economic attributes in the discrimination of farming system. This work allowed to plan a stratified sampling strategy for implementing the TAPE tool.

Study groups (perimeter)

- The study population is located in Troodos, Cyprus [NUTS level 1 - CY000* LAU 2], which covers a total area of 164,239 ha, and a population of 30,528 in 2020, distributed in 125 communities.
- The case study farm population comprises both crop farming systems (TEO[129]) (vineyards, fruit, permanent and vegetables, olive, vegetables, mixed permanent, cereals, mixed annual, feedstuff, root, flowers), and extensive livestock (Sheep, Goat, Mixed Sheep and Goats). It also includes beekeeping, as well as limited but intensive pig farming, poultry farming, and cattle breeding.
- In 2020 (CAPO, 2020; Veterinary Service of Cyprus 2020):
    - Cultivated land (crops):14,196.7 ha => 8.6% of the territory
    - Number of crop holdings: 8,167
    - Number of animals: 35,051 sheep and goats
    - Number of livestock farms: 242 sheep and goat farming units,
    - There are still 16 units of cattle, 5 pig farming units, and 8 poultry units
    - Organic farming: 275 farmers, 499.57 ha in total
- The sample size: 122 crops, that represent 1.5% of the total number of crops (declared) in the area, and 23 livestock holdings ((15 sheep and goats, 4 beekeeping, 1 pig, 2 poultries, 1 cattle)).
- Pre-typology: a stratification of farms based on quantitative criteria (TEO, farm type, region, age), adjusted to reflect actual farming units with corrective emphasis on medium-sized farms.

[129]Definition based on EU Commission Regulation (EC) No 1242/2008 : *At least 2/3 of production value from arable crops*

- Sampling strategy: Since no directory with farmers' contact details was available, the following procedure was adopted:
    - Convenient sampling: identification of farmers and initial contact was established through Community Presidents (local community leaders) and active agricultural associations in the area, who provided contact details of farmers. Farmers were then directly approached and invited to an introductory meeting where the purpose of the research and their expected contribution were explained.
    - **Snowball sampling** within agroecological and conventional networks identified.
    - Criteria used in the sampling process were actual farm size, types and extent of crop and livestock activities, and organic farming
- After the sample was formed, a representativeness check was carried out regarding the distribution of farms: number of farms per TEO and region, and number of organic farms per region

Sampling design

The sampling strategy for the study of agricultural systems in the Troodos region combines quantitative data and qualitative adjustments in order to capture the farming population in a way that reflects not only declared administrative data on holdings and cultivated surface, but also the actual characteristics of agricultural activity.

The sampling design is based on a structured selection of farmers using the EU-FADN classification methodology (Technical-Economic Orientation, TEO), applied to IACS data (Integrated Administration and Control System Data, 2019), which serves as the primary statistical frame for farm-level information.

The application of this framework generates a set of analytical outputs for crop and livestock farms in Troodos area, covering farm size, economic orientation, livestock structure, age of the farm manager, and spatial distribution across historical regions. These variables provide the basis for structuring the agricultural population into an initial classification of holdings. The full set of classification steps and resulting outputs is presented in Appendix 12.6.1.

Limitations and corrective adjustments

A key limitation of the TEO database is that it reflects declared land use rather than actual land management. As a result and based on previous knowledge and fieldwork experience in the area, parcels that are often not declared by farm managers are not captured, leading to potential underestimation of active agricultural land and bias in farm representation. Therefore, TEO dataset does not fully capture undeclared or informally managed agricultural land. As a result, the sampling frame may underrepresent small-medium scale, fragmented, or non-subsidized farming activities, leading to potential underestimation of active agricultural land and bias in farm representation.

To address the issue of representativeness in the definition of the target population, inherent in the TEO-based sampling frame in the Cyprus context, an adjustment strategy is applied to better approximate the actual structure of agricultural holdings. It is assumed that very small farms (below 1 ha) and very large holdings are relatively well captured in the formal IACS database and therefore closely reflect the observed distribution. Therefore, the main representativeness bias is concentrated in the medium size class (1-2.5 ha), where underreporting of operated land is more likely, due to the possible existence of additional non-declared or informally managed parcels (that in most cases are <1ha).

To mitigate this distortion, we adopt a systemic approach by incorporating a deliberate overrepresentation of holdings within this size class, in the sampling design (*for more information see Chapter 9.2.2*). The initial allocation of the sample is defined according to the required distribution across age groups, geographical regions, and TEO farm types, while applying a corrective emphasis on medium-sized farms.

In addition, during the construction of the contact lists and field sampling process, supplementary information is collected on the internal distribution of crop types and total cultivated area. This allows for a more accurate verification of farm structure and supports further adjustment of representativeness at the sampling stage.

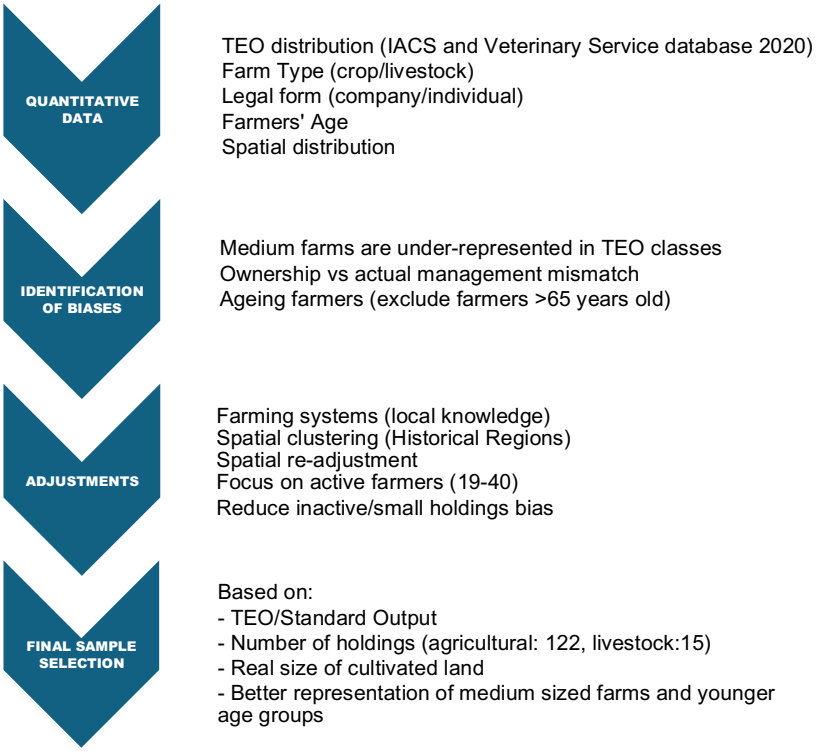


Figure 195 – Methodological workflow leading to the sample selection in Cyprus

Quantitative foundation of the pretypology in Troodos

Discriminating criteria: The quantitative criteria used as dimensions in order to create the farm typology were the following:

- Economic size of the farm expressed through Standard Output (SO) of different crops.
- Farm type, based on Technical-economic Orientation (TEO[130]), distinguishing between crop production and livestock activities.
- Geographical location, based on 11 historical regions
- Age of the farm manager, with a focus on farmers aged 19-40, excluding individuals over 64 years old.

Database: The analysis is based on farm-level data derived from the Integrated Administration and Control System (IACS, 2019). The dataset was provided in two separate components: one including crop production data and another covering livestock activities. Due to differences in coding systems between the two datasets, a joint statistical analysis was not feasible. Therefore, the analysis was conducted separately for crop and livestock production.

Crops: The pre-typology for crop farms is primarily based on quantitative criteria derived from IACS data and complementary administrative sources. These include variables related to economic size (Standard Output), techno-economic orientation (TEO), and spatial distribution. These variables

[130] If the SO of a specific product or mix of products accounts for more than $^2/_3$ of the overall SO of a specific farm, the farm is classified under the respective TEO.

provide the initial stratification framework for the agricultural population and allow for a first categorization of holdings according to structural and socio-economic characteristics.
The analysis highlights significant structural imbalances within the farming system. In particular:

- Dominance of permanent crop systems in farm structure: more than 60% of farms are specialized in permanent crops (vines, olives, fruit trees), which indicates a highly specialized agroecological identity.
- Very small farms (<1ha) account for more than 55% of the total number of holdings, while managing only slightly more than one quarter of the total agricultural land.
- The predominance of small farms affects strong concentration in the lowest economic size classes (< €4,000 Standard Output) and also TEO classification, indicating a structural bias arising from the underrepresentation of medium-sized farms, as they are not consistently declared according to their actual management size.
- Large farms (Standard Output > €15,000), although representing less than 5% of holdings, manage more than 30% of the total agricultural area. This confirms a strong concentration of land in a small number of economically larger farms, indicating structural inequality in land distribution.
- Farms specialized in cereals and annual crops represent only ~7.5% of farms, yet they manage ~28.7% of agricultural land, which indicates that despite being few in number, cereals are land-intensive and structurally important. This highlights the importance of considering both the number of farms and their land share when analyzing the system.

In terms of farm typology, the classification covers approximately 92% of farms in the study area. Farms specialized in permanent crops: such as vineyards, fruit trees, and olives, as well as mixed systems: constitute the dominant farm types, accounting for more than 60% of holdings (see Appendix 12.6.1)

Livestock: Due to the lack of a common coding system between crop and livestock datasets, a similar analytical approach was applied to livestock farms, with certain limitations. In particular, information on the age of the farm manager was not available for livestock holdings.
Livestock farms were classified according to:

- Economic size
- Techno-economic orientation
- Spatial distribution across the 11 historical regions

Given their very limited number, bovine and pig farms (10 and 5 respectively) were treated separately. Due to their very small population size and strong spatial concentration, they were selectively included in order to ensure coverage of all livestock production types present in the study area.

The main livestock category therefore includes sheep and goat farms (hereafter referred to as “livestock farms”), following the standard FADN methodology.

The spatial distribution of livestock farms shows a strong concentration, with more than 50% located in three historical areas: Krasochoria, Koumandaria, and Asinou. The first two areas are predominantly characterized by vineyards, while Asinou presents a more diversified agricultural structure, including olive groves and vegetable production. *(see Appendix 12.6.1 - Number of livestock farm and Animals per Historical Region, Livestock farms' distribution according to TEO and location)*

In terms of land coverage, the Asinou area accounts for a disproportionately large share of agricultural land relative to its number of farms, reflecting the larger physical size of holdings in this region. This area is predominantly lowland and semi-urban and does not exhibit the same level of agricultural abandonment observed in upland regions.

Overall, the sampling strategy ensured full inclusion of livestock production systems present in the area, rather than strict proportional representation, given their limited number and spatial clustering.

Structural limitations of quantitative data

The analysis of the data revealed several structural limitations that affect the representativeness of a purely quantitative classification. In particular:

- Over-representation of very small holdings, which dominate the dataset but do not necessarily reflect actual farming activity. A high proportion of very small holdings, with more than 60% of farms being smaller than 1 hectare.
- This affects high concentration of farms in the lowest economic size classes. The vast majority of the farms in the Troodos area are classified among the first two categories, that is their economic size is less than 4,000€, creating a structural bias arising from the underrepresentation of medium-sized farms, as they are not consistently declared according to their actual management size.
- Mismatch between declared ownership and actual cultivation, where holdings may be fragmented in administrative records but managed as a single functional holding or unified operational units (larger holdings). So, land ownership does not necessarily reflect actual farm management structures and TEO classifications within one holding.
- The TEO classification appears fragmented and somewhat distorted at the level of actual farm exploitation, as officially declared farmer units do not necessarily correspond to operational farming units. This discrepancy may introduce biases if TEO is used directly for sampling purposes.
- Ageing farmer population - with almost half of the farm managers beyond retirement age- affecting the level of active farm management and future continuity (approximately 44% of farm managers being older than 64 years old).
- The TEO classification remains robust at the level of communities and historical regions. It does not significantly alter the main production orientations observed across these areas on the contrary, it reliably reflects the dominant production patterns in each historical region, as these are primarily driven by land use and cultivated area rather than by the SO of declared farm holdings and so we try to follow this classification for sampling.

More information on those quantitative attributes are available in the Appendix 12.6 e.g. *Farms classified according to farm size / Farmland distribution according to economic size / Classification of farms according to their TEO / Distribution of land according to farms' TEO etc*.

Pretypology adjustments and functional interpretation

The observed structural imbalances suggest that medium and small-sized holdings (1-2.5 ha) may not accurately represent the real size and structure of the agricultural production. In many cases, land is declared by owners rather than by active cultivators, resulting in discrepancies between recorded and actual farm structures. Furthermore, the ageing profile of farm managers raises additional concerns regarding farm continuity, succession, and active management, particularly for very small holdings.

In response to these limitations, the sampling approach adopts a systemic perspective that combines statistical criteria with a functional interpretation of farm structures. The pre-typology is therefore adjusted to better represent active farming units, moving beyond a strictly administrative or officially declared classification. It incorporates a functional reading of agricultural activity, taking into account production value, age structure, spatial distribution, and actual farming dynamics.

The final sample is selected proportionally to ensure representation across key farm and farmer categories, with particular attention to:

- Type of cultivation and number/size of holdings based on TEO classification and specializations in the historical regions.
- Geographical area, reflecting the spatial distribution of agricultural activity across 11 historical areas

- Distinction between private farmers and companies (e.g. differences in organization, access to capital, scale of production, and market integration)
- Age group, with emphasis on active and young farmers (19-40 years old), excluding farmers >64 years old
- Reduce over-representation of very small farms (<1ha) and correct underrepresentation of medium-sized farms (1-2.5ha).
- Actual cultivated land size, reflecting the real operational scale of the farm rather than the declared administrative size, and the percentage of crop type within the actual/real holding.
- Include a proportion of organic farmers

To operationalize this approach, a structured selection process is applied during the creation of contact lists, whereby farmers are identified and grouped according to these criteria.

Final sample

The final sampling design integrates production value (Standard Output), farm distribution across typological categories (TEO), and adjustments for age structure, actual size and spatial concentration. The objective is to ensure that the sample reflects actual agricultural activity rather than solely declared holdings.

This results in a refined sampling matrix in which each selected farmer is characterized by location, age, production type, and actual cultivated area. The pre-typology thus serves as the foundation for the sampling strategy. Rather than relying exclusively on proportional representation of administrative units, the design incorporates structural corrections to ensure representativeness of active farming systems.

The sampling selection was restrained as such:

- A total sample of 137 farms was selected, including 122 crop and 23 livestock farms.
- 122 crop farms were selected, representing 1.5% of the total number of declared farms in the study area. According to the TEO classification, their distribution is as follows:
    - 65 annual systems,
    - 26 permanent systems, and
    - 31 cereal-based systems.
- 23 livestock holdings were included. These include:
    - 15 sheep and goat farms,
    - 1 pig farm,
    - 2 poultry farms (1 for eggs 1 for meat),
    - 1 cattle farm, and
    - 4 beekeeping units.
- 24 out of the 122 questionnaires were addressed to companies (agricultural enterprises) the rest to individual farmers.
- Age distribution: 44 out of 122 farmers are aged 18-39, and 32 are aged 40-54.
- Organic farmers: 31 out of the 122 sampled holdings operate under organic farming practices (out of~ 300 farms engaged in organic agriculture in the area).

More information is available in the Troodos Appendix (12.6.1).

10 Core research questions and MAP interests

This section maps the research orientations of the TAPELINE project as consolidated through the Step 0 cross-comparison framework (52 territorial research questions collected and scored by partners), the panorama analysis of research questions, and the territorial chapters (Sections 3-7). Some questions are directly addressable through the TAPE methodology (Steps 0-3); while others fall outside the strict scope of the tool, highlighting qualitative interests specifically voiced by MAP members and actors peripheral to the project.

10.1 Common research backbone at EU level

All territorial questions complement the three core questions of the TAPE deployment:

- What are the current levels of agroecological integration in European territories, and how should this level of integration be defined?
- What are the performance scores across the five dimensions (economic, social, environmental, health and nutrition, governance), and are these scores relevant and informative for European farmers?
- Is there a correlation between the level of agroecological integration and multidimensional performance?

Across territories, four shared research foci structure the contextualized agendas, converging towards a method to assess the level of advancement of farms in their agroecological transition and their multidimensional performance in a given territory:

- Consolidating the knowledge and understanding of barriers, lock-ins and levers to the agroecological transition at landscape, value-chain and territorial level;
- Which farming systems are aligned with the definition of agroecology, and how they perform compared with others;
- How agroecology can contribute to the provision of ecosystem services;
- Whether TAPE can act as a harmonized framework enabling meaningful comparisons of agroecological practices and performance (including ecosystem-service provision) among diversified systems: with attached challenges regarding policy impact assessment, the integration of externalities and ecosystem services into value chains, and decision support.

10.2 Interactions between research questions and the TAPE tool

52 specific research questions were collected: 18 from Wallonia, 18 from Saxony-Anhalt, 8 from Valais, 5 from Lazio and 3 from Troodos.

28 of the 52 questions (54%) are judged directly addressable through the TAPE process ; either through the assessment of agroecological practices at farm and territorial level (Step 1) ; based on insights from the multidimensional performance assessment (Step 2) ; or from the intercorrelation possible between agroecological practices and outcomes (Step 3).

12 questions are uncertain and 12 would require complementary research approaches.

Thematic convergence across territories (common interest): Farming systems and the Policy supporting framework are each raised by four territories; Enabling/disabling factors, Environmental challenges and the Adaptation and integration of the TAPE tool by three; Value chains and market initiatives concentrate 10 questions from two territories (WAL, SA).

10.3 Priority pool of TAPE-connected questions

Eight questions related to the TAPE method are judged scientifically relevant (≥ 2); of interest for the MAP's (≥ 2) and constitute therefore the priority pool for the TAPE deployment:

- **Wallonia:** What are the concrete results achieved by farmers who are most advanced in agroecology and organic and conservation agriculture (3/2)? How can a harmonized framework be designed to enable meaningful comparisons of agroecological performance across diverse agricultural systems (3/3)?
- Saxony-Anhalt: What are the main biodiversity/environmental matters that could be better addressed by agroecology (3/2)? What are the pros and cons of simpler agroforestry systems such as short-rotation plantations (KUPs), e.g. regarding erosion and biodiversity (3/3)? Can a local/regional food chain be established for specific tree crops, e.g. self-sufficiency in walnuts (3/3)?
- Valais: How and what should be produced in the territory to encourage a transition towards a healthy and sustainable diet (3/2)? Which factors enable or hinder a diversity of food products within a farming system (3/2)? What restructuring efforts, requiring individual and collective investment or policy change, should be implemented to achieve a sustainable food-system transition (2/3)?

An extended pool of 19 TAPE-addressable and scientifically relevant questions widens the exploitable scope: including the Troodos question on the influence of agroecological practices on water-use efficiency, fire risk and landscape management in mountain agroecosystems, the TAPE-adaptation questions of Saxony-Anhalt, Valais and Lazio (decision support, monitoring, relevance in mountain contexts, participatory operationalization), and Lazio's five questions once their scoring is completed.

10.4 Other questions from local stakeholders

Eight questions rank high in MAP importance (≥ 2) but are considered unlikely to be addressed directly through TAPE; they call for complementary approaches (qualitative surveys, social sciences, advisory accompaniment) while remaining on the project's radar:

- How can farmers' psychological barriers to adopting conservation and organic practices be overcome? (WAL)
- Is the agroecological transition perceived as needed by farmers? Which role could nature parks play in supporting agroforestry? Is an adequate agricultural extension service available? How can adequate market systems and infrastructure be promoted, including public procurement? When will farmers consider it relevant to invest time and energy in changing their system (avoiding a "tragedy of the commons", following E. Ostrom)? (SA)
- What promising initiatives contribute to a healthy and sustainable territorial diet, and how can they be strengthened? How can stakeholders be engaged in the long term to promote such initiatives? (VAL)

These questions predominantly concern psychological and social levers, actor engagement, accompaniment schemes and market infrastructures.

10.5 Territory-specific declinations and MAP interests

- Wallonia: the research design cross-references (i) farm structural and socio-economic factors (technical-economic orientation, certification, network membership, farm size, workforce structure), (ii) levels of implementation of agroecological practices (CAET, Step 1) and (iii) performance levels combining standardized semi-qualitative indicators with quantitative assessments of pesticide risk (Harmonized Pesticide Load Index) and economic performance. Interests specifically communicated by peripheral actors: retailers wish to translate macro-level ESG/CSRD commitments into measurable farm-level agroecological indicators, to move assessment frameworks beyond economic profitability, and to differentiate organic farming from regenerative agriculture in market communications (MAP importance 3); the MAP also

emphasizes the integration and accounting of agroecological dimensions within long value chains and new mid-sized value chains.

- Saxony-Anhalt: the agenda shows the highest self-rated scientific relevance (mean 2.71/3) and focuses on agroforestry and environmental issues: improving market-related framework conditions; reducing short-term, high-investment cost barriers (e.g. public-private-producer partnerships, intercropping); designing agroforestry systems viable for both small- and large-scale farms; producing evidence on soil quality and biodiversity impacts; proving the relevance of agroforestry for economies undergoing systemic transition; and analyzing consumer demand and new business opportunities (plant proteins, bioeconomy). TAPE-related interests include its use as a decision-support and monitoring tool and its possible integration into public funding systems. MAP interests are oriented around local walnut value chain, short-rotation plantations, the role of nature parks, extension services and agroforestry-fed heat networks.
- Valais: a food-system oriented agenda: how and what to produce for a healthy and sustainable territorial diet; factors enabling or hindering product diversity; structural and socio-cultural factors slowing agroecology; restructuring efforts required for the transition; and whether TAPE provides a pertinent framework for mountain regions and a communication asset with stakeholders. MAP members place the highest importance on strengthening promising initiatives and on long-term stakeholder engagement.
- Lazio: a governance-oriented agenda: characterizing the heterogeneity of regional farming systems; using the 10 Elements of Agroecology as a framework to assess the transition of rural areas; embedding agroecological principles into land-use planning and territorial strategies; monitoring agroecology within land-governance processes by linking biophysical, institutional and socio-economic indicators; and adapting TAPE to a European and regional governance context through participatory, multi-actor approaches.
- Troodos: a territorial agenda articulated around land abandonment and revitalization: identifying the farming-system and territorial determinants of abandonment risk and the agroecological levers to counter it; assessing how agroecological practices influence water-use efficiency, fire risk and landscape management in mountain agroecosystems; and understanding the contribution of agroecology to territorial identity, product valorization and the development of collective action and governance dynamics.

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12 APPENDIX

12.1 TAPE questionnaire Contextualization at EU level

Shared research and field project partner's knowledges on local contexts allowed to suggest modifications in criteria selected for characterizing the level of transition towards agroecology (CAET, Step1). Those context-specific modification are summarized in Table 21.

Table 21 - Key modifications integrated in Step 1 questionnaire adapted for Wallonia to assess the level of transition towards agroecology (CAET) - December 2025

Pillar of Agroecology (FAO)	Key new or adapted criteria integrated in Step 1 for Wallonia (& EU) *Existing and modified indices are in italic*
1 - Diversity	• Adapted evaluation of crop and forage diversity in case of pastoralist systems (share of the main forage plant, variety of grasses and herbs grazed, rangeland rotation) for assessing *diversity*
2 - Synergies	• Use of non-competing feed resources for assessing *plant-livestock integration* • Integration and diversification of tree species into the farm's production system
3 - Recycling	• Renewable energy sources differentiation • Broadened assessment of source of water for farming activities, beyond surface irrigation, for assessing *water use and autonomy*
4 - Efficiency	• Energy & Water-saving techniques to assess *Resource Use Efficiency* • On-farm nutrient application along a wider gradient of soil fertility management practices, and phytosanitary protection, for assessing *input use efficiency*
5 - Resilience	• Climate change adaptation capacity for assessing *social resilience* • Diversity of income-generating activities for assessing *economic resilience* • Reduced soil disturbance (limiting deep ploughing, simplified cultivation techniques) and degradation control for assessing *soil conservation* • Reduced dependence on external financial support (e.g., CAP subsidies) for assessing *economic resilience*
6 - Culture & Food traditions	• Share of farm production for food production and diversity of food-oriented products for assessing *food self-sufficiency* • Participation in geographical and traditional food quality schemes (PDO, PGI, TSG) for assessing *valorization of local food heritage*
7 - Co-creation & sharing of knowledge	• Peer-learning & diversity of knowledge sources for assessing *knowledge sharing and access* (new isolated index)

	• Adoption of new sustainable practices, use of local and context specific agronomic knowledge, and involvement in participatory and transdisciplinary platforms to assess *co-creation of knowledge and context specific innovation*
8 - Human & Social values	• Women's financial independence and formal recognition in farm ownership or management to assess *women's empowerment* • Physical and mental working conditions of farmers and employees to assess *labor conditions* • Professional motivation in the continuity of farming activity and the continuity of engagement in sustainable farming practices and Youth access to resources and farm transmission
9 - Circular & Solidarity economy	• Involvement in Community Supported Agriculture [CSA], Participatory Guarantee Systems [PGS], producer cooperatives as examples of Farmer-consumer partnerships and trust-based certification to assess *local marketing of products and services*
10 - Responsible governance	• Access to a variety of value chains and markets allowing for diversification to assess *producer's empowerment*

Step 2 was also contextualized both at EU & regional level to account for the multi-dimensional outcomes of farming activities, as originally suggested by the FAO [306]. Criteria proposed to EU partners in the TAPELINE project (Table 23) were derived from the 2025 update of the TAPE tool (Table 22), with a minimum threshold of one criterion retained by dimension of sustainability.

Table 22 - overview of core criteria and indicators in the 2025 TAPE update [306]. . In green are the elements kept or derived in the TAPELINE contextualization. In purple are the elements not retained in this process. Finally, in orange are the quantitative indices that could yet be further processed with primary data collected in the survey.

Dimension	Core criteria	*Indicator*
GOVERNANCE	Secure land tenure	*Land tenure score*
ECONOMY	Added Value and Productivity	*Added Value/Gross Value Production ratio (AV/GVP)**
		Land productivity
		Labor productivity
	Income	*Farm net income*
		Economic performance perception index
ENVIRONMENT	Soil health	*Soil Health score*
	Biodiversity	*Agrobiodiversity (Gini Simpson Index)*
HEALTH AND NUTRITION	Exposure to pesticides	*Management of pesticides*
		Exposure risk to pesticides
	Food security	*Food Insecurity Experience Scale (FIES)*
	Dietary diversity	*Minimum dietary diversity for women (MDD-W)*

SOCIETY AND CULTURE	Youth employment	*Youth employment and agricultural aspirations*
	Women's Empowerment	*Abbreviated Women's Empowerment in Agriculture Index (A-WEAI)*

The biodiversity assessment was removed from the set of indicators due to the volume of data required to conduct a representative assessment. The Soil health indicator (SOCLA) was adapted to minimize the need for field measurements and focus solely on farmers' perceptions of their soil's quality characteristics.

For other reasons, notably the complexity involved in assessing these criteria at the farm level within the EU context, contributions related to food security and dietary diversity were not taken into account. The same applies to youth employment, which was interpreted as the potential to facilitate generational succession to young farmers (only for farmers over the age of 50).

In addition, a set of complementary quantitative indicators was proposed to validate the qualitative indicators retained. Due to significant difficulties in collecting quantitative data at the farm level (e.g., pesticide use via field logs, economic data via farm accounting records), only a small fraction of farmers was assessed using these quantitative indices (e.g. HPLI, gross margins, VA/GVP) .

Table 23 - Criteria & indicators retained for the Step 2 adaptation. In grey are the elements as proposed by the FAO in the latest update of the tool. In orange is presented the indicators derived (i.e. adapted) from preexisting indicators suggested by the FAO. In green are presented the newly introduced criteria &/or indicators.

Dimensions of sustainability	Criteria	Criteria and associated indicators	Type of indicator	Related SDGs[131]	Related CAP PMEF[132]
Governance	Secure land tenure	Adapted *Land tenure score*	Qualitative	SDGs 1.4.2, 2.4.1, 5.a.1	SO8
Economy	Income	Adapted *Economic performance perception indicator*	Qualitative	SDGs 1.2.2, 2.3.2, 2.4.1	SO1 R4, R5, R6PR, R7
		Gross margins (with & without subsidies)	Quantitative		

[131] https://sdgs.un.org/goals
[132] Regulation (EU) 2021/2115. Strategic objectives & result indicators surrounding the CAP framework (PMEF)

		Value Added / Gross value of production	Quantitative		
Environment	Soil health	Adapted *Soil health score* (*SOCLA*)	Qualitative	SDGs 2.4.1, 15.3.1	SO5 R19PR, R14PR
		Humic Balance (quantitative)	Quantitative		
Health and nutrition	Pesticides	Adapted *Pesticide Management score*	Qualitative	SDGs 2.4.1	SO5 R24PR
		HPLI (*Harmonized Pesticide Load Index*)	Quantitative		
	Well-being	Adapted *Well-being index*	Qualitative	~ SDG 3	~SO8
Society and culture	Women's empowerment	Adapted *Women's Empowerment Index in Agriculture* (AWEAI)	Qualitative	SDGs 2.4.1, 5.a.1, 5.a.2	SO8
	Generational Renewal	*[NEW] Generational renewal score*	Qualitative	~ SDG 8.6.1	SO7 R36PR

12.2 Wallonia

12.2.1 Step 0 – Set of criteria used to define farm pre-typology

This table has been adapted from the FAO TAPE guidelines for step 0 [305].

1) Criteria kept for clustering & archetype analysis, including discriminating and observatory variables (ex-post/descriptive) based on data available for the population of farms studied:

Table 24 - Set of criteria retained for differentiating farm types, derived from the FAO's guidebook on Step 0 process [305].

Type of variable	Criteria	Level	Sub-Categories	Description
Discriminating	Crop productions	Farm (& group) level	*Forage Maize*	Hectares and %UAA < IACS 2024
			Cereals & Grains	
			Oilseeds	
			Legume seeds	
			Permanent and Temporary Grasslands	
			Other forage crops	
			Potatoes	
			Sugar Beets	
			Vegetables	
			Fruits	
			Non-productive elements	
			Other surfaces	
Discriminating	Animal herds	Farm (& group) level	*Dairy herds*	Heads, Livestock Units and %Total herd size < IACS
			Suckler herds	
			Mixed cattle	
			Pork	
			Poultry	
			Other animals	

Descriptive	Farm size (ha)	Farm (& group) level	/	Quantitative (continuous) variable
Descriptive	Share of organic farms	Farm (& group) level	/	Quantitative (continuous) variable
Descriptive	Share of grasslands	Farm (& group) level	/	Quantitative (continuous) variable
Descriptive	Share of legumes	Farm (& group) level	/	Quantitative (continuous) variable
Descriptive	Share of non-productive elements	Farm (& group) level	/	Quantitative (continuous) variable
Descriptive	Standardized gross production (€)	Farm level	/	Quantitative (continuous) variable
Descriptive	Agricultural zones	Landscape level	Defined by common pedological, climatic and economic conditions	Regrouped agricultural Regions (RAR's) - Corder, 2025

12.2.2 Questionnaire contextualization for Wallonia

Specifically for Wallonia, practices such as direct sowing were further investigated. The engagement in renewable energy contracts was also further surveyed.

Also, based on specific recommendations made by close stakeholders (e.g. TEV) ; the questionnaire was adapted to include key questions around land tenure security and generational renewal potential as Step 2 indicators.

Based on first feedback from Walloon enumerators in the pilot test ; the Women empowerment index (A-WEAI) was not retained in the final regional adaptation, as its original configuration and EU adaptation still made the survey process uncomfortable for farmers (personal questions entering the intra-household dynamics).

The final selection and detail of KPI retained for Step 2 evaluation in Wallonia is presented in Appendix.

Answers options to each criterion retained for Step 1 were adjusted to fit with EU regulation frameworks, and better illustrate concrete practices found in EU and Walloon farms. Specific formulations of CAET criteria are shown below in Table 25. Specific inclusions & adaptations of KPI are also described more thoroughly in Table 26.

Those specific adaptations & calibration of the TAPE are to be considered as the reference of EU adaptation led as part of the TAPELINE project. Further contextualization to regional contexts is described in the following sections dedicated to other territories.

Table 25 - Step 1 - Elements, indices & criteria adapted for Wallonia

Index	Criteria	Original Question	Updated Question	Status	Justification	Updated answer options			Status	Justification
						No	More or less	Yes		
1) DIVERSITY										
Plant diversity (including forage and trees)	Number of plant species	Do you produce a diversity of plant species on your farm?	Do you produce a diversity of plant species on your farm (permanent grassland excluded) ?	Minor adjustment	Exclusion of grassland to focus on crop diversity	I focus on the production of 1 or 2 crops, forages or trees over the entire farm.	I produce 6 to 9 crops, forage and trees species, but 1 or 2 of them cover(s) more than a third of my cultivated area.	I produce a large diversity of crops, forage and trees (12 species or more), none covering more than a third of	Minor adjustment	Need to account both for the number and equilibrium of species. + Walloon pilot experiment highlighted the necessity to

								my cultivated area.		increase the intervals of diversity.
	Plant genetic diversity (number of varieties of the main cultivated plant)	Do you have several varieties for the main cultivated crops, forage or trees?	Do you have several varieties for the main cultivated crops?	Minor adjustment	focus on main crop production (forages only addressed if pastoralist system ; and tree species diversity already addressed in a dedicated question)	Only one variety is cultivated for the main crop(s).	A few varieties (around 3) are cultivated, but genetic diversity remains limited.	Several varieties (5 or more) are cultivated, ensuring genetic diversity.	Minor adjustment	focus on crops
Temporal and spatial diversity	Temporal diversity: rotation	Do you regularly rotate your crops or forage over different years?	Excluding permanent grasslands, do you regularly rotate your crops or forage over different years?	Minor adjustment	Exclusion of grassland to focus on crop diversity	I grow the same crops repeatedly without a regular crop rotation system or rotate occasionally.	I rotate regularly with 3 crops in the rotation and non-regular integration of cover crop or fallows periods.	I systematically rotate different crops in my fields over 5 years or more and integrate cover crops or fallow periods.	Minor adjustment	
	Spatial diversity: intercropping	Do you grow multiple crops, forage or trees together in the same field (intercropping)?	Excluding permanent grasslands, do you grow multiple crops, forage or trees together in the same field (intercropping) ?	Minor adjustment	Exclusion of grassland to focus on crop diversity	I grow single crop, forage or tree in separate fields without mixing species.	I intercrop occasionally, but not as a systematic practice on my farm.	I regularly intercrop different plant species (e.g. including agroforestry systems)	Minor adjustment	Agroforestry & regular intercropping are here taken as two cases of "maximum" scoring on spatial diversity. The inclusion of trees is also considered additionally as a quality factor in synergies (see hereunder in plant-

										livestock integration)
Animal diversity (including fishes and insects)	Number of animal species	Do you raise a diversity of animals on your farm?		Unchanged		I do not raise any animals.	I raise two species of animals well represented and balanced in number.	I raise more than three species of animals that are well represented in terms of numbers.	Minor adjustment	Precision of the term "several"
	Animal genetic diversity (genetic variation among farm animals)	Do you have different breeds for your main species?	Do you have different breeds for the main animal species that you raise?	Unchanged		All animals of the same species are of the same breed.	There are some variations in animal breeds among my herds (e.g., 3 breeds for my main herd type).	There are diverse breeds among my herds (e.g., 5 breeds or more for my main herd type).	Minor adjustment	Numeric thresholds included, to help for farmer's answer

2) SYNERGIES										
Plant-livestock-aquaculture integration	Local production of feed consumed by animals	Do you produce the majority of the feed and fodder consumed by your animals?	Do you produce the majority of the feed and fodder consumed by your animals?	Unchanged		I rely primarily on purchased feed and fodder, with little or no on-farm production of forage, fodder, or crop residues.	Some feed or fodder is produced on my farm, but a significant portion (e.g., concentrates, grains, or processed feed) is purchased externally.	I produce most or all of the feed and fodder needed, using pasture, fodder crops, agroforestry systems, or crop residues, significantly reducing dependence on external sources.	Unchanged	
	Use of non-competing feed resources	Do you rely mostly on animal feed resources that do not compete with human food productions ?	Do you rely mostly on animal feed resources that do not compete with human food productions?	New criteria / question		Animals are mainly fed with feedstuffs that could also be used for human consumption (e.g., cereals, soy, pulses), with limited use of grass, residues, or by-products.	Animals' diet includes a mix of feed resources: some derived from materials that compete with human food (e.g., grains), and some that do not (e.g., grass, crop residues, by-products).	Animals are primarily fed on resources that do not compete with human food: such as permanent and temporary grasslands, forage crops, fibrous residues, or processing by-products: minimizing dependence on human-edible feeds.		
	Animal welfare	Do you ensure appropriate living conditions that protect	To what extent are animals integrated into ecosystem services (e.g.,	Merged	Formulation more acceptable in EU context	Animals are mainly for food, with little or no ecosystem services, and live in	Animals provide manure for soil improvement and have moderate living conditions, but integration	The system shows clear synergies between animal presence and other farm	Merged	More consistent with EU regulation.

		animals from climatic stress, predators, and disease risks?	manure for soil health, integrated grazing for vegetation management, biodiversity enhancement, fire risk reduction, pest and weed regulation, pollination…) while benefiting from appropriate living conditions that allow natural behaviors (includes bees and fishes)?			overcrowded or stressful conditions restricting natural behaviors.	and welfare remain limited.	components, strengthening overall agroecosystem resilience. Animals are fully integrated into multiple ecosystem services (grazing, pest regulation, biodiversity, fertilization, social roles) and live in free-range or spacious conditions allowing natural behaviors and protection (e.g. extended access to the outdoors/grazing).		
Integration of trees into the production system	Integration of trees into the farm's production system	Do you grow trees together with plants and/or livestock into your farm's production system?	Do you grow trees together with plants and/or rise livestock within the same space?	NEW INDEX; displaced criteria		Trees are absent or rare; they are not integrated into the farm's production system, or they are removed.	Trees are present, but they are not systematically integrated into the production system or only play a minor role.	I intentionally planted or kept trees in different parts of the farm, in order to enhance interactions with plants and animals (fodder, shade, soil fertility etc.).	Minor adjustment	or kept (if not planted by farmers themselves)

	Diversity of tree species	Do you have a significant richness of tree species in your farm, including naturally occurring and planted ones?	Do you have a significant richness of trees species in your farm, including naturally occurring and planted ones?	NEW CRITERIA		None / only one tree species is integrated into my farm agroecosystem.	Three or more tree species are integrated into my farm agroecosystem.	Five or more tree species are integrated into my farm agroecosystem.		
Habitat management (vulnerability reduction measures)	Mosaic of plots	Does your farm have multiple plots of different shapes and sizes?	Does your farm have multiple plots of different shapes and sizes ?	Unchanged		My farm consists mainly of large, uniform fields with little to no variation in crop type, size, and shape.	My farm has some variation in field types, sizes and shapes but remains somewhat uniform.	My farm has multiple plots of different sizes, with various crops and natural elements (trees, hedges, wetlands) supporting biodiversity.	Minor adjustment	
	Proportion of the farm with natural and semi-natural elements	Does a large proportion of your farm include natural or semi-natural elements (such as native vegetation, wetlands, forest patches, hedgerows, grass strips, melliferous plants, or perennials)?	Does a large proportion of your farm include natural or semi-natural elements (such as native vegetation, wetlands, forest patches, hedgerows, grass strips, melliferous plants, or perennials)?	Unchanged		Less than 5% of the farm consists of natural or semi-natural elements, with most of the land dedicated to cultivation or grazing.	Between 5% and 10% of the farm includes natural or semi-natural elements, but they are limited in coverage or fragmented.	More than 10% of the farm consists of natural or semi-natural elements that provide habitat for biodiversity and ecosystem services.	Unchanged	

3) RECYCLING Water and Energy use questions relocated under "Efficiency"										
Use of seeds and breeds	Use of local and self-produced seeds and breeds	Are the majority of seeds, seedlings or breeds used on your farm self-produced or shared locally?	Are the majority of seeds, seedlings or breeds used self-produced or shared locally?	Unchanged		The majority of seeds, seedlings, and animal breeds come from external suppliers, with little or no reliance on on-farm reproduction or local exchanges.	Some seeds, seedlings, or breeds are produced on-farm or shared locally, but the farm still relies partly on commercial or external sources.	The majority of seeds, seedlings, and animal breeds come from on-farm production or exchanges with local farmers, with minimal reliance on external suppliers.	Unchanged	
	Selection of locally adapted resilient crop varieties, animal breeds, and tree species	Do you prioritize crop varieties and livestock breeds that are naturally adapted to local conditions (e.g., drought tolerance, disease resistance, low fertilizer need, heat resistance, hardy livestock breeds)?	Do you prioritize crop varieties and livestock breeds that are naturally adapted to local conditions (e.g., drought tolerance, disease resistance, low fertilizer need, heat resistance, hardy livestock breeds)?	Unchanged		I prioritize high yielding crops and highly productive animal breeds.	Some adapted varieties and breeds are used, but not consistently across all crops and livestock.	I mainly rely on locally adapted, low-input crop varieties and resilient livestock breeds.	Unchanged	
Biomass and waste management	Reuse of organic residues	Do you reuse all your organic residues (e.g., plant residues, manure, compost) in your farm activities?	Do you reuse all your organic residues (e.g., plant residues, manure, compost) in your activities?	Unchanged		I discard organic residues, burn them, or export them without being repurposed.	Some organic residues are reused (e.g., for compost or mulch), but a significant portion is still discarded or underutilized.	I fully integrate organic residues into soil enrichment, livestock feeding, composting, biogas	Minor adjustment	To account for the fact that letting crop residues accumulate on a field after harvest is not bad practice. Level 0 rather

								production, or other beneficial uses.		includes "export" of residues
	Amount of Management of non-organic waste generated	Do you minimize waste production (non-organic) and/or ensure that most of it is properly recycled or repurposed on the farm?	How do you deal with non-organic waste produced in your farm (tires, metal, plastic packaging and tarps, batteries and other hazardous waste)?	Adapted	rephrased around explicit examples of non-organic waste bad management practices that are found on the fields	My farm generates large amounts of hazardous waste, and I manage all of it by myself by burying in my farm, burning it or reusing it as country road embankments	My farm recycles certain materials, but I manage some part of hazardous waste by myself by burying in my farm, burning it or reusing it as country road embankments	My farm recycles non-organic materials by using official recycling channels organized by the state or municipality and ensures proper disposal of hazardous waste.	Adapted	rephrased around explicit examples of non-organic waste bad management practices that are found on the fields
Source of water for farming activities	Source of water for farming activities	Does the water you use for irrigation come from a sustainable source naturally renewed?	Do you irrigate your crops? If so, is the water you use for irrigation coming mainly from renewable, recycled or naturally replenished sources (e.g., rainwater harvesting, small ponds, shallow groundwater with regular replenishment, perennial	Restructured	enlarged scope (not just surface anthropic exogeneous irrigation) --> 'autonomy'-related	Water is mostly extracted from deep groundwater, fossil aquifers, or other sources that are not naturally replenished.	I use both renewable and non-renewable sources, or small quantities from rainwater/surface water but not the main source.	I use little or no water, mainly coming from recycled or reused farm water or renewable sources.	Restructured	Better fit with the context of agricultural water uses in the EU.

			rivers/lakes with natural recharge and managed extraction)?							
	Source of energy for farming activities		Do you rely on renewable energy sources for your farming activities ?	New criteria / question	In this question we focus on the type of energy (renewable) and not the energy use (efficiency & sufficiency), included in the next section	I do not rely on any renewable energy sources for my farming activities.	I rely on renewable energy sources for about 50% of my on-farm energy use.	I rely exclusively on renewable energy sources for my farming activities.	New levels	

4) EFFICIENCY										
Management of soil fertility	On-farm nutrient cycling and application	Do you manage soil fertility through organic matter inputs such as manure, compost, crop residues, green manure, or mulch?	How do you manage soil fertility on your farm ?	Adapted	Expanded criteria to fit with a new wider gradient of integration of soil fertility management practices.	My farm primarily relies on synthetic, mineral or fossil fertilizers (e.g., guano, seaweed, natural minerals…).	My farm recycles or imports some organic matter but still relies partly on synthetic and mineral fertilizers.	My farm relies mainly or exclusively on organic inputs and ecological practices for soil fertility (e.g., compost, manure, crop residues, green manure (cover crops), intercropping, agroforestry, biofertilizers). No synthetic nutrient inputs are used, or only minimally.	Minor adjustment	" I cannot buy fertilizers" removed from level 2 + remove the term "agroecological" that is not always understood by farmers + levels recentered around the use of organic VS synthetic fertilizer (rather than "local"vs"external", because organic manure

										could be ±locally imported)
	Nitrogen-fixing plants	Do you cultivate or have any nitrogen-fixing plants (including trees and fodder)?		Unchanged		I don't cultivate any plants that fix nitrogen and there aren't naturally occurring nitrogen-fixing plants or trees on my farm.	I cultivate some legumes or trees (i.e. beans, ground nuts etc.) and have some naturally occurring nitrogen-fixing plants or trees.	I cultivate a diversity of nitrogen-fixing plants on my farm (legumes and trees) and manage those naturally occurring nitrogen-fixing plants or trees.	Minor adjustment	formulation adjusted with EU legumes examples
Management of pests and diseases	Phytosanitary protection	Do you manage pests with preventive measures?	Do you try to manage pest using synthetic chemical pesticides only as a last resort, favoring instead preventive measures ?	Minor adjustment		My farm relies mainly on curative pest control (e.g. pesticides, synthetic treatments) and applies few or no preventive strategies. My curative approach is mainly based on a normative calendar approach.	Some preventive practices are in place, but pest control still involves regular curative treatments (e.g., applying pesticides when pest levels are high).	My production system is based primarily on preventive pest control, including crop rotation, intercropping, management of natural predator habitats and resistant varieties. Curative treatments are used only as a last resort and, if pesticides are	Minor adjustment	Level 0 a bit softens

								used, they are preferably biopesticides or low-risk mineral elements.		
	Use of veterinary drugs	Do you manage animal health with minimal use of veterinary drugs?	Do you use veterinary drugs to manage animal health?	Minor adjustment	Reducing biased Q	Regular use of veterinary drugs without alternative measures.	Occasional use of veterinary drugs with some preventive health measures.	Minimal use of veterinary drugs, focusing on preventive health practices.	Minor adjustment	
Resource optimization Resource use efficiency	Water use and saving	Do you apply water-saving techniques to optimize and reduce water waste?	Do you apply water-saving techniques to optimize and reduce water waste?	Adapted (name of criteria ; and position)	Moved from Recycling to here. Adjustment of criteria name to remove irrigation (must account for livestock farming and non-irrigating context) Moved to Efficiency (Resource use efficiency)	No water-saving techniques are used.	Some water-saving practices are in place, but they are not systematically applied across the farm.	Multiple efficient water-saving techniques are systematically applied OR I do not irrigate purposefully / My system does not need irrigation	Minor adjustment	examples of WST are included as note for the enumerator
	Energy use and saving and use of renewable energy	Do you take measures to use renewable energy and/or rely on naturally low energy use in your farm operations?	Do you rely on naturally low-energy practices in your farm operations ?	Adapted	Moved from Recycling to Efficiency Focus on energy consumption (efficiency & sufficiency levers)	My farm relies on fuel-intensive machines (e.g., diesel generators, tractors, electric-powered pumps...) without any energy-saving	Some energy-saving practices are in place (e.g., efficient irrigation or limited machine use), but the farm still relies significantly on fuel or electricity.	My farm either actively reduces its energy use through efficiency OR I deliberately operate with naturally low energy inputs (e.g., minimal machinery,	Minor adjustment	Removed the part about the lack of access to energy, as not fit to EU context and focus on energy consumption without renewable aspect (taken into account below)

						strategies or renewable sources.		reliance on manual or animal labor).		

5) RESILIENCE										
Social resilience	Community cooperation (formal or informal)	Can you rely on any kind of community mechanisms (formal or informal) to sustain your farm?	Can you and do you rely on any community-based mechanisms (formal or informal) to help sustain your farm against risks and crisis (e.g., solidarity support, seed banks, mutual aid funds, risk-sharing or disaster insurance systems)	Minor adjustment in NEW INDEX	This addition (against risks and crisis) helps better distinguishing from the Q under circularity and solidarity economy and put the emphasis on the resilience aspect of the community cooperation	There is no community support system in my area, or I don't belong to it.	Some informal mechanisms exist but I'm not involved or do not have access in it	There are community support mechanisms in my area, and I am involved in it.	Minor adjustment	minor language adjustments and placement of examples in the question, not the level 4
	Climate change adaptation capacity		Do you take into account the impacts of climate change (e.g., longer or more intense droughts, stronger storms, heavier rainfall) to adapt your farming activities ?	New criteria / question in NEW INDEX	Distinct from 'Use of seeds and breeds' (Recycling), which covers current sourcing/adaptation of seeds and breeds; this indicator instead targets long-term resilience to climate change	I don't understand / acknowledge how climate change will affect my farming activities.	I acknowledge and understand how climate change will affect my farming activities but do not yet implement adaptations measures to cope with it.	I do acknowledge and understand how climate change will affect my farming activities and have started adapting my practices.	New levels	

Economic resilience	Dependence on external financial support for farm and income stability	Do you operate independently without external financial support to sustain your farm?	To what extent do you depend on external financial support (e.g., CAP subsidies, bank loans) to sustain your farming activity ?	Adapted in NEW INDEX	Agroecology relies far less on subsidies than conventional farming, reflecting greater autonomy and income-generating capacity (Van der Ploeg et al., 2019) - hence this indicator's focus on farm independence from external financial support.	I am heavily dependent on bank loans and/or subsidies for sustaining my farming activities.	Significant external support is received, but the majority of my activities are sustained by the sale of agricultural products.	I rely mostly on my own production and selling to sustain my farming activities.	Adapted	

	Diversity of livelihood activities income generating activities	Do you have several livelihood activities? (Includes monetary and non-monetary activities related to the farm).	Do you have several income generating activities on your farm?	Minor adjustment in NEW INDEX	refocusing on the monetary aspect rather than livelihood in general. Part of social resilience is tracked through Qs further away from peer exchange, networking, etc.	I depend almost entirely on one single on-farm activity, with no significant alternative sources of income.	Some diversification exists, but additional complementary activities represent a small share of my income.	I have multiple sources of income activities, each contributing significantly to my income.	Minor adjustment	
Soil conservation practices	Permanent soil cover	Do you keep soil covered year-round using mulch, crop residues, cover crops, or continuous cropping?	Do you keep soil covered year-round using mulch, crop residues, cover crops, or continuous cropping?	Unchanged		The soil remains bare for long periods after harvest or is covered only occasionally to comply with regulations.	The soil is covered most of the time, but bare periods still occur between crops or after harvest.	The soil is always covered, ensuring continuous protection.	Adapted	Level 0 reframed to capture situations where practices are minimal, conventional, or purely reactive to regulations, without proactive sustainability intent
	Limiting deep ploughing and soil disturbance	Do you limit deep ploughing (more than 20 cm) to preserve soil structure and health?	Do you limit soil disturbance by avoiding deep ploughing and/or applying simplified cultivation techniques (e.g., shallow tillage, direct seeding under cover, or no-till practices)?	Adapted	Here we have combined "limit deep ploughing" and "Simplified cultivation techniques" (which was a requested addition to TAPE) into one question about soil disturbance in general. This way, we have 1Q for soil cover; 1Q for soil disturbance, and 1Q for degradation control under the soil conservation index.	Deep ploughing (more than 20 cm) is regularly practiced across most fields, with little use of reduced or alternative tillage methods.	Reduced tillage or shallow cultivation is practiced on a significant share of fields, while deep ploughing is limited to specific crops or situations.	Simplified cultivation techniques (e.g., direct seeding under cover, shallow tillage, or no-till) is systematically applied across most or all fields where agronomically feasible, maintaining soil structure and organic matter.	Adapted	adapted to fit with the agronomic concepts developed in the EU by conservation agricultural models

	Soil degradation control	Do you implement soil conservation measures to prevent soil degradation (erosion, reduction in soil fertility, salinization etc.)?	Do you implement other specific measures to prevent soil degradation (erosion control, organic matter management, compaction avoidance, buffer strips,)?	Minor adjustment	Above questions are already soil conservation measures, so this term was removed from the question to reduce confusion Examples are adapted to fit with EU soil degradation challenges	No soil conservation measures are in place.	Some conservation measures are implemented, but not systematically or not on all areas.	Adaptive and site-specific soil conservation measures are applied (cover crops, agroforestry, organic matter, amendments, adapted irrigation, contour planting etc.) and effectively address soil degradation threats.	Minor adjustment	Soil degradation status is removed from the levels. It is checked in an introductive question and impacts the display of this question. Cyprus mentioned that: in their context the EU regulation framework is not yet fully respected in fields so the levels should be adapted to account for the reality of all practices.

6) CULTURE AND FOOD TRADITION										
Dietary diversity and food self sufficiency	Food diversity Food products diversity	Do you and your community value and promote eating a diversity of food such as cereals, legumes, fruits, vegetables, dairy, meat, fish, and nuts?	Does your farm produce and promote a diversity of food products (e.g., cereals, legumes, fruits, vegetables, dairy, meat, fish, and nuts) ?	Adapted	Focus on farm-level practice in terms of food diversity production to assesses whether the farm contributes to dietary diversity through what it produces and promotes locally, not just what the farmer eats + question easier to grasp concretely for a farmer	The farm produces mainly one or two types of food (e.g., only cereals, only fruits/vegetables, or only livestock products)	The farm produces a moderate variety of foods (around 3 to 4 different types) combining several crop and/or livestock products.	The farm produces a wide diversity of foods (at least 6 different types) from multiple food groups (e.g., cereals, legumes, vegetables, fruits, dairy, eggs, meat)	Adapted	
	Share of farm production for food	What proportion of your farm's production is destined for local food or feed purposes compared to other uses (e.g., bioenergy, industrial raw materials, export, non-food markets)	What proportion of your farm production is destined for local human and animal consumption vs. other uses (seed, fuel, fiber, exports)?	New criteria / question	Replace the question below. Aspect of food/feed vs other usage is important in EU context	Almost none (less than 25%) of the farm's production is destined for food or feed; most goes to non-food uses or long-distance markets.	Around half (50%) of production is destined for food or feed purposes	Nearly all (more than 90%) of production is destined for food or feed purposes.	New levels	focusing on the ratio FOOD&FEED VS other uses (independently from local level issues ; that are already addressed through the VC size question)

Local and traditional food heritage	Use and preservation of traditional crops and local food practices	Do you produce and consume traditional food or maintain local food preparation practices?	Do you produce traditional food products or maintain local food preparation practices (e.g., traditional recipes, preservation methods)?	Minor adjustment	Addition of examples	Traditional food products and food practices are rarely or never used, and my farm relies almost entirely on direct selling of agricultural commodities on the market	Some products are grown, processed, and sold on my farm, but most of the agricultural production depends on external sales.	Traditional food is actively cultivated, transformed, and commercialized on my farm. Local food preparation techniques are maintained.	Adapted	Here we clarified the level to have on one side the production, transformation & commercializati on local food products ; on the other side the commercial selling of raw agricultural commodities on the market
	Valuing local cultural heritage Geographical and traditional food quality schemes	Do you actively protect and revive local cultural heritage and traditions?	Do you participate in geographical or traditional identification strategies (e.g. Protected Designation of Origin, Protected Geographical Indication, Traditional Specialty Guaranteed) to promote your products??	Adapted	work done on levels	I do not participate in any geographical or traditional branding, strategy. My products have no official recognition for quality or origin.	I occasionally participate in a quality scheme or use traditional labelling for some products, but not systematically.	I actively participate in one or more geographical or traditional food quality schemes for most of my products, using them strategically to add value, preserve traditions, and/or strengthen local identity.	Adapted	

7) CO-CREATION AND SHARING OF KNOWLEDGE										
Knowledge sharing and access	Peer learning	Do you regularly exchange knowledge with other farmers?	Do you regularly engage in mutual exchange of knowledge and best practices with other farmers (whether they are older or from the younger generation)?	Previously : Involvement in knowledge-sharing platforms between farmers Merged with Intergenerational knowledge transmission --> mutual exchanges between farmers (elders / young people)	Pilot tests allow to show that knowledge exchange was not unidirectional between generations of farmers ; therefore, the intergenerational question appeared less effective than addressing more generally the exchange between peer farmers Examples of knowledge sharing platforms (note): agroecological networks, farmers cooperatives, field schools, online discussion groups, regional agricultural fairs	I rarely have interactions with other farmers.	I regularly exchange knowledge with other farmers but not in a systematic or structured way.	I actively exchange knowledge with farmers through structured knowledge-sharing platform related to agroecology.	Minor adjustment	removing "community" aspect, less obvious from farm-level & entrepreneur perspective in EU
	Diversity of knowledge sources	Do you use a diverse range of knowledge sources (e.g., radio, mobile apps, newspapers, extension services, farmer networks) to inform decisions on your farm?	Do you use a diverse range of knowledge sources (e.g., decision-support tools, agricultural media, newsletters, extension services, farmer networks) to inform	Minor adjustment	Examples adaptation	I rely mostly on personal experience or a single source of knowledge, with little effort to explore new information from different channels.	Some external knowledge sources are used, but I rely primarily on a limited number of channels, such as private (commercial) extension services or practices recommended by	I actively seek out multiple sources of knowledge to improve practices: regularly using a mix of sources to stay informed (e.g., independent advisors ; newsletters ; pilot centers ;	Minor adjustment	inclusion of the contrast btw commercial vs independent advice

			decisions on your farm?				industrial stakeholders	decision-support tools…)		
Co-creation of knowledge and context specific innovation	Adoption of new and sustainable practices	Do you regularly test new practices on your farm and exchange within your community?	Do you regularly test new practices on your farm ?	Minor adjustment + displaced in NEW INDEX	Previously: Sharing of agroecological innovations --> Focus on the testing, as knowledge exchange considered further.	I don't test new practices on my farm.	I sometimes test new practices, or only on small part of my farm.	I test new practices on my farm regularly.	Minor adjustment	
	Use of local and context-specific knowledge in farming	Do you use local, context-specific knowledge (e.g., traditional, indigenous) in your farming practices?	Do you use local and context-specific knowledge to adapt your farming practices?	Minor adjustment + displaced in NEW INDEX	remove "traditional, indigenous"	I mostly follow external recommendations and conventional practices, with little or no adaptation to my context .	Some local knowledge is used for decision-making, but I mainly depend on modern, uniformed, external techniques and recommendations.	I actively integrate farm pedoclimatic and agronomic context and farmer-developed knowledge into decision-making, from soil fertility to pest management and water conservation.	Adapted	Focus on the "context-specific" aspect rather
	Involvement in co-creation and sharing of knowledge (formal and informal) processes	Are you involved in co-creation processes or action-research programs (with researchers and extension services)?	Do you participate in learning activities led by researchers, advisors, or NGOs to co-create solutions ?	Minor adjustment + displaced in NEW INDEX	Language adaptation	I do not participate in research and innovation platforms, or farmer-scientist collaborations and rely primarily on personal experience or	Some engagement occurs with researchers or innovation networks, but my collaboration is irregular or limited to occasional activities (e.g.,	I actively collaborate with researchers, extension services, NGOs, or private actors through platforms like Living Labs,	Unchanged	removing "community" aspect, less obvious in EU

						traditional knowledge.	attending a few workshops, providing feedback but not co-developing solutions).	Farmer Research Networks, or innovation hubs, contributing to testing, adapting, and co-developing agroecological solutions.		

8) HUMAN AND SOCIAL VALUES										
Women empowerment	Women's role in decision-making on the farm	Do women participate equally in key decisions regarding farm management?	To what extent are women involved in key decision-making on the farm (e.g., finances, crop/livestock choices, investments, and farm management), whether formally as farm entrepreneurs or informally as family members?	Adapted	"Equally" not necessarily relevant	Women rarely participate in decision-making, or their involvement is limited to specific minor issues	Women participate in some key decisions but not consistently across all farm management areas	Women regularly participate in most or all key decisions regarding farm management, formally or informally	Adapted	
	Women's financial independence and formal recognition in farm		Do women working on your farm have an independent legal status and receive	New criteria / question	Highly relevant in EU context	Women contribute to farm work but have no formal recognition (no contract, no	Women are formally employed on the farm (receive a salary or are registered as workers).	Women are legally recognized as co-owners or partners, with access to farm income and	New levels	

	ownership or management		financial remuneration for their work?			salary, no share in income).		returns on investments.		
Labor conditions for producers and employees	Physical working conditions of farmers	Do the working conditions on your farm preserve your health and well-being?	Do you implement specific measures related to your working conditions to protect your physical health and safety? (e.g.: ergonomics of work tools, training on safe handling of machinery, access to appropriate protective equipment, minimizing exposure to plant protection products, availability of sanitary facilities,)	Adapted	Separation of physical and mental in 2 distinct questions + addition of examples and focus on means (measures)	No dedicated measures are taken to ensure my physical health and safety	Some measures are taken to ensure my physical health and safety	Specific efforts, innovations and investments are set to improve my working conditions and preserving my physical health and safety	Minor adjustment	
	Mental working conditions of farmers	Do the working conditions on your farm preserve your health and well-being?	Do you implement specific measures related to your working conditions to protect your	Adapted		No dedicated measures are taken to ensure my mental health	Some measures are taken to ensure my mental health	Specific efforts, innovations and investments are set to improve my working conditions and preserving my mental health	Minor adjustment	

			morale and ensure your mental well-being?							
	Working conditions of employees	On your farm, are the working conditions of employees adapted to their health and well-being?	Do you take specific measures to ensure good working conditions for your employees?	Adapted	Focus on ways implemented rather than result	I am not sure they have appropriate working and wage conditions, but I cannot provide more.	I comply with all regulations to ensure their health and well-being (e.g., number of days off ; minimal wages ; insurances…).	I do my best to guarantee their health and well-being by providing appropriate working conditions (equipment, …) and wages.	Minor adjustment	
Motivation in farming activities, transition of practices, and youth transmission .	Motivation in the continuity of farming activity	Are you motivated to continue your farming activity ?		NEW CRITERIA		I am considering giving up farming soon due to a lack of motivation.	I am not sure whether to continue farming until the end of my career.	I remain motivated by my farming activity and wish to continue for as long as possible.	New levels	
	Motivation in the continuity of socially and environmentally responsible farming practices	Are you motivated to continue farming and adopt agroecological practices if you receive the necessary support (training, access to resources, market)?	[IF YES] Are you motivated to start or keep developing agriculture based on socially and environmentally responsible practices?	Minor adjustment	refocused on motivation in pursuing agroecology + rephrase "agroecology" for wider understanding	I do not wish to start or want to stop adopting socially and environmentally responsible practices.	I am motivated to start or continue adopting socially and environmentally responsible practices, IF I receive necessary support (e.g. in training ; labor conditions ; access to resources and market…)	I am fully motivated to start or continue adopting socially and environmentally responsible practices, EVEN if the conditions for achieving this transition are difficult.	Minor adjustment	reword "AE" for wider understanding IF NO to the previous question --> NO here

	Youth access to resources and farm transmission	Do you support your children or young people in the community to establish themselves and practice agroecology?	Are you actively engaged in facilitating the transmission of your farm to younger generations seeking to practice socially and environmentally responsible farming?	Adapted and displaced	Farm succession and generational renewal are significant issues in EU agriculture. + Rename "agroecology" for wider understanding	I don't feel particularly concerned by the issue of transmission towards young generation of independent farmers.	I'm interested in and discuss the issue (e.g., offering informal advice, discussing farm succession with family), but do not have decision-making power on this issue.	I am strongly engaged in transmitting my farm to independent young farmers (e.g., actively seeking information, exchanging good practices, facilitating land transfer, advocating for succession, developing formal support mechanisms)	Levels calibrated around willingness & capacity to transmit to young farmers motivated in agroecology	

9) CIRCULAR AND SOLIDARITY ECONOMY										
Products and services marketed locally	Local food system	Do you sell the majority of your production locally (directly or via short supply chains)?	What proportion of your production is sold locally ?	Minor adjustment	Slight language reformulation + remove "direct" aspect as considered below already.	Most of my products are sold through intermediaries on long supply chains or export markets.	Some products are sold locally, but a significant portion is not and goes through intermediaries.	Most of my products are sold locally, minimizing intermediaries and transportation distances.	Minor adjustment	Slight language reformulation + remove "direct" aspect as considered below already.
	Farmer-consumer partnerships and trust-based certification	Do you sell any of your farm products through a consumer cooperative or trust-based systems?	If you sell directly or through short supply chains, are you surrounded by a community of particularly loyal and supportive customers economically, physically, ideologically, and/or psychologicall y? (e.g., Community Supported Agriculture [CSA], Participatory Guarantee Systems [PGS], producer cooperatives) ?	Adapted	wider formulation of short-supply chains and trust-based systems	I am not part of any consumer cooperative or trust-based system, and I sell everything through the market or intermediaries.	Part of my production (less than a third) is sold through a consumer cooperative based on trust or directly to a community of loyal consumers.	Most of my production is sold directly to a community of loyal consumers or through a trust-based cooperative of customers who support me economically, physically, ideologically, and/or psychologically .	Minor adjustment	

Local sourcing and circularity	Origin of inputs	Do your farm inputs and services come in majority from the local territory?	Are your farm inputs produced in majority in your local area ?	Minor adjustment		A very small part comes from the local area	A significant part of it comes from the local area.	Most of my input and services come from the local area.	Minor adjustment	Issue of "local territory" not well defined, also in scientific literature. Assumption that the term "area" has a wider understanding?
	Local processing and services	Are your products processed within the local territory?	Are your products processed within your local area?	Minor adjustment		They are not processed, or they are processed outside the area.	Part of them is processed in the area.	My products are all processed locally (on-farm, or within the community, in the area).	Minor adjustment	same as above
	Resource sharing practices	Do you share materials, equipment, or labor through collective action?	Do you participate in any collective resource-sharing practices (e.g., shared machinery and inputs, pooling labor, joint purchase, collective composting, waste, or water management systems, common grazing areas, etc.)?	Minor adjustment	Focus on material/equipment sharing to distinguish with community cooperation focused on risk in Resilience	I do not share materials or participate in any collective resource-sharing practices.	I occasionally participate in collective resource-sharing practices.	I regularly participate in collective resource-sharing practices.	Minor adjustment	

10) RESPONSIBLE GOVERNANCE										
Producers' empowerment	Autonomous decision-making	Do you have the freedom to make independent decisions regarding farm management, such as crop selection, resource allocation, use and harvesting of natural resources (such as trees), and farming practices, without external constraints?	Do you have the freedom to make independent decisions regarding farm management, such as crop selection, resource allocation, use and harvesting of natural resources (such as trees), and farming practices ?	Minor adjustment	Regulatory (legal) requirements and biophysical (e.g., pedoclimatic) elements should not be considered as limiting freedom when asking this question	Very little decision-making autonomy. Agronomic and management decisions are largely influenced by technical, commercial or industrial actors (e.g., buyers, input suppliers, processors, investors), leaving little room for independent choice.	Some level of decision-making autonomy. The farmer makes most decisions independently but remains constrained by financial and time limitations or market requirements that restrict certain choices.	Full autonomy in decision-making and management. Decisions are made freely based on agronomic reasoning and farming experience, with access to independent and diverse sources of advice or knowledge.	Minor adjustment	
	Engagement in grassroots farmer organizations for agroecology	Are you an active member of a grassroots farmer organization working on agroecology (e.g., cooperatives, farmer-led advocacy groups, agroecology movements)?	Are you an active member of a grassroots farmer organization working on transition towards sustainable practices?	Minor adjustment	not using the term agroecology	I am not involved in grassroots farmer organizations and do not benefit from collective action or farmer-led and transition-oriented advocacy.	Some interaction with grassroots organizations occurs, but participation is occasional or limited to receiving information/services rather than active engagement.	I actively participate in grassroots farmer organizations that promote sustainable practices, mutual aid, advocacy for farmer rights, and access to innovative markets and supporting policies for transition.	Unchanged	

	Access to financial resources and ability to self-finance	Do both men and women have access to financial resources (credit, loans, subsidies) and the ability to finance your activities independently?	Do you have free access to bank loans without conditions on the economic direction and management of your farm?	Adapted	question of gender equality in financial power is addressed in women's empowerment	No of very few accesses to financial resources, such as bank credit, cooperative funds, or personal savings.	Some financial resources are available, but access to them is limited due to the lending conditions offered by banks (locked-in investments, etc.).	Good access to financial resources, with the ability to finance activities and innovation independently.	Minor adjustment	
	Access to markets	Do you have access to markets (physical access, market information, economic feasibility to participate)?	Do you have access to a variety of value chains and profitable markets in your area that allows for diversificatio n of productions?	Adapted	New proposition answer to the ask of partners to integrate market dimensions, especially markets enabling diversification (in a profitable way). --> Whether farmers can reach markets at all is not relevant in EU, so focus switched to market options, as factor facilitating a transition. it's more relevant where most farms do have basic market access but face limitations in diversity	I have access to a limited number of markets to sell main agricultural commodities (e.g. cereals, potatoes, meat, etc.) through intermediaries.	The farm has access to several markets or value chains, but profitability, logistics, or entry barriers limit real diversification opportunities. Some diversification is possible but constrained.	The farm has good access to a diverse range of value chains and profitable markets (e.g., local, regional, organic, or niche markets) that actively support or reward diversified production.	Adapted	
Producers' access to and control over resources	Access and control over land	Do you have access to land, and is your access to it and the natural resources it contains secure?	Do you have access to land, and is your access to it secure?	Minor adjustme nt	Focus on land access/control	Land access is limited or highly insecure (e.g., no ownership rights, land conflicts, or vulnerability to expropriation or	Some access to land exists, but ownership or tenure is insecure (e.g., short-term lease, informal agreements, legal uncertainty, land conflicts, or restrictions on	My farm has secure land access, either through ownership, long-term tenure, or stable community rights, without risk of eviction	Minor adjustment	

						non-renewal of farm lease).	use or management of certain natural resources).	or major restrictions on use of land or its natural resources.		
	Access and control over water	Do you have secure access to sufficient water for farming?	Do you have secure access to sufficient quantity and quality of water to sustain your farming activities?	Minor adjustment		Water access is highly insecure, unreliable, or unavailable, leading to difficulties in sustaining crops and livestock.	Some access to water exists, but it is seasonally limited, infrastructure is inadequate, or regulations restrict usage (e.g., rationing, competition with other users).	I have consistent and reliable water access (rainfed system with predictable rainfall, well-managed irrigation, access to natural sources) without major restrictions.	Unchanged	
	Control over genetic resources (seeds & livestock & breeds)	Do you have access to and control over diverse genetic resources (seeds and livestock breeds), including on their selection, conservation, and use?	Do you have access to and control over diverse genetic resources (seeds and livestock breeds), including on their selection, use, conservation, reproduction and exchange ?	Minor adjustment	Addition of reproduction and exchange as requested by partners	I depend heavily on external genetic resources, such as hybrid/commercial seeds or livestock breeds, with no ability to save, breed, or adapt genetic material.	Some autonomy exists, but access to diverse genetic resources is limited by market availability, regulations, or external breeding programs.	I have full autonomy in selecting, saving, exchanging, and conserving both seeds and livestock breeds, relying on locally adapted varieties and indigenous breeds for resilience and sustainability.	Minor adjustment	Removal of gender consideration

Table 26 - Step 2 - KPI selected & adapted for Wallonia

Dimension of performance	Indicator(s) retained for Wallonia	Code	Criteria / Questions & Data	Weight & thresholds	Aggregation method	External references
Governance	Secure Land Tenure	SLT_1	Total area of agricultural land that is OWNED (and operated)	Weight 1 (fully secure).	SLT score (%) = round[(0.5 x Land Tenure Security score) + (0.25 x land sufficiency) + (0.25 x land price barrier)] x 100. Land Tenure Security score = share of owned land (weight 1) + share of long-term leased land (weight 0.66) + share of short-term/precarious leased land (weight 0.33), as proportions of total declared land area (free use/borrowed land is excluded, i.e. weight 0). Land sufficiency and land price barrier are already coded 0-1.	
		SLT_2	Total area of agricultural land that is RENTED IN on a LONG-TERM basis (farm lease)	Weight 0.66.		
		SLT_3	Total area of agricultural land that is RENTED IN on a SHORT-TERM basis (e.g., annual lease)	Weight 0.33.		
		SLT_4	Total area of agricultural land occupied or borrowed for free, without legal warranties	Counted in total land area but given no security weight (0).		
		SLT_5	Is your current land area sufficient to ensure the economic viability of your farm?	Weight 0.25		
		SLT_6	Is the price of land a barrier to your plans for acquiring new farmland?	25% of the final score (inverted: high barrier = low score).		
Economy	Economic performance Indicator	QEI_1	How often has your farm activity been profitable over the last three years?	50% of the score; also feeds the Generational Renewal score.	Economic index (%) = round[((profitability score / 5) + (future viability score / 5)) / 2] x 100.	
		QEI_2	How do you see the future economic viability of your farm developing in the next few years?	50% of the score.		
	Gross margins of production	GM	Farm accounting		Weighted means	

	Economic efficiency of production	AV/GVP	Farm accounting & regional (standardized) references of gross economic production per sector[133]		~∑GM's / farm-level GVP	(Van der ploeg et al., 2019)
Society & culture	Generational Renewal (for farmers >= 50 years old)	GR_1	Are you actively engaged in facilitating the transmission of your farm to younger generations?	TAPE 8.3.3; one third of the score.	GR score (%) = round[((1 - difficulty finding a successor) + (youth engagement score / 2) + (farm profitability score / 5)) / 3] x 100. 'Don't know' profitability answers are recoded to the mid-point.	
		GR_2	Are you encountering difficulties finding someone to take over your farm at the end of your career?	Inverted; one third of the score.		
		GR_3	How often has your farm activity been profitable over the last three years?	Shared with the Qualitative Economic Indicator (QEI_1); one third of the score.		
Environment	Humic Balance	HB	Computed net variation of Organic Matter (OM) in soils based on inputs & outputs accounted over one year			Henin et al., 1945; Roussel et al., 2001; VERI, 2012, 2018; De Clerck, 2021.
	Pesticide Management Score	PMS_1	Over last year, did you use any pesticides for crop or livestock production?	If 'No', the score is set to 100% directly.	PMS (%) = 100 if no pesticide is used. Otherwise, round[(IPM + HRM + ERM) / 3] x 100, where: IPM = share of 5 preventive-practice categories adopted; HRM = weighted share of health-protection measures adopted (4 items, one double-weighted, /5); ERM = weighted share of environmental-protection measures adopted (4 items, two double-weighted, /6).	
		PMS_2	Do you try to manage pests using synthetic chemical pesticides only as a last resort, favoring preventive measures instead?	Contextual/display only (auto-answered when not applicable, e.g. organic farms).		
		PMS_3	Please select which pest preventive measures you used	5 items checklist; one third of the score.		
		PMS_4	Which of the following measures did the farm adopt to protect yourself and the	4 items, weighted, /5; one third of the score.		

[133] https://agriculture.wallonie.be/home/politique-economie/prix-et-economie-agricole/les-productions-brutes-standards.html

			people you work with from health-related risks?			
		PMS_5	Which of the following measures has the farm adopted to protect the immediate environment of the farm?	4 items, weighted, /6; one third of the score.		
	Harmonized Pesticide Load (HPLI)	HPLI - *HEALTH*	Field notebooks - quantities of active substances sprayed [kg/ha]	Load factors are computed for each active substance (A.S.) based on properties found in the PPDB. A third of the weight is attributed to the toxic impacts on human health ; a third is determined by parameters on ecotoxicity for non-target organisms ; and a last third based on the persistence in environment.	$\sum_i QAS_i * HPL_{AS_i}$	Noé Vandevoorde, P. Kudsk, Y. Agnan, P.V. Baret. 2025. Five methodological updates of the Danish Pesticide Load Indicator to support EU-wide pesticide risk reduction policies. Environmental Research Letters. https://doi.org/10.1088/1748-9326/ae269b
		HPLI - ECOTOX				
		HPLI - FATE				
Health & nutrition	Personal Well-being index	WBI_1	To what extent does your membership in a cooperative or farmer's network play a positive role in your well-being?	Asked only to respondents who belong to a farmers' network/cooperative.	Average of 10 normalized sub-scores (WBI_1 to WBI_10), rescaled 0-1 each (/ 5); days of leave / 30, capped at 1; training hours / 50, capped at 1; leisure hours / 10, capped at 1), x 100. If the respondent is not part of a farmers' network, WBI_1 is dropped and the average is taken over the remaining 9 items.	
		WBI_2	Number of days of leave per year	Capped at 30 days for scoring.		
		WBI_3	Number of hours of training per year	Capped at 50 hours for scoring.		
		WBI_4	Number of hours of leisure time per week	Capped at 10 hours for scoring.		
		WBI_5	Are you proud and satisfied of your farm and what you have achieved there?	[Not at all (1) - Really proud (5)]		

		WBI_6	To what extent do you feel recognized for your agricultural work? (by society, consumers, your peers or those around you...)	[Not at all (1) - Very strongly (5)]		
		WBI_7	How would you rate the level of physical strain involved in your work?	[Very high (1) - Very low (5)]		
		WBI_8	How would you rate the level of mental strain involved in your work?	[Very high (1) - Very low (5)]		
		WBI_9	How confident are you about your future and the social sustainability of your farm?	[Not at all (1) - Very confident (5)]		
		WBI_10	How confident are you about your future and the sustainability of your farm in terms of environmental issues?	[Not at all (1) - Very confident (5)]		

12.3 Saxony-Anhalt

12.3.1 Agricultural businesses orientations statistics

Agricultural business orientation in Saxony-Anhalt (2020)[134]

Table 27 - Agricultural business orientation in Saxony-Anhalt

Business orientation	Number of farms	UAA [ha]
Arable farming	2,198	712,109
Horticulture	77	1,723
Perennial crops	141	2,071
Forage production	1,172	185,484
Refinement	213	17,637
Crop production integrated farms	38	6,562
Livestock farming integrated farms	49	27,607
Crop production - Livestock farming integrated farms	456	209,509
Total	4,344	1,162,702

Agricultural businesses with selected characteristics according to business orientation [2020][135]

Arable farms:

Table 28 - Agricultural business orientation of arable farms in Saxony-Anhalt

Business orientation	Number of farms	UAA [ha]	Standard-output [€]	Standard-output per farm [€]	Livestock [AU]
Arable farms total	2,198	712,109	809,988,222	368,511	14,344
grain-, oilseed- and protein crop farms	1,284	417,605	399,829,063	311,393	5,501
root crop farms	42	14,886	47,337,556	1,127,085	39
Grain-, protein crop-, oilseed-, and root	85	55,149	77,751,046	914,718	1,207

[134] https://statistik.sachsen-anhalt.de/fileadmin/Bibliothek/Landesaemter/StaLa/startseite/Themen/Land_und_Forstwirtschaft__Fischerei/Berichte/Agrarstruktur/6C422_2020-A.pdf

[135] https://statistik.sachsen-anhalt.de/fileadmin/Bibliothek/Landesaemter/StaLa/startseite/Themen/Land_und_Forstwirtschaft__Fischerei/Berichte/Agrarstruktur/6C422_2020-A.pdf

crop mixed farms					
Field vegetable farms	39	7,493	41,172,818	1,055,713	43
Mixed crop farms (including Hops and tobacco)	748	216,977	243,897,739	326,066	7,555

Perennial crop farms:

Table 29 - Agricultural business orientation of perennial crop farms in Saxony-Anhalt

Business orientation	Number of farms	UAA [ha]	Standard-output [€]	Standard-output per farm [€]	Livestock [AU]
Perennial crop farms total	141	2,071	17,968,000	127,433	58
Wineries	69	542	3,664,234	53,105	-
Fruit farms	53	1,268	12,145,153	229,154	30
Mixed perennial crop farms	19	261	2,158,613	113,611	-

Forage production farms:

Table 30 - Agricultural business orientation of forage production farms in Saxony-Anhalt

Business orientation	Number of farms	UAA [ha]	Standard-output [€]	Standard-output per farm [€]	Livestock [AU]
Forage production farms total	1,172	185,484	363,303,043	309,986	148,474
Dairy farms	214	123,635	315,033,213	1,472,118	110,274
Cattle breeding and fattening farms	439	36,943	29,361,464	66,883	26,273
Cattle farms: milk production, rearing and fattening combined	5	1,459	1,851,214	370,243	843
Grazing livestock farms: sheep, goats and others	514	23,447	17,057,152	33,185	11,084
Sheep farms	200	11,179	8,775,174	43,876	5,220

Sheep and cattle farms	8	-	-	-	-
Goat farms	12	-	-	-	-
Other forage production farms (farms with different grazing livestock)	294	11,727	7,485,366	25,460	5,404

Refinement farms:

Table 31 - Agricultural business orientation of refinement farms in Saxony-Anhalt

Business orientation	Number of farms	UAA [ha]	Standard-output [€]	Standard-output per farm [€]	Livestock [AU]
Refinement farms total	213	17,637	516,392,550	2,424,378	144,407
Pig farms	120	11,013	258,218,770	2,151,823	83,906
- Pig breeding farms	56	3,443	159,108,336	2,841,220	45,190
- Pig fattening farms	50	3,219	64,002,506	1,280,050	25,834
- Pig breeding and fattening farms	14	4,351	35,107,928	2,507,709	11,881
Poultry farms	93	6,624	258,173,780	2,776,062	60,502
- Laying hen farms	38	1,816	100,786,336	2,652,272	18,072
- Poultry fattening farms	54	-	-	-	-
- Laying hen and poultry fattening farms	1	-	-	-	-
Refinement farms with different composite products	-	-	-	-	-

Crop production integrated farms:

Table 32 - Agricultural business orientation of crop production integrated farms in Saxony-Anhalt

Business orientation	Number of farms	UAA [ha]	Standard-output [€]	Standard-output per farm [€]	Livestock [AU]
Crop production integrated farms total	38	6,562	18,890,484	497,118	845
Horticulture and perennial crop integrated farms	4	14	211,903	52,976	-
Arable and horticulture integrated farms	9	774	3,816,033	424,004	-
Arable and winery integrated farms	1	-	-	-	-
Arable and perennial crop integrated farms	15	1,774	6,753,342	450,223	-
Crop production integrated farms with emphasis on arable farming	2	-	-	-	-
Other crop production integrated farms	7	178	633,701	90,529	38

Livestock farming integrated farms:

Table 33 - Agricultural business orientation of livestock farming integrated farms in Saxony-Anhalt

Business orientation	Number of farms	UAA [ha]	Standard-output [€]	Standard-output per farm [€]	Livestock [AU]
Livestock farming group integrated farms total	49	27,607	74,598,699	1,522,422	22,528
Partial alignment forage production (grazing livestock)	33	13,061	29,092,014	881,576	9,688
- Partial alignment dairy production	9	12,501	28,495,846	3,166,205	9,313
- Partial alignment	24	561	596,168	24,840	376

other forage production (other grazing livestock)					
Partial alignment refinement	16	14,545	45,506,685	2,844,168	12,840
- Refinement and dairy production	3	8,444	31,700,888	10,566,963	9,077
- Refinement and other forage production	13	6,101	13,805,797	1,061,984	3,763

Crop production - Livestock farming integrated farms:

Table 34 - Agricultural business orientation of crop production - livestock farming integrated farms in Saxony-Anhalt

Business orientation	Number of farms	UAA [ha]	Standard-output [€]	Standard-output per farm [€]	Livestock [AU]
Crop production-livestock farming integrated farms total	456	209,509	319,015,561	699,596	71,783
Arable and forage production (grazing livestock) integrated farms	370	183,503	263,485,534	712,123	61,291
- Arable and dairy production integrated farms	46	65,267	116,603,423	2,534,857	21,577
- Dairy production and arable integrated farms	43	46,300	85,871,272	1,997,006	20,338
- Integrated farms arable farming with other forage production	145	41,040	33,643,713	232,026	8,444

- Integrated farms with other forage production	136	30,895	27,367,117	201,229	10,933
Integrated farms with different combinations crop production and livestock farming	86	26,006	55,530,027	645,698	10,491
- Arable and Refinement	43	17,042	40,017,000	930,628	7,440
- Perennial crops and forage production integrated farms	9	166	245,073	27,230	109
- Crop production and livestock farming integrated farms	34	8,798	15,267,954	449,057	2,943

12.3.2 Soil-Climate-Zones („Boden-Klima-Räume“)

“The *Soil-Climate Zones* (BKR) represent areas with relatively homogeneous site conditions for agricultural production in the Federal Republic of Germany. The BKR were defined on the basis of municipal boundaries, with particular account taken of the influences of soil quality and climate.” (Translation from German) (Bundesministerium für Landwirtschaft, Ernährung und Heimat, 2021). Since they this common approach for regionalising agricultural conditions in Germany, resulting in compact areas, we decided to run the analysis of the pre-typologies again within the BKR of Saxony-Anhalt.

At Figure 196 the distribution of the five BKR can be seen within Saxony-Anhalt.

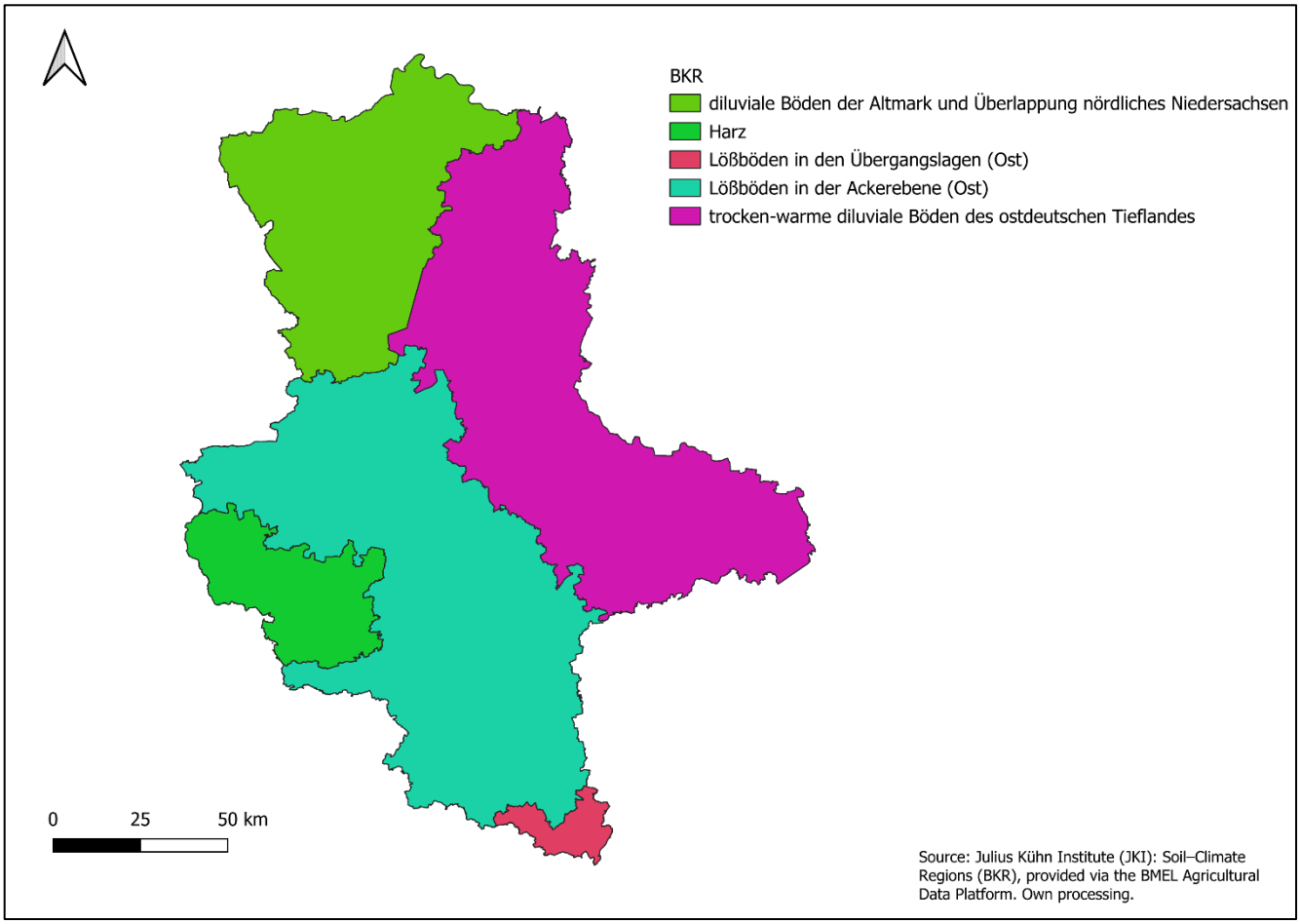


Figure 196: BKR within Saxony-Anhalt. Source: Julius Kühn-Institut (JKI), Institut für Strategien und Folgenabschätzung: Boden-Klima-Räume (BKR). Data clipped to Saxony-Anhalt; own processing.

The abbreviations are as follows within this appendix:

BKR	*Name of the soil climate zone*
BKR_1	Lößböden in der Ackerebene (Ost)
BKR_2	Harz
BKR_3	Lößböden in den Übergangslagen (Ost)
BKR_4	trocken-warme diluviale Böden des ostdeutschen Tieflandes
BKR_5	diluviale Böden der Altmark und Überlappung nördliches Niedersachsen

12.3.3 Alternative pre-typology based on BKR spatial reference

As introduced in 4.2.3 and 9.1.2 ; an alternative discrete spatial framework called *Boden-Klima-Räume* (Soil-Climate Zones) was also bring along further steps of the TAPE evaluation process to compare the relevance of the predefined *Agrozones* to the official mapping (5 *BKR)*, based on official climate & soil statistics. The following figures (Figure 197 to Figure 211) display the Clusters, Archetypes & FSO products and their spatial distribution along this alternative BKR framework.



Figure 197 - Description of the 4 clusters using their paragons defined at regional level (BKR) using the HCPC algorithm (Husson et al., 2010) on restrained Saxony-Anhalt IACS. Production factors (animal & crop productions) were aggregated into 19 categories. Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.

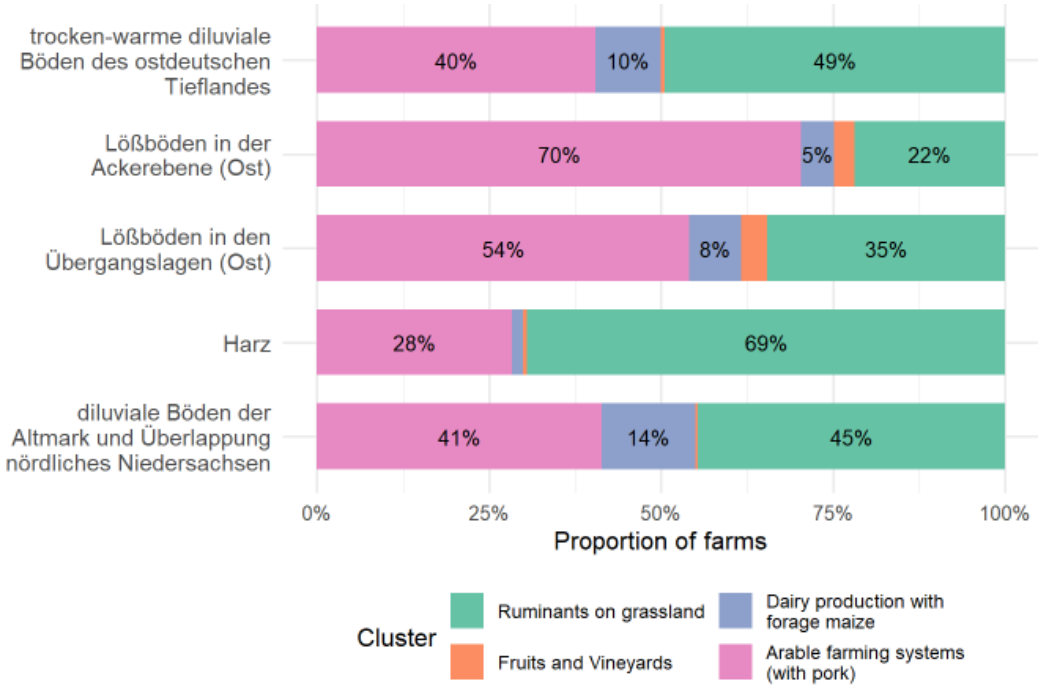


Figure 198 - Distribution of Saxony-Anhalt farms - registered in the regional IACS - into clusters across regions (BKR). Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.

Archetype interpretation and labelling

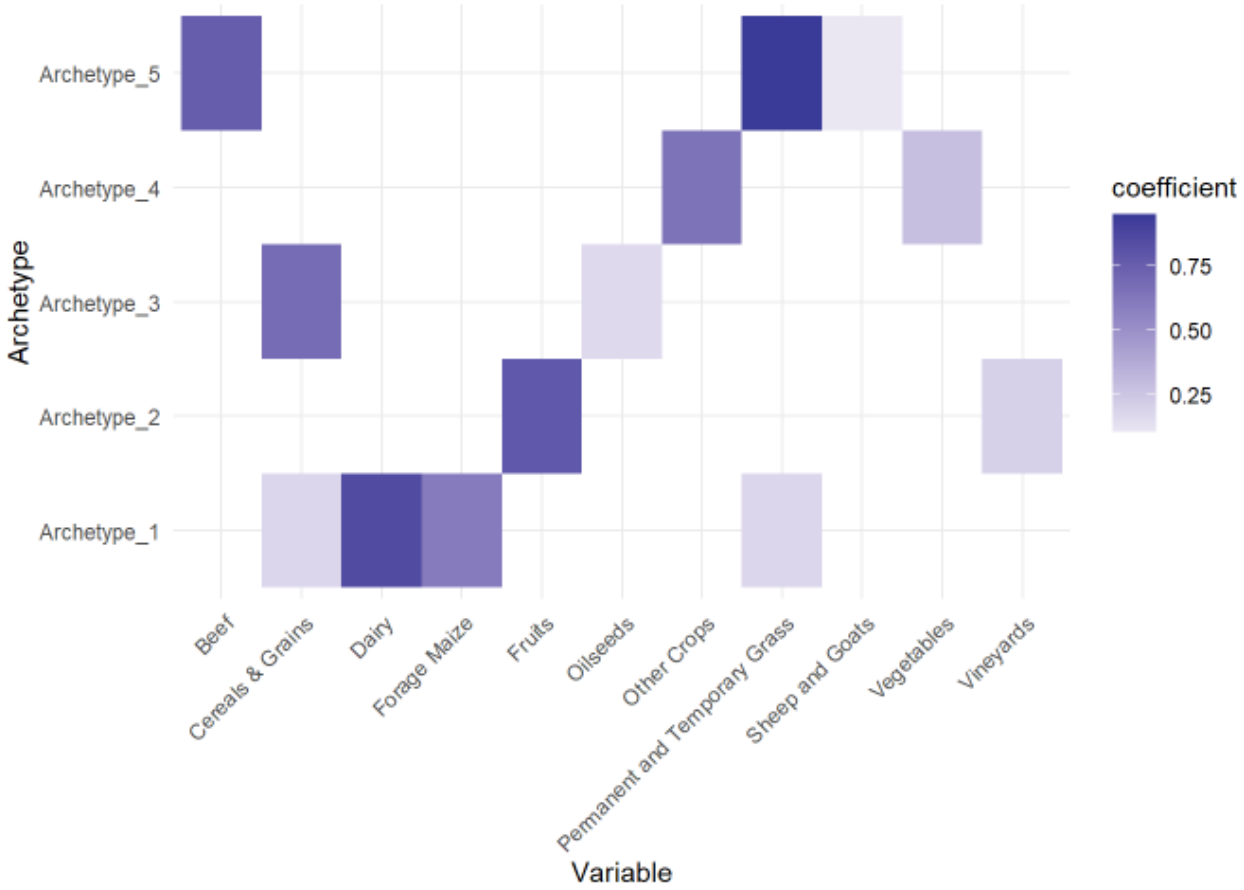


Figure 199 - Heatmap of archetype coefficients defining the production profiles of the identified archetypes. Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.



Figure 200 - Production profiles of the five archetypes and the undifferentiated group (bottom right) identified using archetype analysis (Eugster & Leisch, 2009). Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.

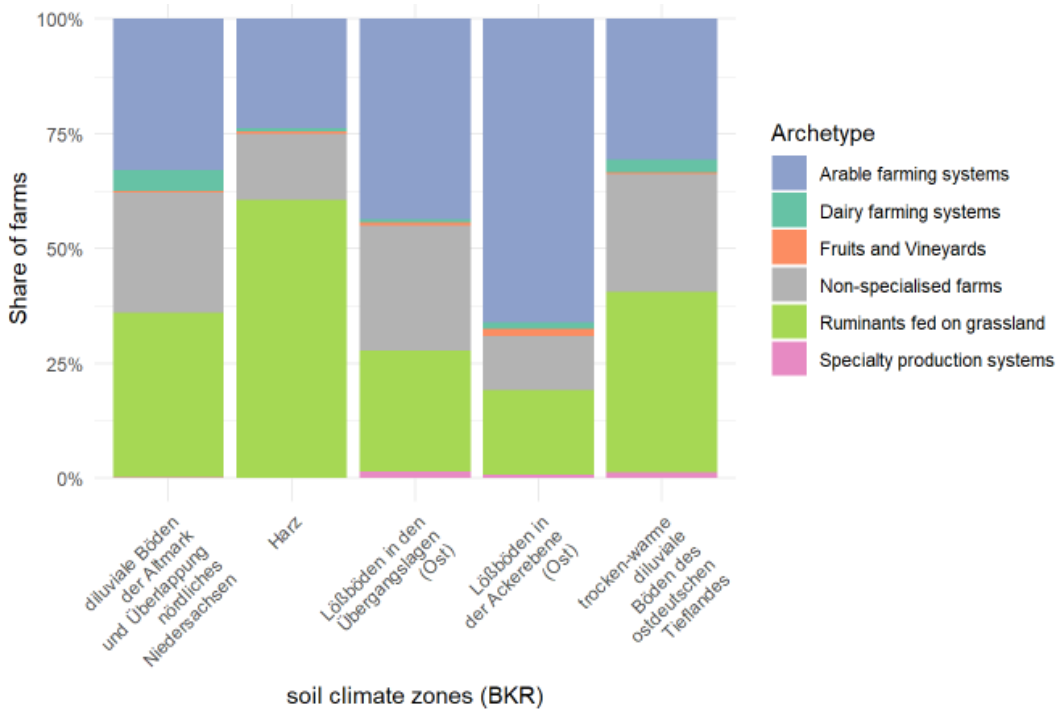


Figure 201 - Allocation of Saxony-Anhalt farms - registered in the regional IACS - into archetypes across regions (BKR). Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.

Crossed-allocation and merging into 9 Farming Systems Orientations (FSO)

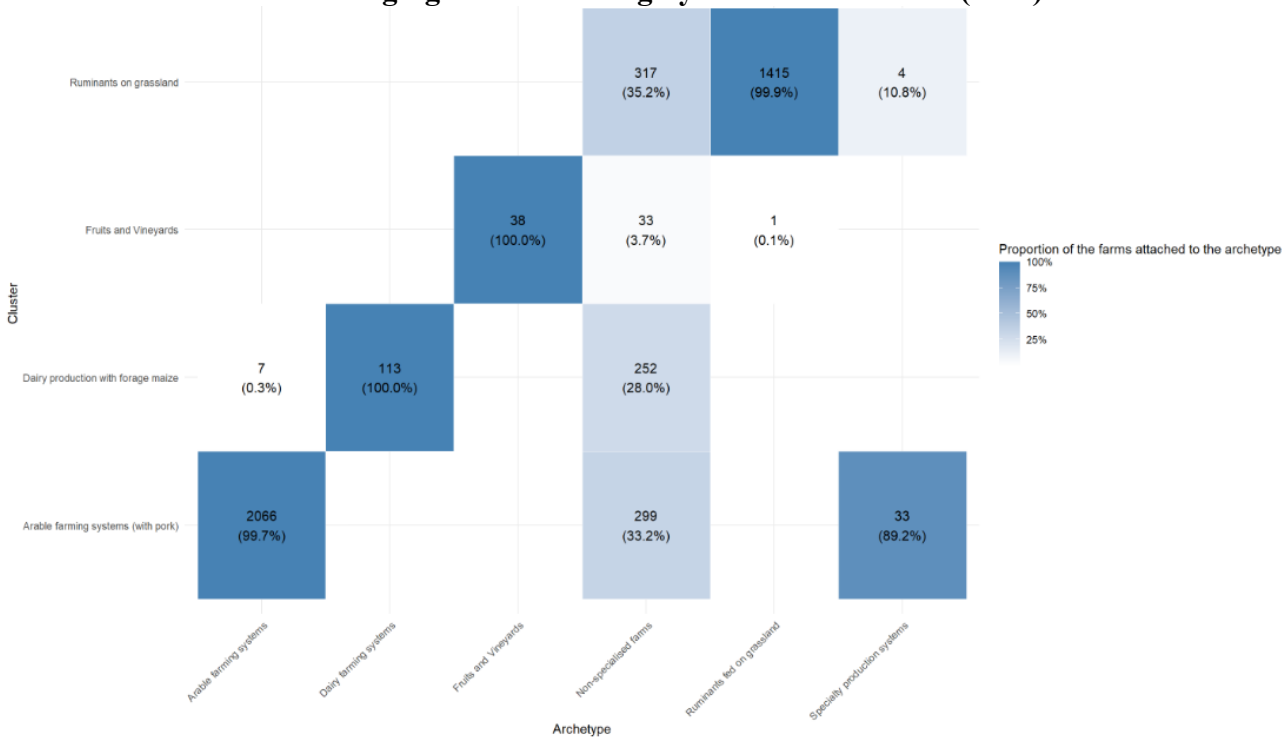


Figure 202 - Number of farms allocated to the 4 clusters & 5 archetypes, and grouping process into Farming System Orientations (FSO). Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.



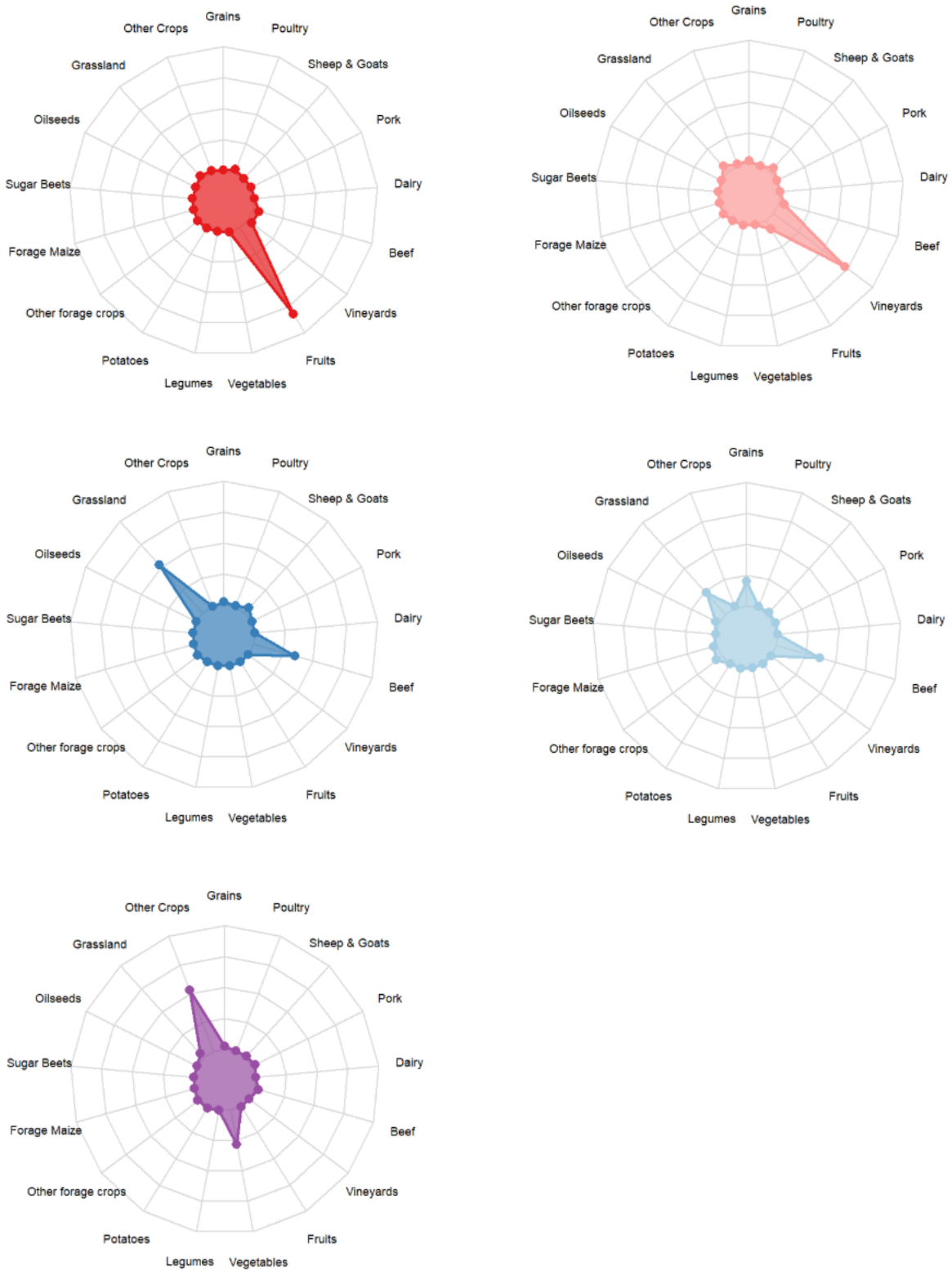


Figure 203 - Discriminating factors describing the 9 Farming System Orientations (FSO) after grouping clusters & archetypes attributions. Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.

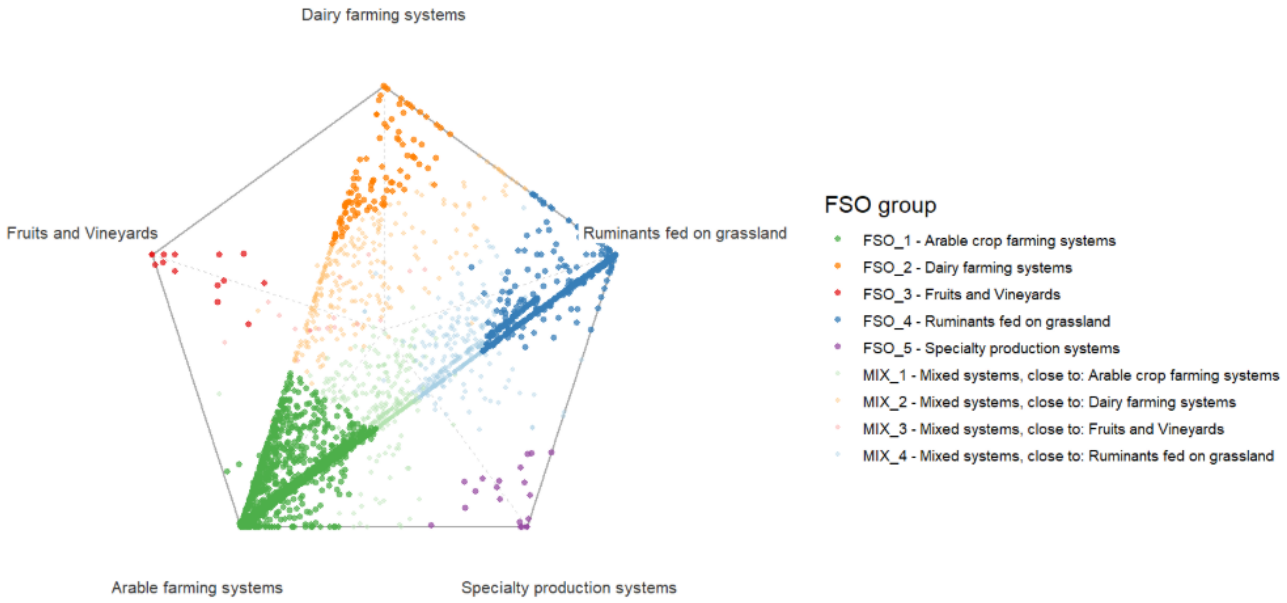


Figure 204 - Allocation of Saxony-Anhalt farms across archetypal & mixed Farming System Orientations (FSO) in a 5-dimension space. Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.

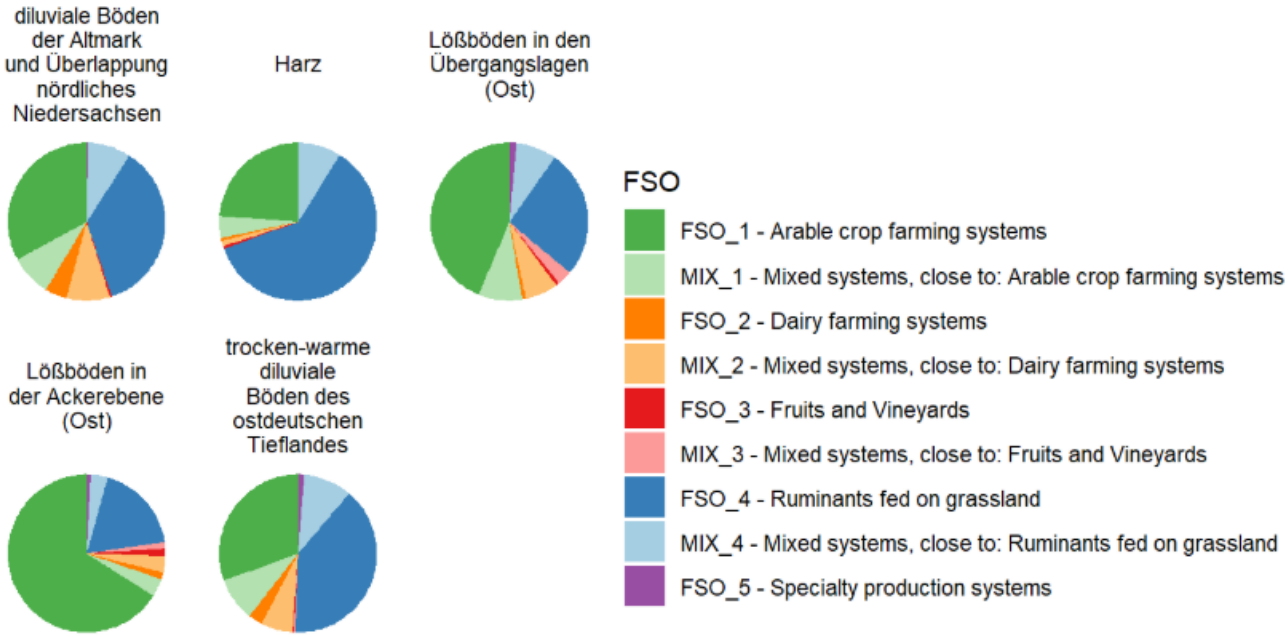


Figure 205 - Distribution of farms registered in the Saxony-Anhalt IACS across Farming System Orientations (FSO) consolidated based on the crossed allocation between clusters & archetypes. Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.

Descriptive characteristics of farming system orientations

Farm size (Total area) [hectares] – Figure 206: Average farm sizes differed between farming system orientation and regions. With the highest average farm sizes associated with arable (342 ha) and dairy-oriented farming systems (544 ha). Specialty production systems (67 ha), Ruminants fed on grassland (60 ha) and fruits and vineyards (27 ha) are characterised by smaller average farm sizes.

The highest average farm size withing the FSO_1 (arable farming system) can be found in the BKR_2 (441 ha) and the smallest within BKR_5 (221 ha). The Mixed system close to arable farming systems tended to be a bit smaller (average farm size 314 ha), with the highest average farm size within BKR_4 (391 ha) and the smallest within BKR_3 (118 ha). But the last one only covers 12 farms, therefore, the results should be interpreted carefully.

The highest and lowest average farm size within the FSO_2 (dairy farming systems) are represented by regions with only one farm (1,424 ha in BKR_2 and 10 ha in BKR_3) and should be interpreted carefully. Within the Mixed system close to dairy farming systems the highest average farm size is represented by BKR_4 (764 ha) and the smallest by BKR_2 (13 ha), but BKR_2 value is based on just two farms and should be therefore interpreted carefully.

For the fruits and vineyards farming systems (FSO_3) the average farm size varies between 7 ha (BKR_2) and 47 ha (BKR_4). But most regions contain only one or very few farms and the results should not be overinterpreted. For the Mixed systems close to fruits and vineyards two regions doesn't represent any farms (BKR_2 and BKR_5). The highest average farm size is given in BKR_4 with (24 ha) and the smallest in BKR_3 (10 ha). But both only cover 4 farms each, with the usual conclusion.

Ruminants fed on grassland farming systems (FSO_4) varies between 17 ha (BKR_3) and 88 ha (BKR_2). Mixed systems close to ruminants fed on grassland (Mix_4) tended to be bigger, with an average farm size of 228 ha instead of 60 ha (FSO_4). The highest average farm size is present in BKR_2 (377 ha) and the smallest in BKR_1 (82 ha).

FSO_5 (Specialty production systems) where not present in every region, since no farm is located within the BKR_2. The highest average farm size was given in BKR_1 (117 ha) and the smallest within BKR_5 (16 ha), but the last one is based on just 3 farms and should be therefore interpreted carefully again.

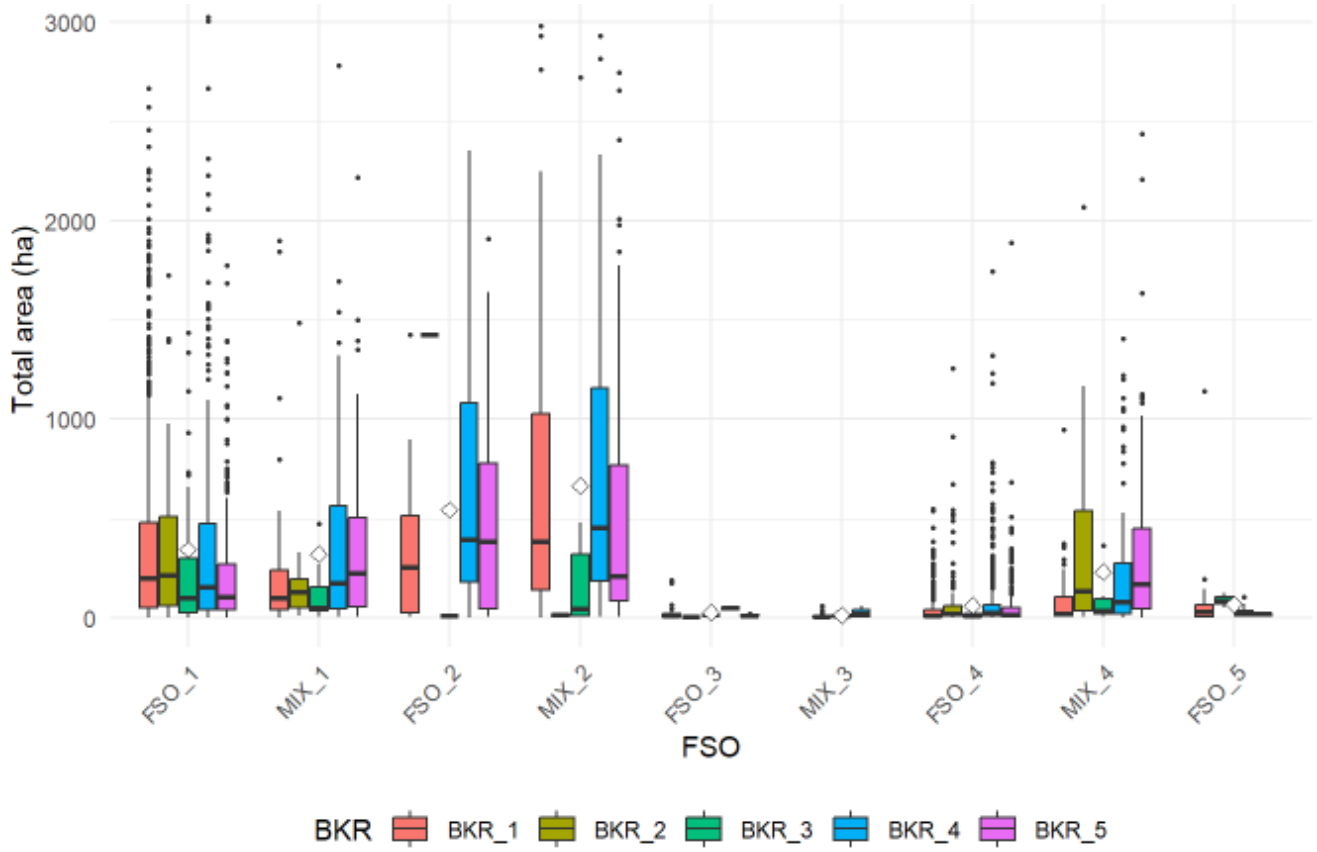


Figure 206 - Farm size distribution across farming system orientations (FSOs) at the regional (Saxony-Anhalt; top) and soil climate zone (BKR; bottom) scales. White squares indicate the mean, and black lines indicate the median. Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.

Share of certified organic farms [%] – Figure 207: The share of certified organic farms varies between 0.9 % farms/0.8 % of land for dairy farming systems and 21.6 % of farms and 23.7 % of land for fruits and vineyards. For nearly all bigger FSOs the share of organic farms is higher than the share of organic managed land, tends to indicate smaller farming structures for organic farms.

FSO_1 (arable farming systems) represents relatively low organic shares. The lowest share is given in BKR_2 (4.5 % of land / 4.7 % of farms), and the highest share is given in BKR_5 (7.8 % land / 10.2 % farms) and BKR_4 (6.8 % land / 10.9 % farms).
Mixed systems close to arable farming systems (Mix_1) tended to have a higher organic share (7.9 % land / 12.7 farms % vs. 6.9 % land / 8.4 % farms). With the highest share within BKR_4 (9.2 % land / 17.1 % farms). Two regions (BKR_2 and BKR_3) represent 0 % for land and farm share, but both with a limited number of farms (8 respectively 12).

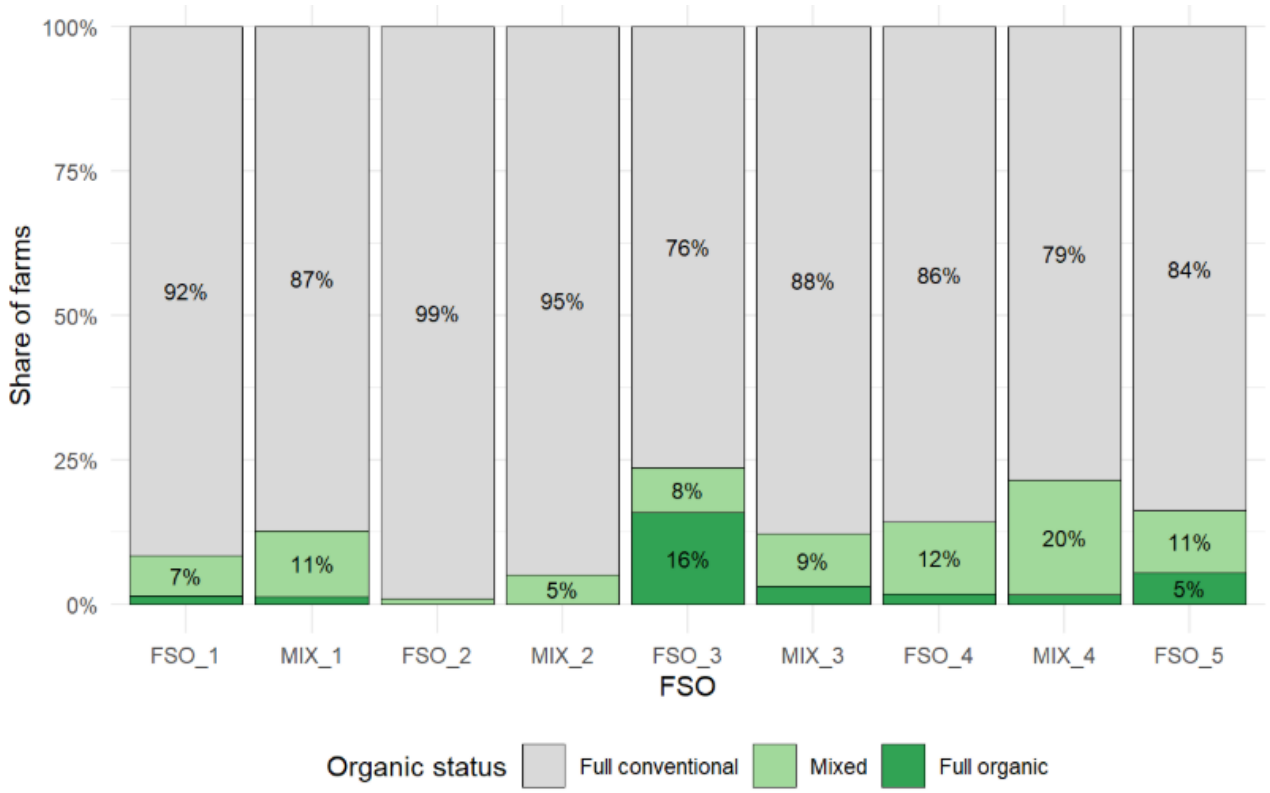
Dairy farming systems (FSO_2) represent the lowest organic share (0.8 % land / 0.9 % farms) with only one region with values above 0 % for both indicators, BKR_4 (2.3 % land / 2.6 % farms). Mixed systems close to dairy farms tended to have higher organic shares (3.9 % land / 5.2 % farms), but still a low share compared to some other mixed systems (e.g. Mix_1 or Mix_4). The highest share was given in BKR_1 (7.7 % land / 8.3 % farms), and BKR_2 and BKR_3 had a share of 0 for both indicators. But with a limited number of farms (2 respectively 9).

Fruits and vineyards farming systems (FSO_3) had the highest share of organic farming (21.6 % land / 23.7 % farms). The highest share where present in the two regions with only 4 farms each, BKR_5 (74.9 % land / 75.0 % farms) and BKR_4 (30.5 % land / 50.0 % farms). BKR_2 and BKR_3 both contain only one farm and represent for both indicators 0 %.
The mixed systems close to fruits and vineyards (Mix_3) had lower shares of organic farming (9.0 % land/ 12.1 % farms). Within BKR_2 and BKR_5 no farms where present. BKR_4 represent only a share of organic managed land 0.2 %, but 25.0 % of farms. But this region only contains 4 farms

and results should therefore be interpreted carefully. Within BKR_1 the share is 11.9 % (land), respectively 12.0 % (farms).

FSO_4 (ruminants fed on grassland) had a medium share of organic farming (8.8 % land / 14.3 % farms). The highest shares where present in the regions BKR_5 (9.6 % land / 15.0 % farms) and BKR_4 (10.2 % land / 18.8 % farms).
The mixed system close ruminants fed on grassland (Mix_4) tended to have higher organic shares (11.6 % land / 21.5 % farms) with the highest shares within BKR_4 (9.6 % land / 26.7 % farms) and BKR_2 (20.3 % land / 25.0 % farms).

The share for specialty production systems is also relatively high (13.6% land / 16.2 % farms). BKR_2 contains no farms and therefore has no organic share. Besides that, the values vary between 0 % each (BKR_3), with only two farms, and 32.6 %/33.3 % (BKR_5), with only three farms. Therefore, the results should be interpreted carefully.



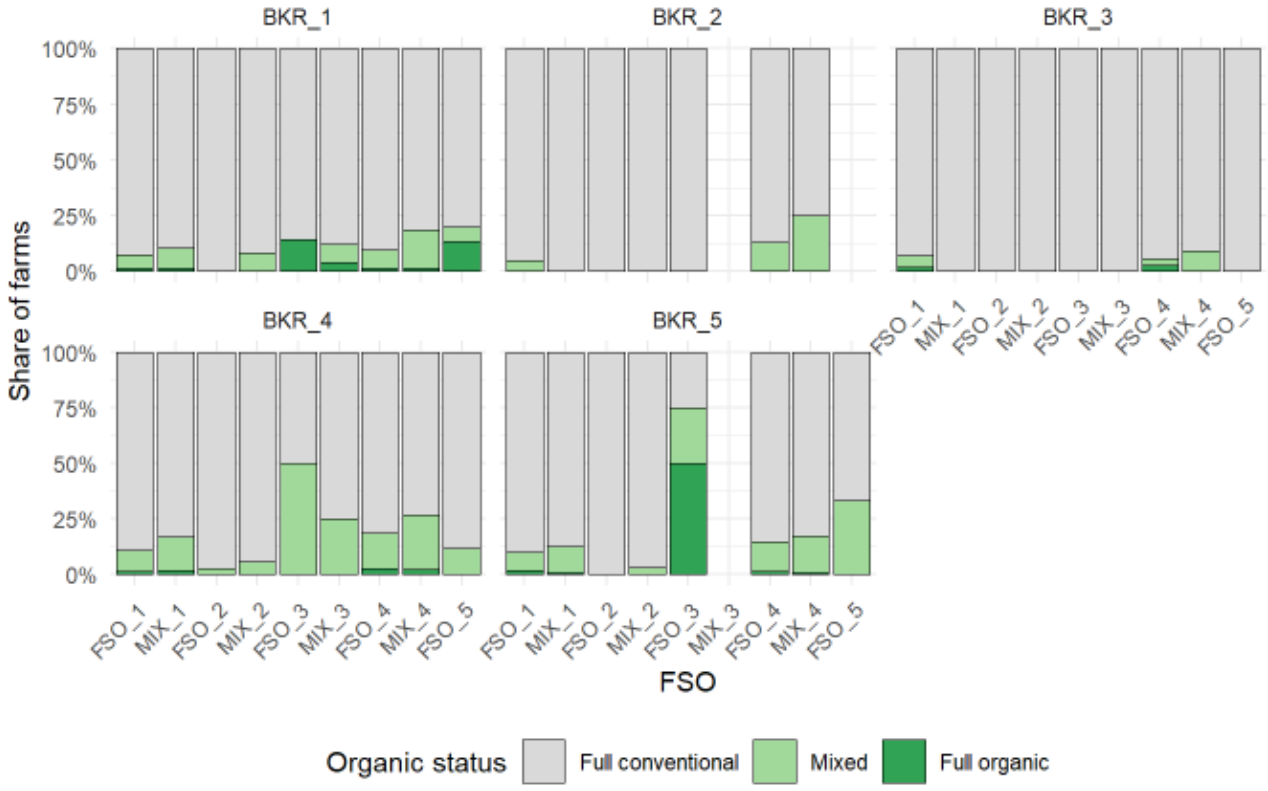


Figure 207 - Distribution of farms by organic certification status (full conventional, mixed, and full organic) across farming system orientations (FSOs) at the regional (top) and soil climate zone (BKR; bottom) scales. Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.

Livestock unit density [LU/hectare] – Figure 208: For the indicator livestock density the farming system plays a more important role than the zone. The farming system orientation with the highest average density is FSO_4 (1.62 LU/ha), whereas FSO_1 (0.22 LU/ha), Mix_1 (0.15), Mix_3 (0.02 LU/ha) and FSO_5 (0.01 LU/ha) are characterized by low densities. FSO_4 is also the farming system orientation where the regional differences are most present. For FSO_1 (arable farming systems) all zones have quite low livestock densities, with values between 0.05 LU/ha (BKR_3) and 0.28 LU/ha (BKR_1) and an average of 0.22 LU/ha.

Mixed system close arable farming systems has at average even a lower value (0.15 LU/ha) but a higher variation between the zones. With 0.06 LU/ha in BKR_5 and 0.78 LU/ha in BKR_3, but the last one with only 12 farms. The average density for dairy farming systems (FSO_2) is 0.81 LU/ha. The variation is, besides two BKRs with only 1 farm each (BKR_2 and BKR_3) and therefore negligible values, low (0.76 LU/ha BKR_4 and 0.96 LU/ha BKR_1). For the mixed system close to dairy farms (Mix_2) the BKR with the highest (BKR_3 12.90 LU/ha) and lowest (BKR_2 0.15 LU/ha) densities have again small sample sizes (9 respectively 2) and are therefore not representative for the zone in total. The average density is 1.27 LU/ha with a higher density within BKR_4 (1.46 LU/ha).

For fruits and vineyards (FSO_3) all zones don't represent a higher density of Livestock units. Therefore, the average is 0.02 LU/ha with a variation between 0.00 (all BKR besides BKR_1) and 0.02 (BKR_1). For mixed systems close to fruits and vineyards (Mix_3) the average density is again 0.02 LU/ha and the only BKR with a density higher then zero is again BKR_1 (0.03 LU/ha). As described above, FSO_4 (Ruminants fed on grassland) has the highest average Livestock density (1.62 LU/ha). The variation between the BKRs is higher with values between 0.42 LU/ha (BKR_2) and 3.97 LU/ha (BKR_1).

The mixed systems close to ruminants fed on grassland (Mix_4) have a lower but still high average Livestock density (0.75 LU/ha). The lowest density is again within BKR_2 (0.16 LU/ha) and the highest density is again within BKR_1 (2.78 LU/ha). Besides this BKR, every other BKR has

densities below 0.50 LU/ha. FSO_5 (specialty production systems) has nearly no Livestock present, average density is 0.01 LU/ha. With only two BKR with densities above 0, BKR_1 (0.01 LU/ha) and BKR_4 (0.02 LU/ha). The other BKRs have densities of 0 (BKR_3 and BKR_5), with 2 respectively 3 farms, or doesn't contain any farm of this orientation (BKR_2).

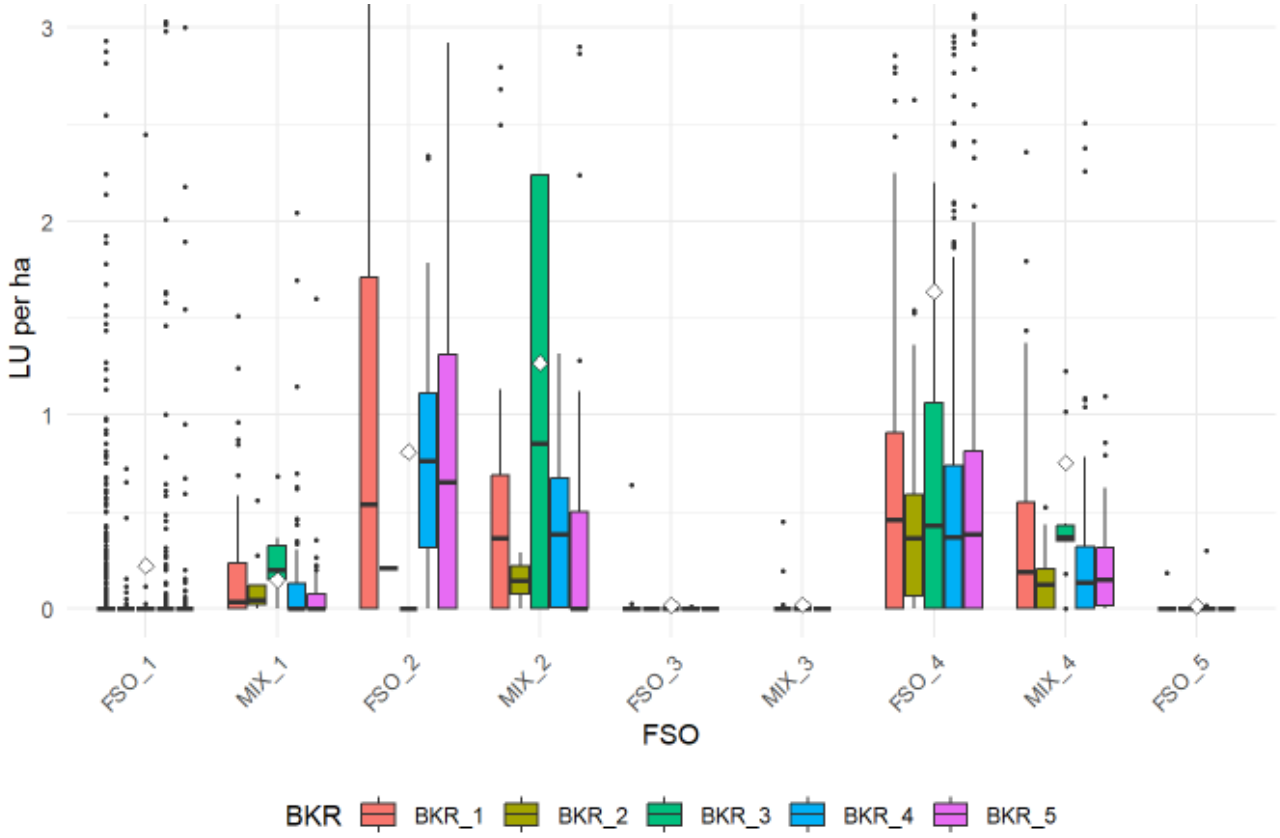


Figure 208 - Livestock density (LU ha⁻¹) across farming system orientations (FSOs) and soil climate zones (BKR) in Saxony-Anhalt. Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.

Share of grasslands [%] – Figure 209:

The highest share of grassland is present in the FSO_4 (63.9 %), followed by Mix_4 (33.6 %). The farming system orientations FSO_3 and FSO_5 have the lowest share (3.1 % respectively 4.5 %).

Arable farming systems (FSO_1) have a lower share of grassland (4.7 %) with distribution between 7.8 % (BKR_2) and 3 % (BKR_1). Mixed systems had a considerable higher share of grassland (21 %), with the highest shares within BKR_2 (20.2 %) and BKR_4 (22 %). Dairy farming systems (FSO_2) had a medium share of grassland (10.9 %) with a variation between 12.6 % (BKR_4) and 0 % BKR_3, but the last one is only based on 1 farm and shouldn't be interpreted as a regional pattern. Mixed systems close to dairy farming systems (Mix_2) have a slightly higher share of grassland (14.6 %) with a variation between 7.8 % (BKR_1) and 57.6 % (BKR_2). Since BKR_2 only contains two farms it shouldn't be interpreted as a regional pattern as well. The second highest value is 18.2 % for BKR_4. For fruits and vineyards systems (FSO_3) all regions have a low share of grassland (0 – 4.4 %) and an average of 3.1 %. Mixed systems close to fruits and vineyards also have low shares of grassland (average 6.3 %), with the highest share for BKR_4 (11.5). But this one only contains 4 farms with the common conclusion. FSO_4 (Ruminants fed on grassland) have the highest share of grassland with shares between 62.5 % (BKR_3) and 71.6 % (BKR_2). Mixed systems close to ruminants fed on grassland also have high shares, but considerably lower than the related FSO system (33.6 %). The shares vary between 27.5 % (BKR_3) and 37.9 % (BKR_2). FSO_5 (specialty production systems) have for all regions low shares of grassland. With a variation between 0.5 % (BKR_5) and 7.1 % (BKR_4) and no farms within BKR_2.

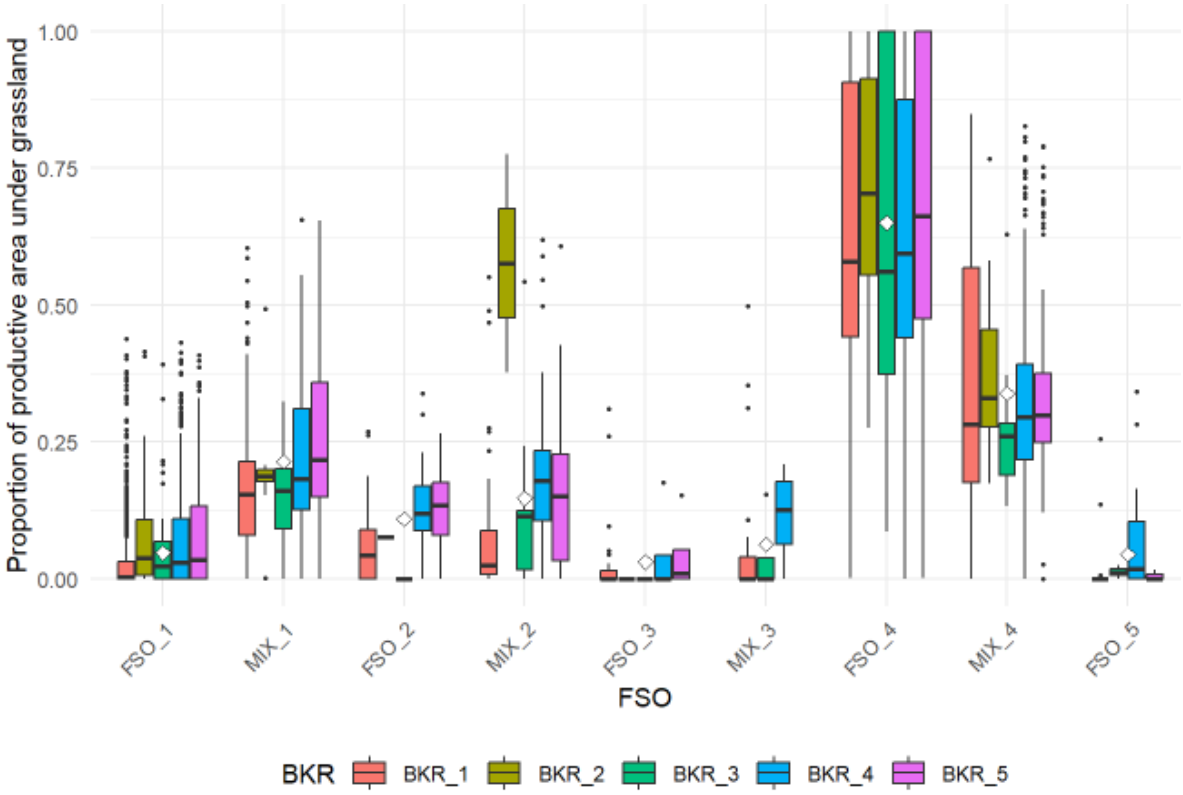


Figure 209 - Share of grassland across farming system orientations (FSOs) and soil climate zones (BKR) in Saxony-Anhalt. Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.

Share of legumes [%] – Figure 210:

For the share of legumes the farming system orientation tended to be more important than the region. With the highest shares for Mix_4 (11.8 %) and Mix_1 (7.7 %), whereas FSO_2, Mix_2 and FSO_4 have shares between 2 and 4 %. For some orientations (Mix_1, Mix_4 and FSO_4) the BKR_4 zone has the highest share of legumes.

Arable farming systems (FSO_1) has an average share of 5.4 % and variation between 2.7 % (BKR_3) and 6.3 % (BKR_4). Mixed systems close to arable farming systems (Mix_1) tended to have higher shares of legumes with 7.7 % and variation between 1.7 % (BKR_2) and 9.4 % (BKR_4). Dairy farming systems and mixed systems close to dairy farming systems (FSO_2 and Mix_2) both have lower shares of legumes (2.3 % and 4.2 respectively). The highest shares tended to be in BKR_4 (2.9 % respectively 4.8). FSO_3 (fruits and vineyards) have for all zones low shares of legumes (0.0 – 1.5 %). Mix_3 also have a share of just (1.5 %), but a considerably higher share for BKR_4 (10.4 %) but just based on 4 farms. Ruminants fed on grassland (FSO_4) have a lower share as well (1.0 % - 5.2 %, average 3.1 %) with the lowest share within BKR_2 and the highest again within BKR_4. Mix_4 has a higher share (11.8 %), and the highest share was within BKR_4 again (17.6 %). Specialty production systems (FSO_5) have a variation between 0.0 % (BKR_2), based on just two farms, and 5.2 % (BKR_5), only 3 farms, and an average share of 2.5 %.

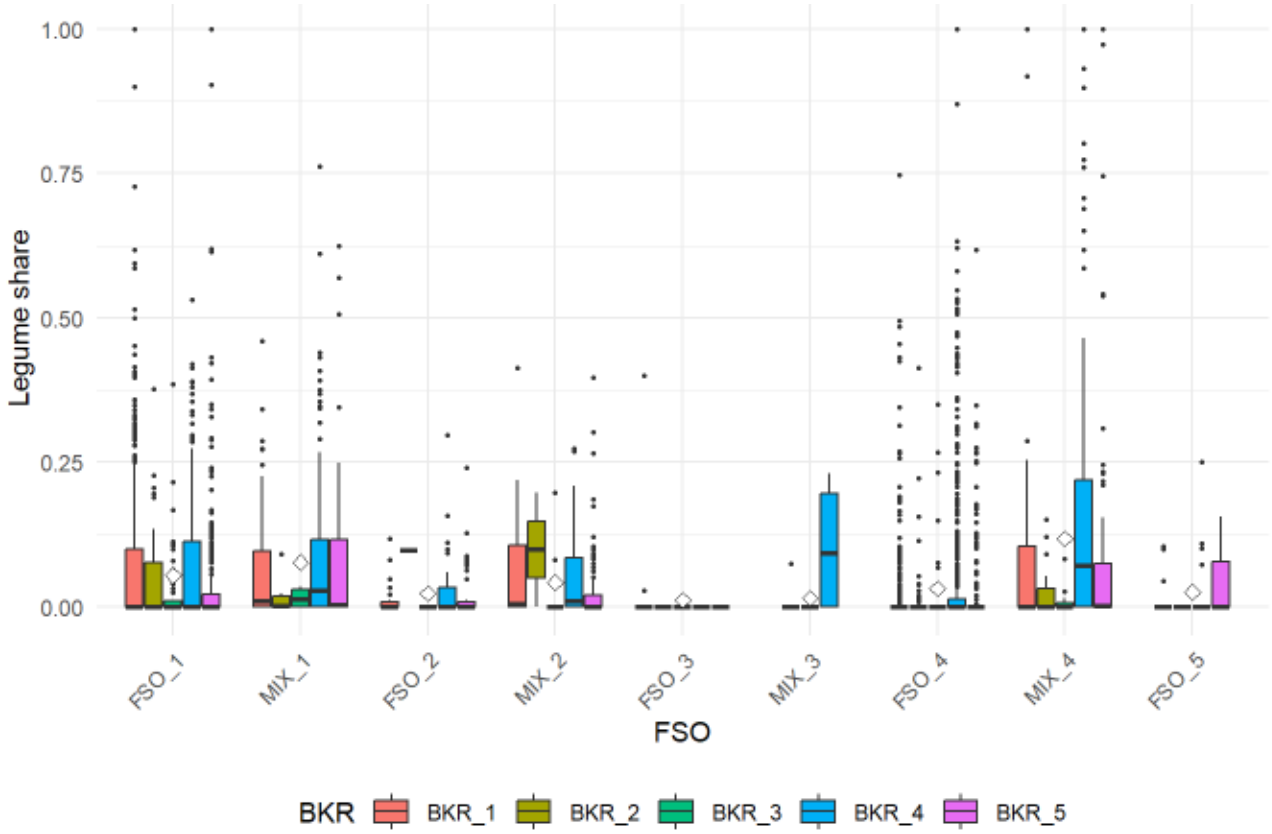


Figure 210 - Share of legume (including dry legume seeds and legume forage crops such as clover and alfalfa) across farming system orientations (FSOs) and soil climate zones (BKRs) in Saxony-Anhalt. Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.

Share of Non-productive elements [%] – Figure 211:

For non-productive elements (NPEs) the farming system orientation and the BKR play an important role, with especially higher shares within BKR_5 and BKR_4. FSO_1 (arable farming systems) has an average share of 4.6 % and a variation between 2.9 % (BKR_3) and 7.1 % (BKR_4), but BKR_5 also represent high shares (6.8 %).
Mixed farming systems close to arable farming systems has a slightly higher average share of NPEs with 5.6 %. The highest shares where present in BKR_2 and BKR_5 (both 6.4 %) and BKR_4 (6.7 %). The lowest share was again BKR_3 with 2.1 %. FSO_2 (dairy farming systems) has an average share of 4.0 % and the highest shares again in BKR_5 and BKR_4 (4.7 % respectively 4.6 %).
For the mixed systems (Mix_2) the average is again higher (4.6 %) and the highest shares can be found in BKR_5 and BKR_4 again (5.0 % respectively 5.9 %). FSO_3 (fruits and vineyards) has an average share of 5.5 %. And the highest shares can be found again in BKR_5 and BKR_4 (10.9 % respectively 14.2 %).

Mixed systems close to fruits and vineyards have generally low shares (0.7 %) with no clear regional trend. For ruminants fed on grassland (FSO_4) the highest values can be found again in BKR_5 and BKR_4 (5.3 % respectively 4.9 %). The average share of this FSO is 4.1 %.
Mixed systems close ruminants fed on grassland (Mix_4) has an average share of 5.5 % with the highest shares again in BKR_5 and BKR_4 (7.9 % respectively 5.8 %).

For the FSO_5 (specialty production system) the average is 9.3 % and with that relatively high. The highest shares are within BKR_5 and BKR_4 (35.2 % respectively 12.8 %). But the first one is based on just 3 farms and shouldn't be interpreted as a regional pattern for this farming system orientation, even this zone represents for most of the orientations relatively high shares of NPEs.

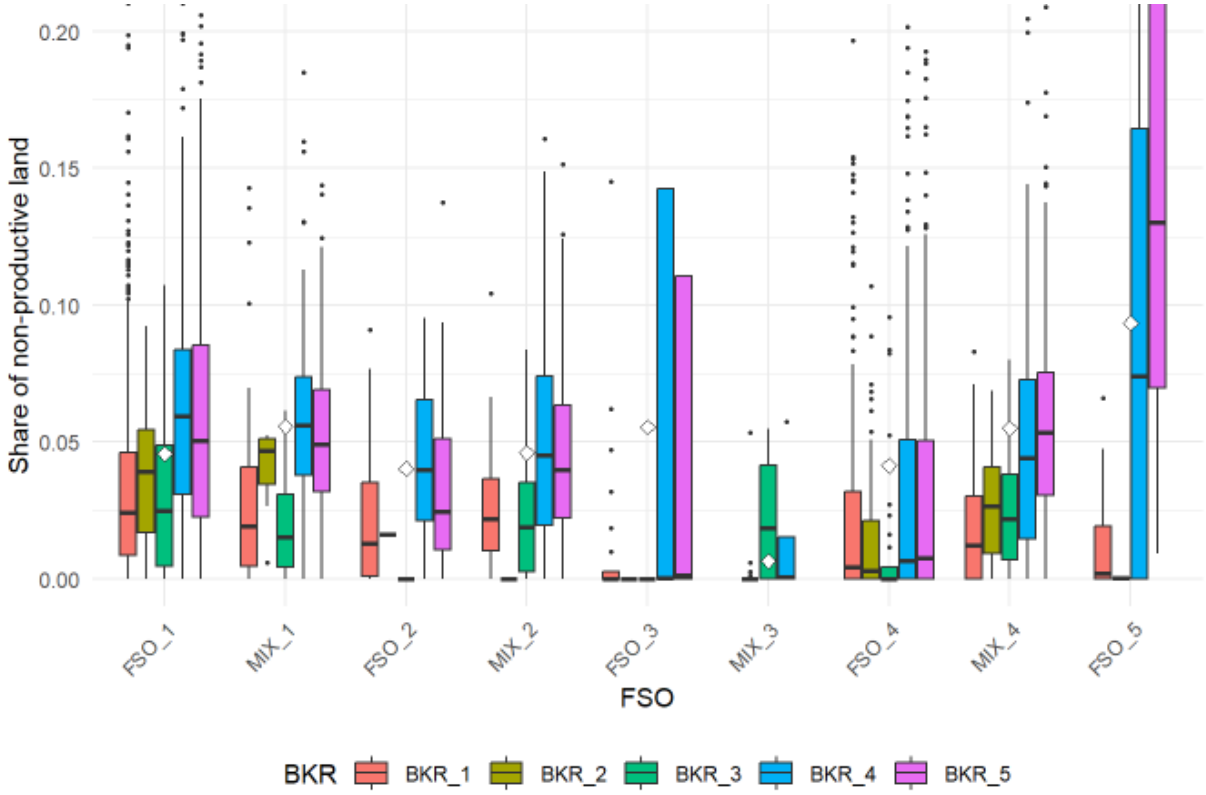


Figure 211 - Share of Non-productive elements (e.g.: hedges, grass strips, fallow land) across farming system orientations (FSOs) and soil climate zones (BKR) in Saxony-Anhalt. Source: Own calculations based on INVEKOS data (application data 2025), ©Geodienst MWL LSA 2025.

Additional data sources

The farm-level production data were derived from the 2025 INVEKOS application data provided by the Geodienst MWL LSA (Geodienst MWL LSA, 2025). The data were subsequently aggregated and processed to derive farm-level production indicators used for the clustering and archetype analyses. Spatial allocation was based on the Soil–Climate Regions (Boden-Klima-Räume, BKR) dataset provided by the Julius Kühn Institute (JKI), Institute for Strategies and Technology Assessment (Julius Kühn-Institut, 2013), which was spatially adapted to the study area of Saxony-Anhalt.

Additional references

1. Bundesministerium für Landwirtschaft, Ernährung und Heimat. (2021). Boden-Klima-Räume (Daten). Retrieved from: https://www.landwirtschaftsdaten.de/detailansicht.html?tx_epadpsearch_showdetails%5Baction%5D=show&tx_epadpsearch_showdetails%5Bcontroller%5D=Search&tx_epadpsearch_showdetails%5Bgeodata%5D=11&cHash=adef209ee406f24cd6412785944e353e, last visited 10.08.2026.
2. Julius Kühn-Institut, Institut für Strategien und Folgenabschätzung. (2013). *Boden-Klima-Räume (Daten).* Landwirtschaftsdaten. Retrieved from: https://www.landwirtschaftsdaten.de/detailansicht.html?tx_epadpsearch_showdetails%5Baction%5D=show&tx_epadpsearch_showdetails%5Bcontroller%5D=Search&tx_epadpsearch_showdetails%5Bgeodata%5D=11&cHash=adef209ee406f24cd6412785944e353e, last accessed 15 July 2026.
3. Geodienst MWL LSA. (2025). *INVEKOS-Daten (Antragsdaten 2025)*. Sachsen-Anhalt. Data provided under a data use agreement.

12.3.4 Questionnaire contextualization for Saxony-Anhalt

A thorough discussion around the STEP 1 and STEP 2 questionnaire was conducted for the German territory of Saxony-Anhalt. The adaptation was conducted in close cooperation between the German team at MLU, the WP2 leaders and FAO experts.
Although the main structure and content of the questionnaire was kept unchanged, for several questions an adjustment of the thresholds and values for the answers had to be adapted to the context. In some cases, the questions needed even to be rephrased to be more consistent and pertinent with the main features of the territory of Saxony-Anhalt.
In the following paragraphs an overview of the main points that were discussed along the adaptation process is provided.

During the first round of contextualization for the territory of Saxony-Anhalt, several initial comments were shared by the MLU team about almost each of the ten sections of the original TAPE questionnaire. A brief overview of the main aspects highlighted during this first phase of discussion is reported below:

About section 1) DIVERSITY
Concerning the diversity, the discussion focused on:

- the distinction between arable and grass land
- Population varieties
- Level of diversity to be set for more than four crops
- Temporal diversity
- Spatial diversity
- Number of animals (no animals is not necessary a negative condition)
- Inclusion of endangered breeds

About 2) SYNERGIES

- Type of fodder and concurrence with human consumption
- Level of semi-natural habitats (the target of 4% is no longer part of the conditionality of the CAP).

About 3) RECYCLING

- Level of reuse of organic residues
- Application of water-saving techniques almost always adopted in Germany
- Specification about renewable energies (PV more common for electricity but tractors with diesel are standard)

About 4) EFFICIENCY

- Include tillage as relevant for soil fertility
- The level for soil fertility to be adjusted, since the original ones present high distance between 2 and 3
- Specification about nitrogen-fixing plants and grass land (to avoid confusion)
- Clarification about the use of farm made biopesticides, which is not allowed
- Inclusion of "integrated plant protection" for the highest level for on-farm organic ecological measures
- Specification about use of veterinary drugs since "on farm medicine" cannot be considered a suitable option
- Adjustment in the level for alignment with natural production seasons, the original level was not fully relevant for the actual conditions in Europe (more relevant to include the use of summer and winter crops, secondary crops, use of catch crops in the possible levels)

About 5) RESILIENCE

- Clarification about dependence on external financial support and CAP
- Adaptation in levels for diversity of livelihood
- Adaptation in level for soil disturbance (A distribution between turning methods (e.g. ploughing) vs. non-turning methods (e.g. cultivator))

- Adjustment for animal health and nutrition

About 6) CULTURE AND FOOD TRADITION
- Adaptation in levels for “farm produced ingredients”
- More specific questions about local initiatives to protect cultural heritage and traditions

About 7) CO-CREATION AND SHARING KNOWLEDGE
- Adaptation of the question “Do you actively learn from elders and pass on traditional farming knowledge to younger generations?” to the European context

About 9) CIRCULAR AND SOLIDARITY ECONOMY
- Inclusion of “Maschinenring” as example for resource sharing

About 10) RESPONSIBLE GOVERNANCE
- Need to specify what is “local”
- Adaptation of questions about management of financial resources (from gender perspective)
- Adaptation of question about access to land

In the table below the list of questions (Step 1) and indicators (Step 2) that were slightly changed to better reflect territorial features.

Table 35 - Calibrations and adaptations made to the TAPE tool for implementation in Saxony-Anhalt

Question / indicators	Change	Justification
Do you produce a diversity of plant species on your farm (permanent grassland excluded) ?	Adaptation in the levels	Levels didn't represent the actual diversity found in our country
Do you use a diverse range of knowledge sources (e.g., decision-support tools, agricultural media, newsletters, extension services, farmer networks) to inform decisions on your farm?	Highest level added "Feldtage" as an example	
Do you use local and context-specific knowledge to adapt your farming practices?	Change in the levels - exclude "modern" in the mid-level.	With "modern" it seems as if modern is bad
Are you actively engaged in facilitating the transmission of your farm to younger generations seeking to practice socially and environmentally responsible farming?	Excluded "independant".	Independent was unclear for a lot of farmers
Soil health Indicator	- removed “microbiology activity” as an indicator. - Adjusted formulations	We changed the SOCLA to Perception of the farmers instead of measuring by ourselves. Therefore the last indicator has to be removed.

	to perception of farmers	
Women Empowerment Indicator	- Question also for women in a company	A lot of farms in Saxony-Anhalt are companies instead of family farms. We want to differentiate between household work on the farm and household work in general.

12.4 Valais

12.4.1 Raclette cheese PDO – A case study

Dairy cow farm example

This section on dairy cow farms producing raclette is inspired by a case study on the raclette cheese Protected Designation of Origin (PDO) realized using the TAPE methodology and authored by Tshering Lhamo, Antoinette Bernard, and Dominique Barjolle in June 2025 [109]. The study explored the functioning and agroecological performance of dairy farms in three valleys in the Valais Canton: the Val d'Illiez, the Val d'Hérens, and the Val d'Anniviers.

Based largely on the study by Lhamo et al., this section explores the following themes:

- The social and cultural dimension of dairy farming, and raclette cheese in particular
- The conditions of farming in the past and today
- Specialisation of some farms in summer pasturing
- Revenue diversification
- Regulations tied to the PDO that impact modes of production (feed, milk, cheese)
- The role of cooperatives in organizing raclette production
- The market value chain for raclette cheese
- Progress of the PDO over time

Raclette cheese as a social institution

Before delving into farm characteristics, it is worth recalling the cultural and societal importance of raclette cheese in the context of the Valais Canton:[136]

The characteristics of this cheese are the result of a way of life and practices adapted to the environment. Until around 1920, raclette cheese was produced exclusively on mountain pastures. In the spring, farmers gradually climbed with their cows, following the growth of the vegetation, to reach the high pastures and reserve the fatty meadows at lower altitudes for mowing (this movement is called *inalpe*). They would pass through the *Mayens*, intermediate areas between the dwellings and the mountain pastures, dotted with converted barns. Once they arrived at the mountain pastures, the animals were entrusted to the mountain pasture *consortages*, or guilds of farmers who collectively managed a mountain pasture or were kept in individual mountain pastures where animals were boarded. During the summer season, the herd moved between pastures at different altitudes, depending on the growth of the grass.

The milk was drawn by hand. The isolation of the high mountain pastures due to the absence of roads meant that the milk had to be processed into cheese on the spot, so that it could be preserved and transported. Raclette du Valais cheese is traditionally made in a copper cauldron heated over a wood fire.

[136] The following quotations come from Lhamo et al., *Assessing the Contribution of an Origin-Linked Product to the Agroecological Transition of a Territorial Food System Case Study of the Raclette Du Valais PDO Sector in Switzerland*.

The alpine cheeses used for raclette were the best in the world. The raclette was often reserved for festive occasions, such as *désalpes* (day when the cows lift from alp to villages) or bourgeois (citizens) assemblies.
Raclette, a rural and urban tradition, is part of the globalization phenomenon and is enjoying a renaissance. This convivial way of eating Raclette du Valais AOP cheese remains as popular as ever. For example, the PALP Festival, which organizes events throughout the Valais during the summer, revisits raclette by creating events around this flagship local product.



Figure 212 - Picture of traditional production of Raclette du Valais in a copper cauldron on the Lapisa mountain pasture in Val d'Illiez. Source: La Cavagne

Specialisation of farms in summer pastures
One unique characteristic of the Val d'Illiez (one of the case studies conducted by Lhamo et al. (2025)) [109] is that cattle are brought to the summer pastures on an annual basis and return to their place of origin once the summer milking season is over:
The Val d'Illiez has a special feature when it comes to its farms: many of them operate on a seasonal basis, only during the summer, when they go up to the mountain pastures. These farms take in boarding cows, mainly from the cantons of Vaud and Fribourg, from late spring to late summer. As a result, although the average number of livestock units (LU) per farm is relatively low over the year, it increases significantly by 360% during the summer period.
The Val d'Illiez has limited forage capacity, which makes it difficult to keep large numbers of livestock over the winter. This constraint explains why the herd is considerably increased during the summer, when alpine pastures are available. In addition, the permanent dairy farms in the Val d'Illiez also take in extra cows for boarding during this period.
Summer boarding of cows is also practiced in the Val d'Hérens.
Diversification of revenues
According to Lhamo et al. (2025), in the Val d'Illiez many farmers are engaged in work outside cattle raising [109]:
Raclette PDO production in the Val d'Illiez is based mainly on these private mountain pastures, which have their own cheese dairies. During the rest of the year, the seasonal livestock farmers generally turn to jobs in winter sports resorts, which means that two-thirds of agricultural jobs in the region are filled by dual-activity workers.
The farms in the Val d'Illiez are diversified. Alpine pasture producers generally have a bar or restaurant to sell their produce directly. Full-time farmers, on the other hand, diversify their production throughout the year, in the absence of facilities for processing milk into raclette cheese. Some produce milk for the industry, yoghurts, or even Raclette cheese if they have a cheese dairy on the farm all year round.

In the Val d'Hérens, the other case study of Lhamo et al. (2025), "2/3 of livestock farmers in Val d'Hérens are double workers, who also have other jobs." [109]

The impact of regulations on production practices

The Raclette PDO has strict regulations that impact how farmers are to run their farms. The most obvious regulation is that all milk used to make raclette cheese must come from the Valais Canton. Further, there are specifications on feed for the cows: "The Raclette du Valais PDO specifications require milk producers to ensure that 75% of their dairy cows' feed consists of roughage produced in the Valais. The use of silage or other fermented products is strictly prohibited, as is the use of genetically engineered feed." [109] This designation of roughage from the Valais Canton is noteworthy, since it creates an impetus for the preservation of prairies used to produce this roughage. Whether milk producers process their own cheese or whether they sell milk to a processor, strict specifications govern the process. For instance, these regulations concern the precise timing of milk deliveries: farmers are required to deliver their milk to the dairy once a day, or to process their milk into cheese on a daily basis if they do the processing themselves. Other regulations include the use of a copper vat; curd and whey separation using veal rennet and lactic ferments; pouring into moulds and immersion in brine baths, etc. Similar types of restrictions govern the refining process [109].

Participation in cooperatives and other institutions

The role of agricultural cooperatives is not to be neglected. Indeed, Lhamo et al. add that "Across all systems [Type 1, Type 2, Type 3][137], dairy products are sold through direct-to-consumer routes, producer cooperatives, or dedicated milk buyers. In mountain areas such as Val d'Hérens and Val d'Illiez, cooperatives play a central role in organizing milk collection, cheese processing, and local distribution. These networks ensure that products remain closely tied to their place of origin and reach consumers with minimal intermediaries. This structure not only enhances producer income but also strengthens consumer trust in local products." [109]

Cooperatives are particularly important for raclette-only producers producing under PDO, although participation depends on many factors [109]:

The high governance scores among many Type 1 farms [raclette only] reflect the presence of strong territorial organizations, such as cooperatives, consortia, livestock unions, and dairy federations. This is especially true when raclette cheese is produced under the PDO scheme, where these organizations play a vital role in structuring the sector. They support the coordination of producers, facilitate collective decision-making, and contribute to the recognition of traditional production methods. These mechanisms are especially important in maintaining sustainable farming in more challenging mountainous environments.

Farms that produce both industrial milk and raclette are also involved in governance structures, especially those producing under PDO [109]:

Type 2 farms [raclette and industrial milk] also benefit from governance structures, particularly those involved in PDO raclette production. Their scores suggest moderate and consistent engagement with institutional frameworks. These farms, positioned between traditional and industrial models, may have access to both cooperative networks and commercial governance systems. The PDO framework supports responsible governance by offering inclusive and transparent organizational models. It helps producers maintain control over the marketing and value of their cheese, while also ensuring the continuation of local traditions and sustainable practices.

Type 3 farms, which sell exclusively industry milk, "report the lowest governance scores. These farms are often more market-driven and less involved in local cooperatives or community-based organizations. As a result, they may have fewer opportunities to participate in decision-making processes or influence regional strategies. Their compact score distribution suggests a uniform but limited role in governance." [109]

[137] By systems, the authors mean the three ideal types that they have identified: Type 1 (Raclette only, no industrial milk); Type 2 (mixed: raclette and industrial milk) and Type 3 (industrial milk).

A remark made about Type 1 farms may apply to other farms as well: “Participation in governance is often shaped by individual factors, such as age, personality, and time availability. Some farmers actively participate in associations and contribute to sectoral decisions, while others are more passive or disengaged. This uneven participation contributes to mixed perceptions of effectiveness; despite general recognition of the value these institutions provide.” [109]
Finally, any discussion of agriculture in the Valais Canton would be incomplete without a discussion of the “consortages,” which consist of the following [216]:

The “consortages”: It is about a common management of the work (construction and maintenance of the “bisses”, paths, high mountain pastures, and baker’s ovens) and the common goods (water, forests, high mountain pastures). One of the objectives is the search for a balance between the preservation of scarce resources and their exploitation. “Consortages” also strengthen the solidarity between the members who each have rights and duties. This way of managing the common property dates the Middle Ages and showed its ability. Today, the “consortages” of high mountain pastures often rent their lands. In spite of the disappearance of the traditional agriculture, “consortages” still fill an important function on the legal, economic, ecological and social side.

Market value chain for raclette cheese
Dairy farming in the Valais Canton is primarily commercially oriented. While many farmers consume a part of their milk, cheese, yogurt, and meat production (especially on Type 1 farms), most of the production is destined for the market [109].

The four main steps of the value chain are breeding and milk production; transformation of the milk into PDO Raclette du Valais; cheese aging; different market outlets; and finally, consumption.

The following quotation from Lhamo et al. (2025) summarizes the market value chain, from producers, through cooperatives, to the final market [109]: *Milk is produced by 350 producers in the Valais. This milk is processed by 27 cheese dairies throughout the year, covering the winter period, plus 55 alpine cheese dairies during the summer. Finally, the cheeses are either matured in the cheese dairies or taken care of by the canton's 4 cheese affineurs.*

Numerous cooperatives exist at all steps of the value chain: producer dairy cooperatives for processing milk into cheese, maturing cooperatives and marketing cooperatives.

There are also 2 large co-operatives, Walker and Valdor (Cremo), which buy the cheeses from producers or cheese dairies, mature them in their cellars and then market them, particularly to supermarkets. Between 40 and 45% of total Raclette du Valais PDO production is marketed by these two cooperatives.

Raclette PDO is a local product that is concentrated on the Valais and Swiss markets. It is mainly sold and consumed in the region where it is produced. Only 3% of production is exported outside Switzerland, mainly to France, Germany and the Benelux countries. These exports are hampered by high customs costs, which make the price too high for consumers (between €35 and €40 per kg).

All levels of the value chain are supervised by the Raclette du Valais Interprofession.

Progress of the Protected Designation of Origin
Raclette cheese is characterized by an increasing production under PDO as opposed to conventional raclette, which opens new opportunities for marketing. The following figure gives an indication of the progress of the Raclette PDO since 2012:

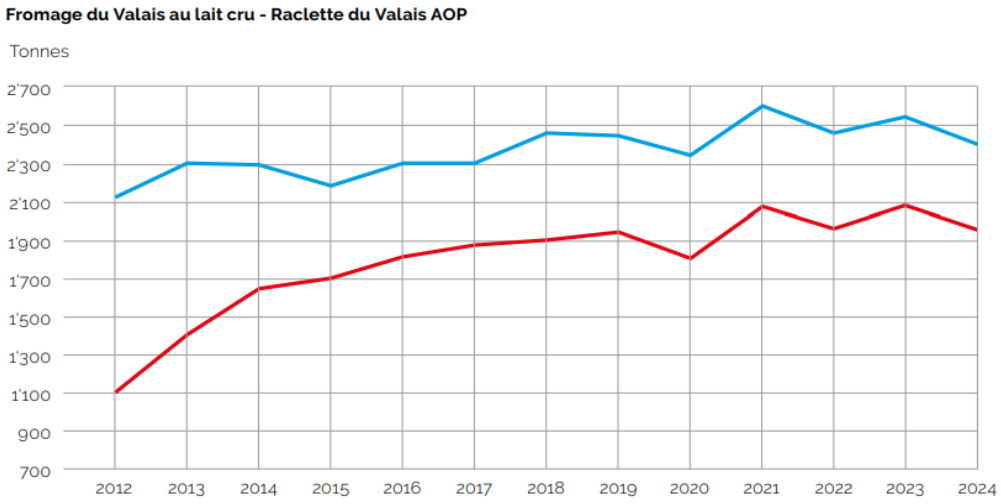


Figure 213 - Evolution of the share of PDO raclette as a proportion of total raclette production since 2012. Source: AOP Raclette du Valais [217]

Recommendations for the agroecological transition

Based on the above, the authors of Lhamo et al. (2025) make the following recommendations regarding dairy farming in the Valais Canton [109]:

The survey highlights the importance of balancing economic, environmental, and social dimensions in dairy farming. Traditional, mixed, and industrial systems each have strengths and weaknesses, but system coherence and community engagement are critical for sustainable agroecological transitions. Supporting diverse, context-sensitive practices and addressing structural inequalities will be essential for the future of those three valleys. In particular:

- System Coherence Matters: Strong agroecological outcomes are linked to system coherence, not just efficiency. Supporting context-sensitive practices in transitional and culturally rooted systems is key to advancing sustainability.
- Economic Viability: All systems are economically viable when supported by subsidies, but traditional systems (Type 1) are more dependent on public support. Recommendation is to strengthen the economic power of the PDO as a brand, federating more the producers in collective branding and marketing strategies from the short circuits as well as with the local gastronomy. Some other initiatives could link more research and practice, in applied research program looking for low-input solution that may reduce the costs, as well as smart-irrigation system for the pastures.
- Environmental Performance: Traditional systems excel in biodiversity and ecological integration, while mixed and industrial systems achieve higher production diversity and efficiency. Recommendation is to introduce participatory workshop and individual coaching mixing innovative farmers from all types, for consolidating their innovative initiatives towards any kind of diversification on-farm and out-of-farm, because diversity would be key for building better resilience.
- Social Dynamics: Traditional systems offer more opportunities for women's land tenure and self-sufficiency, while industrial systems are more commercially oriented but less socially inclusive. Recommendation is to offer continued education programmes for all women in agriculture in the region, with a focus about building capacities related to empowerment and entrepreneurship.

- Policy Implications: Policies should support agroecological transitions by addressing land tenure equity, promoting cooperative structures, and fostering intergenerational renewal. Qualitative methods are needed to better capture gender and youth dynamics.

12.4.2 Raclette case study: Strengths and enabling factors

In Lhamo et al. (2025), which served as the basis for the Dairy cow farm case study in the section on Categories and ideal types of farms, the following were identified as strengths and enabling factors of the raclette sector, based on the three valleys:

- Raclette du Valais cheese is a traditional product adapted to its terroir
- Livestock farming is ingrained in the culture of alpine pastures, although diversification of revenue occurs (tourism in particular)
- Farming practices are characterized by resilience and collective action
- The arrival of the Protected Designation of Origin (PDO) in 2007 provided a framework for raclette cheese production, while capitalizing on the value and practices of traditional farming, and also opening more remunerative markets for farmers
- There are well-established networks of institutions (notably, cooperatives) which allow for short food circuits, low costs, and better sales prices
- The PDO has helped to maintain the landscape and the vitality of mountain areas, which is an end in itself but also offers more opportunities for tourism

This full quotation explores these themes in greater depth [109]:

Raclette du Valais cheese is a traditional product deeply rooted in a specific natural, landscape, geographical, climatic, cultural, social and economic context.

This emblematic product is the fruit of farming adapted to its terroir. In the Valais, mountain farming is predominant, characterized by a harsh climate and difficult terrain. These areas can only be developed through extensive grazing. Cattle farming is therefore predominant in the region. By preserving and passing on traditional farming know-how, including alpine pasture practices, and by encouraging direct payments, it is possible to maintain efficient farming practices that optimize the use of resources, limit inputs and promote synergies within the ecosystem.

Raclette du Valais production models are highly localized and perfectly adapted to local conditions. This study has enabled us to characterize and compare two contrasting areas of Raclette du Valais PDO production.

The Val d'Illiez is an area with a high capacity for innovation and more productive farms than the Val d'Hérens or Val d'Anniviers. The farming model here is more individualistic and professional, with a greater diversity of farms than in other regions. This valley, which is less isolated and more open to tourism, benefits from a dynamic economy that has a positive influence on farming practices.

One of the special features of the Val d'Illiez is its seasonal lifestyle, structured around the summer ascent to the mountain pastures. This way of life, deeply rooted in local culture, plays a crucial role in maintaining interest in livestock farming. The region's farmers are motivated by this age-old tradition, which not only supports the agricultural economy but also enriches the valley's cultural and tourist experience.

Val d'Illiez's appeal also lies in the diversity of its farms, which combine different agricultural practices to maximize productivity while preserving the environment. This diversified approach makes the most of local resources, contributing to the production of the famous Raclette du Valais

cheese. It is this combination of innovation, professionalism and respect for seasonal traditions that makes Val d'Illiez a unique and dynamic model in the Swiss agricultural landscape.



Figure 214 - Picture of cows on the Tovassière mountain pasture. Source: La Cavagne

Val d'Hérens and Anniviers, meanwhile, are characterized by their deeply traditional character, with agricultural production rooted in the land. The passion for queen fights, a tradition around the Hérens cattle breed, plays a crucial role in maintaining motivation for livestock farming and ensures the cultural continuity of the region. Livestock farming is at the heart of regional identity and social interaction, strengthening the community fabric.

Farming practices in those two valleys are characterized by resilience and collective action exemplified by structures such as alpine pasture consortia, livestock unions and village dairy cooperatives. These practices help to reduce individual costs and workloads, thereby encouraging collective management of resources.

These farms receive substantial subsidies because they are in mountain areas, breed Hérens cattle and process the milk into cheese. They are heavily dependent on direct payments and, although they are less productive because of the Hérens breed, they do not necessarily seek to reverse this trend, focusing instead on preserving local traditions and quality of life.

The Val d'Hérens and d'Anniviers embody a farming system in which tradition and a passion for livestock are at the heart of practices, supporting a culturally rich agriculture that is essential to the production of Raclette du Valais.

The creation of the Protected Designation of Origin (PDO) in 2007 brought together all the very different players involved in the production of this emblematic cheese and created a unique, identifiable, traceable product with a protected name.

Thanks to the Raclette du Valais reputation, and maybe the PDO registration and protection, producers benefit from a remunerative price, guaranteed by the efforts to improve and guarantee the high quality of its products, reinforced by the PDO regular controls.

Finally, the interprofession's work on marketing and visibility enhances the attractiveness of Raclette

du Valais PDO cheese to consumers, thereby stabilizing demand in a context where the Raclette du Valais is produced almost only in the Mountain lateral valleys. These measures justify a higher price, ensuring a remuneration for producers that would not be enough to cover the costs but is at least higher than fresh milk or industrial yogurt, fresh cheese, cream or butter. Despite this milk high price, the labor intensity and other high costs, notable the permanent constructions in winter and in summer double the costs for the stables. Without direct payments, no farm can cover those costs in the mountains, and even with those public contributions, farmer income is notably low.

Well-established and efficient marketing networks limit the number of intermediaries, thereby preserving added value for producers. For example, village cooperative dairies manage to sell cheese at the recommended price (around CHF 20/kg) and pay producers for their milk at between 90 centimes and one franc per liter.



Figure 215 - Picture of the central dairy in the village of Evolène. Source: Commune of Evolène

This remuneration of producers has enabled them to perpetuate their farms and the production of Raclette du Valais. By guaranteeing a stable income and production for producers, the existence of the well-known Raclette, very typical and linked to the Hérens breed, has been preserving the heritage production. PDO as legal tool does not play a big role but allows establishing more rigorous quality, and pool money for the advertising and promotion. Indeed, many producers in the Val d'Illiez who used to produce industrial milk have redirected their production towards Raclette du Valais PDO by adding a processing plant and cellar on their mountain pastures. And in recent years, new cheese dairies have been built in Anniviers, but as well in other Valais lateral valleys, like Orsières and Etiez. The industry believes that there is potential in production.

“In addition to its economic importance, the PDO has also helped to maintain the landscape and the vitality of mountain areas by ensuring the continued existence of livestock farming in the region [246]. The maintenance of grassland is guaranteed by the requirements set out in the PDO specifications for the feeding of dairy cattle [247].”

The production of Raclette du Valais AOP is part of a wider system of activities, closely linked to the preservation of the landscape and the economic dynamism of the region. By keeping the countryside open and welcoming to visitors, agriculture plays a key role in the canton's tourist industry. In winter, meadows are mown to prevent snow accumulation and the risk of avalanches, while in summer they ensure that the countryside is clear and attractive for walkers. What's more, the upkeep of traditional buildings such as Mayens and alpine pastures enhances their appeal to tourists.



Figure 216 - Picture of a Mayen used as an Airbnb in Evolène. Source: Antoinette Bernard

Cattle rearing, alpine pastures and the Hérens breed are emblematic elements of the Valais that attract many visitors. This contribution from agriculture to tourism is reciprocal, as tourism creates outlets for agricultural production. Consumers, including restaurateurs, look forward to the Raclette du Valais PDO cheese, which puts pressure on producers to meet this demand. There is therefore a real interdependence between agriculture and tourism in the Valais valleys.

Valais agriculture is also deeply rooted in a cultural system, particularly in the Val d'Hérens and the Val d'Anniviers, where culture, identity and traditions are inextricably linked to livestock farming. This cultural system maintains a strong appeal for livestock farming despite the difficulties and constraints associated with this way of life. The folkloric aspect of this culture is creating new economic models for farms, such as the boarding of Hérens cows for enthusiastic owners, or the setting up of community stables in the Val d'Anniviers.

Finally, the production of Raclette du Valais PDO is part of a wider agricultural system on a cantonal scale, where the various Valais products complement each other. Thanks to the PDO strategy, this heritage production has been preserved and revitalised, creating solid links with other activities and ensuring fair remuneration for producers. As a result, Raclette du Valais PDO continues to prosper, supported by a network of interdependent activities that enhance the vitality of the Valais region.

12.4.3 Raclette case study: Weaknesses and disabling factors

On the other hand, Lhamo et al. (2025) also identified weaknesses and disabling factors in the raclette sector. They include:

- A marked diversification in farming practices, which causes breakdown in local relationships and makes it difficult to organise collective action
- Paradoxically, a PDO system that has weakened traditional farming systems by failing to specify the natural context of producing farms - to the benefit of lowland dairy farmers
- Environmentally sustainable producing practices that are not emphasised in the PDO specifications: their existence relies on the goodwill and traditional practices of farmers
- A high dependence of farms on subsidies

The following quotation in full goes into greater detail [109]:
“The interprofession plays a crucial role in the cohesion and organisation of the Raclette du Valais PDO sector. By structuring the industry and guaranteeing fair remuneration for those involved, it has encouraged the professionalisation of operators. This development has been accompanied by a marked diversification in farming strategies, both at cantonal level and on individual farms. The orientation, diversification of production, annual rhythm and balance of activities now vary considerably from one farm to another.
However, this great diversity of farms has led to a breakdown in local relationships. Divergent interests make the operation of community organisations more delicate than before. Inter-professional organisations are facing increasing challenges to unify this heterogeneous sector and effectively represent all the players. Making the right decisions for the whole industry is therefore becoming a delicate exercise, requiring careful listening and a deep understanding of the varied needs of each farm.

The PDO has introduced a new standard of quality, with a risk of denaturing the product. Although the PDO requires that Raclette du Valais s produced in the Valais from Valais milk, it does not specify the natural context of the producing farms. This has enabled new players, particularly a very few lowland dairy farmers, to turn to producing milk for the more lucrative Raclette du Valais.

This opening up compromises the link with the origin of the product and the mountain terroir and creates a risk that the original agricultural model will disappear. Traditionally, the strength of an origin-linked product lies in its match with the environment, including unique climatic conditions, specific soil characteristics, local varieties of plants or animal breeds, as well as historical know-how and cultural practices. The conditions and skills required to make cheese in the mountains differ from those found in cheese dairies on the plains: heating the milk over a wood fire, fluctuating milk quality depending on the day, the weather and the pastures, managing the lactic cultures for curdling, and removing and pressing the cheese are all part of everyday life on the mountain pastures.

However, the PDO has not reinforced the value of alpine pasture production by clearly differentiating between the two designations: "Raclette du Valais" and "Raclette du Valais d'Alpage". This configuration allows farms to be larger and more productive for the same number of labour units. By establishing a cantonal zone in the PDO specifications to protect local production, there is a paradoxical risk of a transition towards more opportunistic models, leading to a loss of the link with the origin.

The PDO has played a structuring role in the economic and social aspects of the industry but has been less of a driving force in the environmental aspect. The PDO does not include restrictions on the breed of cattle, or the amount of milk produced per hectare in its specifications. It only imposes requirements on the origin of 75% of the fodder in the PDO area and a ban on silage feeding. However, since sustainable practices such as spreading manure and optimising the use of resources are already well established in a geographical, environmental, social, traditional and cultural context, stabilising income and facilitating organisation via the PDO have made it possible to protect and perpetuate these practices.

Despite the added value created by the PDO label, producers remain extremely dependent on agricultural policies. According to the results of the economic performance, livestock farms are entirely dependent on direct payments, which account for almost 70% of their income from sales and subsidies. Farms in the Val d'Illiez are more autonomous. In Grand Entremont, a valley that produces Raclette du Valais PDO, farms depend on public support for 50-90% of their income, depending on their estimates [249]. The competitiveness of the cheese industry is supported by the accumulation of direct payments specific to mountain areas. In 2022, according to the Swiss Federal Council [251], mountain farms received 40% more in direct payments than lowland farms, as well as premiums for milk processed into cheese. Without this support, it would be difficult for farms to survive [248].”

12.4.4 Questionnaire contextualization for Valais

The full set of Step 1 adaptations are presented in the questionnaire contextualized to Valais's pastoralist context (Table 36). Beyond the element-specific changes listed below, frequent adaptations concerned formulations and examples for better understanding in the Swiss context (e.g. replacing references to the Common Agricultural Policy by the Swiss direct-payment system). To ensure the highest possible comparability, several criteria were aligned with the TAPE version previously used in Valais within the AniTerrae project (2024/25, raclette dairy farms); the corresponding dataset will be integrated into the new TAPE assessment of the region, completing data gaps by returning to the interviewed farms where needed.

- Diversity: minor changes for grassland-only production types; thresholds of crop diversification adapted to terrain that is difficult to cultivate, where little diversification is possible.
- Synergies: categories aligned with the Swiss biodiversity payments (flower fallows, extensive crop strips, extensive grasslands, extensive pastures or woodlands, hedges) to establish a common understanding with farmers; higher threshold for natural/semi-natural areas, as Swiss legislation already requires a minimum of 7% of biodiversity-enhancing surfaces on the total farming surface.
- Recycling: criteria brought closer to the TAPE version used in the AniTerrae project to guarantee comparability; scoring options added on purchased water (including water-scarcity situations) and on the absence of renewable-energy use or production.
- Efficiency: highest score reformulated ("There is an abundance" instead of "I cultivate") to include naturally occurring species in grassland-based systems without sowing.
- Resilience: inclusion of para-agricultural activities; highest scores attributed to pasture-only farming systems for the relevant criteria (5.3.1–5.3.3).
- Culture and food tradition: beverage production added; lowest score extended to farms whose products are mainly non-material services or goods (e.g. sheep systems focused on beauty competitions without production).
- Human and social values: aspect added on social security for women; the reference to explicitly "agroecologically motivated" young farmers was removed, as information on generational renewal is considered crucial regardless of its motivation.
- Circular and solidarity economy: option added for farms marketing no agricultural product at all; on-farm processing explicitly included.
- Responsible governance: aspect added on water access, explicitly covering summer pastures.

For Step 2, the panel of indicators was contextualized as follows: an adapted Land Tenure Score integrating summer pastures (surface available for summer farming and legal form of access); the FAO Qualitative Economic Indicator complemented by quantitative accounting data and the value of total direct payments; the SOCLA soil-health score (for farms with integrated crop systems) and an agrobiodiversity index (animal and/or crop diversity, natural vegetation/pollination scores) guaranteeing comparability with the AniTerrae dataset; a Personal Well-being Index; a generational-renewal indicator (farm transmission capacity, for elder farmers); and a feeding-capacity indicator (Potential Nutrient Adequacy) measuring the nutritional diversity of all products sold at farm level, following Wood (2017, doi 10.1111/1365-2664.13026).

Additional adjustments include a list of farmer organisations common in the Swiss context (Union Suisse des Paysans, Jeunes USP, Uniterre, Association des petits paysans – VKMB, organic label organisations, AOP organisations, Révolte paysanne, others), and a set of open questions on "farmers' perception of areas for action to strengthen agroecology" (resources needed to strengthen elements of agroecology; infrastructure for water, electricity, pastures, product transformation and social cohesion). The specific module on farmers' perception of ecosystem services was not integrated into the Swiss questionnaire.

Table 36 - Contextualization of Step 1 questionnaire – Pastoralism in Valais

Questions					Levels				
			Modification	Justification	No	More or less	Yes	Modif.	Justif.
1) DIVERSITY									
Plant diversity (including forage and trees)	Number of plant species	Do you produce a diversity of plant species on your farm (permanent grassland excluded)?	unchanged		*I focus on the production of 1 or 2 crops, forages or trees over the entire farm.*	*I produce up to 4 crops, forage and trees species, but they cover more than a third of my cultivated area.*	*I produce a large diversity of crops, forage and trees (6 species or more), none covering more than a third of my cultivated area. OR My farmland is not adapted for crop production.*	*adapted thresholds*	*small ruminant farmers are largely located in mountainous areas with very limited possibilities for crop production and diversification. usually they focus on permanent grasslands + adding of "OR My farmland is not adapted for crop production."*
	Plant genetic diversity (number of varieties of the main	Do you have several varieties for the main cultivated crops?	unchanged		*Only one variety is cultivated for the main crop(s).*	*More than one variety of the same crop are cultivated, but genetic diversity*	*Several varieties (3 or more) are cultivated, ensuring*	*adapted thresholds*	*small ruminant farmers are largely located in mountainous*

	cultivated plant)					*remains limited.*	*genetic diversity.*		*areas with very limited possibilities for crop production and diversification. usually they focus on permanent grasslands*
		[ALTERNATIVE FOR PASTORAL CONTEXTS] How many different grasses and herb types feed your animals on (biological composition of the pasture/feed)?	additional element to avoid confusion with legal types of pastures/grasslands	original question might be misunderstood to answer in legal terms even though the composition of the feed might be the same	*Animals graze only one or very few species of forage plants*	*A moderate number of forage species (e.g., 3-5 species) are available for grazing.*	*An extensive variety of forage species (e.g., 10+ species) are grazed by animals.*	*unchanged*	
Temporal and spatial diversity	Temporal diversity: rotation	Excluding permanent grasslands, do you regularly rotate your crops or forage over different years?	unchanged		*I grow the same crops repeatedly without a regular crop rotation system or rotate occasionally.*	*I rotate regularly with 3 crops in the rotation and non-regular integration of cover crop or fallows periods.*	*I systematically rotate different crops in my fields over 5 years or more, and integrate cover crops*	*unchanged*	

							or fallow periods.		
		[ALTERNATIVE FOR PASTORAL CONTEXTS] Do you practice rangeland rotation and/or do you take your herds up to the alpine pastures/to different pastures in winter?	formulation changed	adapted to Swiss reality (seasonal grazing = alpine pastures)	*No rangeland rotation or seasonal grazing is practiced.*	*Rangeland rotation or seasonal grazing is practiced occasionally.*	*Rangeland rotation or seasonal grazing is extensively practiced. It is a core component of the farming system (including pastoral mobility).*	*unchanged*	
	Spatial diversity	Excluding permanent grasslands, do you grow multiple crops, forage or trees together in the same field (intercropping)?	unchanged		*I grow single crops, forage or trees in separate fields without mixing species.*	*I intercrop occasionally, but not as a systematic practice on my farm.*	*I regularly intercrop different plant species (e.g. including agroforestery systems)*	*unchanged*	
		[ALTERNATIVE FOR PASTORAL CONTEXTS] What is the share of the main forage plant?	unchanged		*The grazing system is dominated by one single forage species, making up 100% of the pasture.*	*One main forage species makes up about 50-75% of the pasture.*	*The main forage species makes up less than 30% of the pasture.*	*unchanged*	

Animal diversity (including fishes and insects)	Number of animal species	Do you raise a diversity of animals on your farm?	unchanged		*I do not raise any animals.*	*I raise two species of animals well represented and balanced in number.*	*I raise more than three species of animals that are well represented in terms of numbers.*	*unchanged*	
	Animal genetic diversity (genetic variation among farm animals)	Do you have different breeds for your main species?	unchanged		*All animals of the same species are of the same breed.*	*There are some variations in animal breeds among my herds (more than one breed for my main herd type).*	*There are diverse breeds among my herds (e.g., 3 breeds or more for my main herd type).*	*adapted thresholds*	

2) SYNERGIES									
Plant-livestock integration	Local production of feed consumed by animals	What is the source of your animal feed?	different formulation	adaptation from a yes/no question towards a more open formulation	*I rely primarily on purchased feed and fodder, with little or no on-farm production of forage, fodder, or crop residues.*	*Some feed or fodder is produced on my farm, but a significant portion (e.g., concentrates, grains, or processed feed) is purchased externally.*	*I produce most or all of the feed and fodder needed, using pasture, fodder crops, agroforestry systems, or crop residues, significantly reducing dependence on external sources.*	*no changes*	
	Use of non-competing feed resources	Do you rely mostly on animal feed resources that do not compete with human food productions ?	no changes		*Animals are mainly fed with feedstuffs that could also be used for human consumption (e.g., cereals, soy, pulses), with limited use of grass, residues, or by-products.*	*Animals' diet includes a mix of feed resources - some derived from materials that compete with human food (e.g., grains), and some that do not (e.g., grass, crop residues, by-products).*	*Animals are primarily fed on resources that do not compete with human food - such as permanent and temporary grasslands,,forage crops, fibrous residues, or processing by-products - minimizing dependence on human-edible feeds.*	*no changes*	

	Animal in the agroecosystem	To what extent are animals integrated into ecosystem services* while benefiting from appropriate living conditions that allow natural behaviours? (includes bees and fishes) *Manure for soil health, integrated grazing for vegetation management, biodiversity enhancement, fire risk reduction, pest and weed regulation, bees for pollination, aquaculture	no changes		*Animals are mainly for food, with little or no ecosystem services, and live in overcrowded or stressful conditions restricting natural behaviours.*	*Animals provide manure for soil improvement and have moderate living conditions, but integration and welfare remain limited.*	*The system shows clear synergies between animal presence and other farm components, strengthening overall agroecosystem resilience. Animals are fully integrated into multiple ecosystem services (grazing, pest regulation, biodiversity, fertilisation, social roles) and live in free-range or spacious conditions allowing natural behaviours and protection (e.g. extended access to the outdoors/grazing).*	*no changes*	

		for irrigation and fertilisation, cultural or educational value…							
Integration of trees into the production system	Integration of trees into the farm's production system	Do you integrate trees into your farming system?	different formulation	simpler formulation	*Trees are absent or rare; they are not integrated into the farm's production system, or they are removed.*	*Trees are present, but they are not systematically integrated into the production system or only play a minor role.*	*I intentionally planted or kept trees in different parts of the farm, in order to enhance interactions with plants and animals (fodder, shade, soil fertility etc).*	*no changes*	
	Diversity of tree species	Did you allow a diversity of trees to grow naturally and/or planted it?	different formulation	simpler formulation	*None / only one tree species is integrated into my farm agroecosystem*	*Two or more tree species are integrated into my farm agroecosystem.*	*Four or more tree species are integrated into my farm agroecosystem.*	*adapted thresholds*	*to match with old unil version*
Habitat management (vulnerability reduction measures)	Mosaic of plots	Does your farm have multiple plots of different shapes, sizes and altitude?	no changes		*high uniformity within and outside the agroecosystem, no semi-natural environments,*	*several elements are adjacent to crops and/or pastures or a large zone of*	*the agroecosystem presents a mosaic and diversified landscape, many elements such as trees, shrubs,*	*different formulation*	*Formulation similar to old unil version for better comparability*

					no zones of ecological compensation.	*ecological compensation.*	*fences or ponds can be found in between each plot of cropland or pasture, or several zones of ecological compensation.*		
	Proportion of the farm with natural and semi-natural elements	How much of your surface consists of natural or semi-natural elements such as flower fallow, extensive crop strips, extensive grasslands, extensive pastures or woodlands, hedges, etc.?	minor update	adaptation to fit the criteria for Swiss biodiversity payments	*Not more than 7% of the farm consists of natural or semi-natural elements, with most of the land dedicated to cultivation or grazing.*	*Between 10% and 15% of the farm includes natural or semi-natural elements, but they are limited in coverage or fragmented.*	*More than 15% of the farm consists of natural or semi-natural elements that provide habitat for biodiversity and ecosystem services.*	*adapted thresholds*	*Swiss legislation requires a minimum of 7% of biodiversity enhancing surfaces*

3) RECYCLING									
Use of seeds and breeds	Use of local and self-produced seeds and breeds	Where do you obtain your seeds, seedlings and/or young animals?	different formulation	simpler formulation	The majority of seeds, seedlings, and animal breeds come from external suppliers, with little or no reliance on on-farm reproduction or local exchanges.	About half of the seedlings or breeds are produced on-farm or shared locally, but the farm still relies partly on commercial or external sources.	The majority of seeds, seedlings, and animal breeds come from on-farm production or exchanges with local farmers, with minimal reliance on external suppliers.	*adapted thresholds*	*to match with old unil version*
	Selection of locally adapted, resilient crop varieties, animal breeds, and tree species	Do you prioritize crop varieties and livestock breeds that are naturally adapted to local conditions (e.g., drought tolerance, disease resistance, low fertilizer need, heat resistance, hardy livestock breeds)?	no changes		I prioritize high yielding crops and highly productive animal breeds.	Some adapted varieties and breeds are used, but not consistently across all crops and livestock.	I mainly rely on locally adapted, low-input crop varieties and resilient livestock breeds that require minimal external inputs.	*no changes*	

Biomass and waste management	Reuse of organic residues	Do you reuse your organic residues (e.g., plant residues, manure, compost) in your farm activities?	no changes		I discard organic residues, burn them, or export them without being repurposed.	More than half of the organic residues are reused (e.g., for compost or mulch), but a significant portion is still discarded or underutilized.	I fully integrate organic residues into soil enrichment, livestock feeding, composting, biogas production, or other beneficial uses.	*adapted thresholds*	to match with old unil version
	Management of non-organic waste generated	Do you recycle the non-organic waste generated on the farm?	update	question focuses on recycling to make the question softer (previous interviews showed that this can be a quite sensitive quesiton)	My farm generates large amounts of hazardous waste and I manage all of it by myself by burrying in my farm, burning it or reusing it as country road embankments.	My farm recycles certain materials but I manage some part of hazardous waste by myself.	My farm recycles non-organic materials by using official recycling channels organized by the state or municipality, and ensures proper disposal of hazardous waste.	*shortened formulation*	to make answer option softer during the interview process
Water & Energy Sources	Source of water for farming activities	Is the water you use for irrigation and/or for your animals coming mainly from renewable, recycled or naturally	additional element	added and/or for your animals	All the water consumed by the animals / used to irrigate is purchased. AND/OR Water is mostly extracted from deep groundwater, fossil aquifers, or other sources that are	I use both renewable and non-renewable sources, or small quantities from rainwater/ surface water but not the	I use little or no water, mainly coming from recycled or reused farm water or.renewable sources.	*addition*	added "All the water consumed by the animals/ used to irrigate is purchased." to lowest score.

		replenished sources? (rainwater harvesting, small ponds, shallow ground water with regular replenishment, perennial rivers or lake with natural recharge and managed extraction…)			not naturally replenished.	main source. There might be water scarcity leading to the need to purchase water.			Added "There might be water scarcity leading to the need to purchase water." to middle score. Closer to old unil version
	Source of energy for farming activities	Do you rely on renewable energy sources for your farming activities ?	no changes		All the energy for agricultural production comes from non-renewable resources (fuel, etc.). No renewable energy is used nor produced.	I rely on renewable energy sources for about 50% of my on-farm energy use. OR No renewable energy is used nor produced, and the levels of non-renewable energy use are negligible.	I rely exclusively on renewable energy sources for my farming activities.	*addition*	Added "No renewable energy is used nor produced" to lowest score. Added "OR No renewable energy is used nor produced, and the levels of non-renewable energy use are

									negligible" to middle score. Closer to old unil version
4) EFFICIENCY									
Management of soil fertility	On-farm nutrient application	How do you manage soil fertility on your farm ?	no changes		*My farm primarily relies on synthetic, mineral or fossil fertilizers (e.g., guano, seaweed, natural minerals…)*	*My farm recycles or import some organic matter but still relies partly on synthetic and mineral fertilizers.*	*My farm relies mainly or exclusively on organic inputs and ecological practices for soil fertility (e.g., compost, manure, crop residues, green manure (cover crops), intercropping, agroforestry, biofertilizers). No synthetic nutrient inputs are used, or only minimally.*	*no changes*	
	Nitrogen-fixing plants	Do you cultivate or have any nitrogen-fixing plants (including	no changes		*I don't cultivate any plants that fix nitrogen and there aren't naturally occurring nitrogen-fixing plants or trees on my farm.*	*I cultivate some legumes or trees (i.e. Alfalfa, faba beans, clover etc) and have some naturally*	*There is a diversity of nitrogen-fixing plants on my farm (legumes and trees) and manage those*	*minor change*	*Change of highest score to "There is an abundance" instead of*

		trees and fodder)?				*occurring nitrogen-fixing plants or trees.*	*naturally occurring nitrogen-fixing plants or trees.*		*"I cultivate" in order to include grassland based farming systems*
Management of pests and diseases	Phytosanitary protection	What are your methods for pest control?	different formulation	simpler formulation	*My farm relies mainly on curative pest control (e.g. pesticides, synthetic treatments) and applies few or no preventive strategies. My curative approach is mainly based on a normative calendar approach.*	*Some preventive practices are in place, but pest control still involves regular curative treatments (e.g., applying pesticides when pest levels are high).*	*My production system is based primarily on preventive pest control, including crop rotation, intercropping, management of natural predator habitats and resistant varieties. Curative treatments are used only as a last resort and, if pesticides are used, they are preferably biopesticides or low-risk mineral elements.*	*no changes*	
	Use of veterinary drugs	Do you use veterinary drugs to	no changes		*Regular use of veterinary drugs and*	*Occasional use of veterinary*	*Minimal use of veterinary drugs or antibiotics*	*addition*	*include antibiotics*

		manage animal health?			*antibiotics without alternative measures.*	*drugs (treatment oriented) with some preventive health measures.*	*focusing on preventive health practices.*		
Water & Energy use	Water use and saving	Do you apply water-saving techniques to optimize and reduce water waste?	no changes		No water-saving techniques are used and measures to avoid evaporation and retain soil moisture are absent.	Some water-saving practices are in place, but they are not systematically applied across the farm.	Multiple efficient water-saving techniques are systematically applied OR I do not irrigate purposefully / My system does not need irrigation	addition	*avoid evaporation*
	Energy use and saving	Do you deliberately work on the reduction of energy needs of your farm and/or use energy saving techniques?	different formulation	clarity	My farm relies on fuel-intensive machines (e.g., diesel generators, tractors, electric-powered pumps...) without any energy-saving strategies or renewable sources.	Some energy-saving practices are in place (e.g., efficient irrigation or limited machine use), but the farm still relies significantly on fuel or electricity.	My farm either actively reduces it's energy use through efficiency OR I deliberately operate with naturally low energy inputs (e.g., minimal machinery, reliance on manual or animal labour).	*no changes*	

5) RESILIENCE									
Social resilience	Community cooperation (formal or informal)	Can you and do you rely on any community-based mechanisms and networks (formal or informal) to help sustain your farm against risks and crises (e.g., solidarity support, mutual aid funds, risk-sharing or disaster insurance systems)	no changes		*There is no community support system in my area, or I don't belong to it.*	*Some informal mechanisms exist but I'm not involved or do not have access to it*	*There are community support mechanisms in my area, and I am involved in it.*	*no changes*	
	Climate change adaptation capacity	Are there changes in the climate that have an impact on your farming activities and to which you are adapting? (e.g., longer or more	different formulation	*question tries to be less accusing if respondent does not acknoledge climate change*	*I don't understand / acknowledge how climate change will affect my farming activities.*	*I acknowledge and understand how climate change will affect my farming activites but do not yet implement adaptations*	*Yes, I do acknowledge and understand how climate change will affect my farming activities and have started adaptating my practices.*	*no changes*	

		intense droughts, water shortage, stronger storms, heavier rainfall) to adapt your farming activities ?				*measures to cope with it.*			
Economic resilience	Dependence on external financial support for farm and income stability	To what extent do you depend on external financial support (e.g., direct payments, subsidies for rural development, bank loans or your own economic activity outside of agriculture) to sustain your farming activity?	change of examples	*adapted to Swiss context + added cross-financing of the respondent's own other non-agricultural activities*	*I am heavily dependent on bank loans and/or subsidies for sustaining my farming activities OR I only practice agriculure as a hobby financed by an economic activity outside of agriculture (entrepreneurship/wage labor).*	*Significant external support is received, but the majority of my activities are sustained by the sale of agricultural products.*	*I rely mostly on my own production and selling or other para-agricultural activities (agri-tourism, boarding stable etc.) to sustain my farming activities.*	*additional element para-agricultural activities*	

	Diversity of income generating activities	Do you have several income generating activities on your farm (including para-agricultural activities)?	additional element	*para-agricultural activities (tourism, landscape maintenance etc.) can be a contributing factor to agroecology*	*I depend almost entirely on one single on-farm activity, with no significant alternative sources of income.*	*Some diversification exists, but additionnal complementary activities represent a small share of my income.*	*I have multiple sources of income activities, each contributing significantly to my income.*	*no changes*	
Soil conservation practices	Permanent soil cover	Do you keep soil covered year-round using mulch, crop residues, cover crops, or continuous cropping?	no changes		*The soil remains bare for long periods after harvest, or is covered only occasionally to comply with regulations.*	*The soil is covered most of the time, but bare periods still occur between crops or after harvest.*	*The soil is always covered, ensuring continuous protection.*	*no changes*	
	Limiting deep ploughing and soil disturbance	Do you limit soil disturbance by avoiding deep ploughing and/or do you apply simplified cultivation techniques (e.g., shallow tillage, direct seeding under cover, or no-	no changes		*Deep ploughing (>20 cm) is regularly practiced across most fields, with little use of reduced or alternative tillage methods.*	*Reduced tillage or shallow cultivation is practiced on a significant share of fields, while deep ploughing is limited to specific crops or situations.*	*Simplified cultivation techniques (e.g., direct seeding under cover, shallow tillage, or no-till) is systematically applied across most or all fields where agronomically feasible, maintaining soil structure and organic matter.*	*no changes*	

		till practices)?							
	Soil degradation control	Do you implement other specific measures to prevent soil degradation (erosion control, organic matter management, compaction avoidance, buffer strips,...)?	no changes		*No specific additionnal soil conservation measures are in place*	*Some specific conservation measures are implemented, but not systematically or not on all areas*	*Adaptive and site-specific soil conservation measures are applied (cover crops, agroforestry, organic matter, amendments, adapted irrigation,contour planting etc.) and effectively address soil degradation threats.*	*no changes*	

6) CULTURE AND FOOD TRADITION									
Dietary diversity and food self sufficiency	Food products diversity	Does your farm produce and promote a diversity of food products (e.g., beverages, legumes, fruits,	other examples	to match the characteristics of our sample	The farm produces mainly one or two types of food (e.g., only beverages, only fruits/vegetables, or only livestock products)	The farm produces a moderate variety of foods (around 3-4 different types) combining several crop and/or	The farm produces a wide diversity of foods (at least 6 different types) from multiple food groups (e.g., beverages, legumes, vegetables,	changed examples	added beverages (wine or juice production)

		vegetables, dairy, meat)?				livestock products	fruits, dairy, meat)		
	Share of farm production for food	What proportion of your farm production is destined for local human and animal consumption vs. other uses (seed, fuel, fibre, exports)?	no changes		Almost none (<25%) of the farm's production is destined for food or feed; most goes to non-food uses, long-distance markets or the majority OR the majority of products are non-material services/goods (leisure or other).	Around half (50%) of production is destined for food or feed purposes	Nearly all (>90%) of production is destined for food or feed purposes	additional element	Added "OR the majority of products are non-material services/goods (leisure or other)." to lowest score possible to include sheep farming systems that concentrate on beauty copmetitions without producing
Local and traditional food heritage	Use and preservation of traditional crops and local food practices	Do you produce traditional food products or maintain local food preparation practices (e.g., traditional recipes,	no changes		Traditional food products and food practices are rarely or never used, and my farm relies almost entirely on selling of non-transformed agricultural commodities on the market	Some products are grown, processed, and sold on my farm, but most of the agricultural production depends on external sales.	Traditional food is actively cultivated, transformed, and commercialized on my farm. Local food preparation techniques are maintained.	different formulation	

		preservation methods)?							
	Geographical and traditional food quality schemes	Do you participate in geographical or traditonal identification strategies (e.g. Protected Designation of Origin, Protected Geographical Indication, Traditional Speciality Guaranteed) to promote your products?	no changes		I do not participate in any geographical or traditional branding, strategy. My products have no official recognition for quality or origin.	I occasionally participate in a quality scheme or use traditional labelling for some products, but not systematically.	I actively participate in one or more geographical or traditional food quality schemes for most of my products, using them strategically to add value, preserve traditions, and/or strengthen local identity.	no changes	

7) CO-CREATION AND SHARING OF KNOWLEDGE									
Knowledge sharing and access	Peer learning	Do you regularly engage in mutual exchange of knowledge and best practices with	*no changes*		*I rarely have interactions with other farmers.*	*I regularly exchange knowledge with other farmers but not in a systematic or*	*I actively exchange knowledge with farmers through structured knowledge-sharing platform related*	*additional element*	*specific example for Swiss context*

		other farmers (whether they are older or from the younger generation)?				*structured way.*	*to agroecology (ProBio groups or others).*		
	Diversity of knowledge sources	How do you get informed on agricultural topics (e.g., decision-support tools, agricultural media, newsletters, extension services, farmer networks) to inform decisions on your farm?	*different formulation*	*formulation that tries not to sound accusing of the participant if they don't use many information canals*	*I rely mostly on personal experience or a single source of knowledge, with little effort to explore new information from different channels.*	*Some external knowledge sources are used, but I rely primarily on a limited number of channels, such as private (commercial) extension services or practices recommended by industrial stakeholders*	*I actively seek out multiple sources of knowledge to improve practices- regularly using a mix of sources to stay informed (e.g., independent advisors, newsletters etc.)*	*adaptation of examples*	
Co-creation of knowledge and context specific innovation	Adoption of new and sustainable practices	Do you regularly test new practices on your farm ?	*no changes*		*I don't test new practices on my farm.*	*I sometimes test new practices, or only on small part of my farm.*	*I test new practices on my farm regularly.*	*no changes*	

	Use of local and context-specific knowledge in farming								
	Involvement in co-creation and sharing of knowledge (formal and informal) processes	Do you participate in learning activities led by researchers, advisors, or NGOs to co-create solutions ?	*no changes*		*I do not participate in research, innovation platforms, or farmer-scientist collaborations and rely primarily on personal experience or traditional knowledge.*	*Some engagement occurs with researchers or innovation networks, but my collaboration is irregular or limited to occasional activities (e.g., attending a few workshops, providing feedback but not co-developing solutions).*	*I actively collaborate with researchers, extension services, NGOs, or private actors through platforms like Living Labs, Farmer Research Networks, or innovation hubs, contributing to testing, adapting, and co-developing agroecological solutions.*	*no changes*	

8) HUMAN AND SOCIAL VALUES									
Women empowerment	Women's role in decision-making on the farm	To what extent are women involved in key decision-making on the farm (e.g.,			*Women rarely participate in decision-making or their involvement is limited to specific minor issues*	*Women participate in some key decisions but not consistently across all farm management areas*	*Women regularly participate in most or all key decisions regarding farm*		

		finances, crop/livestock choices, investments, and farm management), whether formally as farm entrepreneurs or informally as family members?					*management, formally or informally*		
	Women's financial independence and formal recognition in farm ownership or management	Do women working on your farm have an independent legal status and receive financial remuneration and social security for their work?	*additional element*	*social security (pension, insurance etc.)*	*Women contribute to farm work but have no formal recognition (no contract, no salary, no share in income).*	*Women are formally employed on the farm (receive a salary or are registered as workers).*	*Women are legally recognized as co-owners or partners, with access to farm income and returns on investments.*	*no changes*	
Labour conditions for producers and employees	<u>Physical</u> working conditions of farmers	Do you implement specific measures related to your working conditions to protect your physical health and safety?	*no changes*		*No dedicated measures are taken to ensure my physical health and safety*	*Some measures are taken to ensure my physical health and safety*	*Specific efforts, innovations and investments are set to improve my working conditions and preserving my physical health and safety*	*no changes*	

		(e.g.: ergonomics of work tools, training on safe handling of machinery, access to appropriate protective equipment, minimizing exposure to plant protection products, availability of sanitary facilities,...)							
	<u>Mental</u> working conditions of farmers	What do you do to ensure your mental well being?	*different formulation*	*simpler formulation*	*No dedicated measures are taken to ensure my mental health*	*Some measures are taken to ensure my mental health*	*Specific efforts, innovations and investments are set to improve my working conditions and preserving my mental health*	*no changes*	
	Working conditions of employees	How do you evaluate the working conditions for your employees (physical and mental well-being, salary, etc)?	*different formulation*	*simpler formulation*	*I am not sure they have appropriate working and salarial conditions, but I cannot provide more.*	*I comply with all official regulations to ensure their health and well-being (e.g., number of days off ; minimal wages ; insurances…).*	*I comply with all official regulations and do my best to guarantee their health and well-being by providing appropriate*	*minor additional elements*	

							working conditions (equipments, ...) and wages.		
Motivation in farming activities, transition of practices, and youth transmission.	Motivation in the continuity of farming activity	Are you motivated to continue your farming activity ?	*no changes*		*I am concretely considering giving up farming soon due to a lack of motivation.*	*I am not sure whether to continue farming until the end of my career.*	*I remain motivated by my farming activity and wish to continue for as long as possible.*	minor additional elements	
	Motivation in the continuity of socially and environmentally responsible farming practices	[IF YES] Are you motivated to start or keep developing your farming system around socially and environmentally responsible practices?	*minor change in formulation*		*I do not wish to start or want to stop adopting socially and environmentally responsible practices.*	*I am motivated to start or continue adopting socially and environmentally responsible practices, IF I receive necessary support (e.g. in training ; labor conditions ; access to resources and market…)*	*I am fully motivated to start or continue adopting socially and environmentally responsible practices, EVEN if the conditions for achieving this transition are difficult.*	*no changes*	

	Youth access to resources and farm transmission	Are you actively engaged in facilitating the transmission of your farm to younger generations?	*cut out element*	*deleted "Seeking to practice socially and environmentally responsible farming". Knowing about generational renewal is important even if the farmers aren't talking explicitly about agroecologically motivated young farmers.*	*I don't feel particularely concerned by the issue of transmission towards young generation of independent farmers.*	*I'm interested in and discuss the issue (e.g., offering informal advice, discussing farm succession with family), but do not have decision-making power on this issue.*	*I am strongly engaged in transmitting my farm to independant young farmers (e.g., actively seeking information, exchanging good practices, facilitating land transfer, advocating for succession, developing formal support mechanisms)*		

9) CIRCULAR AND SOLIDARITY ECONOMY									
Products and services marketed locally	Local food system	What proportion of your production is sold locally (directly to consumers/local shops etc.)?	*additional examples*		*Most of my products are sold through intermediaries on long supply chains or export markets OR no agricultural product is marketed at all.*	*Some products are sold locally, but a significant portion is not and goes through intermediaries.*	*Most of my products are sold locally, minimizing intermediaries and transportation distances.*	*adapted threshold*	*added "OR no agricultural product is marketed at all." to lowest score*

	Farmer-consumer partnerships and trust-based certification	If you sell directly or through short supply chains, are you surrounded by a COMMUNITY OF PARTICULARLY LOYAL AND SUPPORTIVE CUSTOMERS economically, physically, ideologically, and/or psychologically? (e.g., Agriculture contractuelle de proximité (ACP), épiceries participatives or producer cooperatives) ?	*change of examples*	*Swiss context*	*I AM NOT PART OF ANY CONSUMER COOPERATIVE OR TRUST-BASED SYSTEM, and I sell everything through the market or intermediaries.*	*PART OF MY PRODUCTION (LESS THAN A THIRD) is sold through a consumer cooperative based on trust or directly to a community of loyal consumers.*	*MOST OF MY PRODUCTION is sold directly to a community of loyal consumers or through a trust-based cooperative of customers who support me economically, physically, ideologically, and/or psychologically.*	*no changes*	
Local sourcing and circularity	Origin of inputs	Are your farm inputs produced in majority in your local area or on your own farm?	*additional element*	*added "or on your own farm?"*	*Noting or a very small part comes from the local area*	*A significant part of it comes from the local area.*	*Most of my input and services come from the local area.*	*adapted threshold*	*"nothing or a very small part" for lowest score*
	Local processing and services	Are your products processed within your local area or on your own farm?	*additional element*	*added "or on your own farm?"*	*They are not processed, or they are processed outside the area.*	*Part of them are processed in the area.*	*My products are all processed locally (on-farm, within the community, in the area).*	*no changes*	

	Resource sharing practices	Do you participate in any collective resource-sharing practices (e.g., shared machinery and inputs, pooling labour, joint purchase, collective composting, waste, or water management systems, common grazing areas etc.)?	*no changes*		*I do not share materials or participate in any collective resource-sharing practices.*	*I occasionnally participate in collective resource-sharing practices.*	*I regularly participate in collective resource-sharing practices.*	*no changes*	
10) RESPONSIBLE GOVERNANCE									
Producers' empowerment	Autonomous decision-making	Do you have the freedom to make independent decisions regarding farm management, such as crop selection, resource allocation, use and harvesting of natural resources (such as trees), and	*no changes*		*Very little decision-making autonomy. Agronomic and management decisions are largely influeenced by technical, commercial or industrial actors (e.g., buyers, input suppliers, processors, investors), leaving little room for*	*Some level of decision-making autonomy. The farmer makes most decisions independently but remains constrained by financial and time limitations or market requirements that restrict certain choices.*	*Full autonomy in decision-making and management. Decisions are made freely based on agronomic reasoning and farming experience, with access to independent and diverse sources of*	*no changes*	

		farming practices?			*independent choice.*		*advice or knowledge.*		
	Engagement in grassroots farmer organizations for agroecology	Are you an active member of a grassroots farmer organization working on transition towards socially and environmentally sustainable practices (e.g., cooperatives, farmer-led advocacy groups, ...)?	*no changes*		*I am not involved in grassroots farmer organizations and do not benefit from collective action or farmer-led agroecological advocacy.*	*Some interaction with grassroots organizations occurs, but participation is occasional or limited to receiving information/services rather than active engagement.*	*I actively participate in grassroots farmer organizations that promote agroecology, mutual aid, advocacy for farmer rights or access to agroecological markets and policies both for men and women.*	*different formulation*	*or instead of and for conditions in highest score*
	Access to financial resources and ability to self-finance	Do you have free access to bank loans without conditions on the economic direction and management of your farm?	*no changes*		*No or very few access to financial resources, such as bank credit, cooperative funds, or personal savings.*	*Some financial resources are available, but access to them is limited due to the lending conditions offered by banks (locked-in investments, etc.).*	*Good access to financial resources, with the ability to finance activities and innovation independently.*	*no changes*	

	Access to markets	Can you sell your products to different profitable channels in your area that allow for diversification of productions?	*different formulation*	*simpler formulation*	*I have access to a limited number of markets to sell main agricultural commodities (e.g. milk, meat, etc.) through intermediaries.*	*The farm has access to several markets or value chains, but profitability, logistics, or entry barriers limit real diversification opportunities. Some diversification is possible but constrained.*	*The farm has good access to a diverse range of value chains and profitable markets (e.g., local, regional, organic, or niche markets) that actively support or reward diversified production.*	*change of examples*	*adaptation to sample in CH*
Producers' access to and control over resources	Access and control over land	Do you have access to land, and is your access to it secure?	*no changes*		*Land access is limited or highly insecure (e.g., no ownership rights, land conflicts, or vulnerability to expropriation or non-renewal of farm lease or too short contracts).*	*Some access to land exists, but ownership or tenure is insecure (e.g., short-term lease, informal agreements, legal uncertainty, land conflicts, or restrictions on use or management of certain natural resources).*	*My farm has secure land access, either through ownership, long-term tenure, or stable community rights, without risk of eviction or major restrictions on use of land or its natural resources.*	*added element*	*added "or too short contracts" to lowest score*

	Access and control over water	Do you have secure access to sufficient quantity and quality of water to sustain your farming activities?	*no changes*		*Water access is highly insecure, unreliable, or unavailable, leading to difficulties in sustaining crops and livestock.*	*Some access to water exists, but it is seasonally limited, infrastructure is inadequate, or regulations restrict usage (e.g., rationing, competition with other users). OR water access is becoming increasingly difficult in summer pastures.*	*My farm has consistent and reliable water access (rainfed system with predictable rainfall, well-managed irrigation, access to natural sources) without major restrictions.*	*added element*	*water access in summer pastures*
	Control over genetic resources (seeds & livestock & breeds)	Do you have access to and control over diverse genetic resources (seeds and livestock breeds), including on their selection, use, conservation, reproduction and exchange ?	*no changes*		*I depend heavily on external genetic resources, such as hybrid/commercial seeds or livestock breeds, with no ability to save, breed, or adapt genetic material.*	*Some autonomy exists, but access to diverse genetic resources is limited by market availability, regulations, or external breeding programs.*	*I have full autonomy in selecting, saving, exchanging, and conserving both seeds and livestock breeds, relying on locally adapted varieties and indigenous breeds for resilience and sustainability.*	*no changes*	

12.5 Lazio

12.5.1 Agroecosystems description

Kiwi production agroecosystem

Kiwifruit cultivation was introduced in Italy, and particularly in the Lazio region, during the 1970s. Since then, the crop has undergone a marked expansion, especially in the area between the provinces of Latina and Rome, where favorable pedoclimatic conditions and the land reclamation works carried out in the Agro Pontino plain supported the development of a specialized production system. As a result, this territory has become one of the main kiwifruit-producing areas in Italy. The Protected Geographical Indication (PGI) production area currently includes 24 municipalities (Figure 217).

The study area extends over 1,640.7 km2 with a total population of 844,046 inhabitants and a population density of 514 inhabitants per km2. According to the OECD classification, only 1% of the municipalities are rural. The territory is predominantly flat, with an average elevation of 143 m above sea level. Despite the limited incidence of rural municipalities, agriculture remains a relevant component of the local economy, employing 12,907 people. Within this territorial context, kiwifruit production represents a highly specialized agricultural activity and contributes to the broader competitive position of Italy, which is currently the world's leading kiwifruit producer.

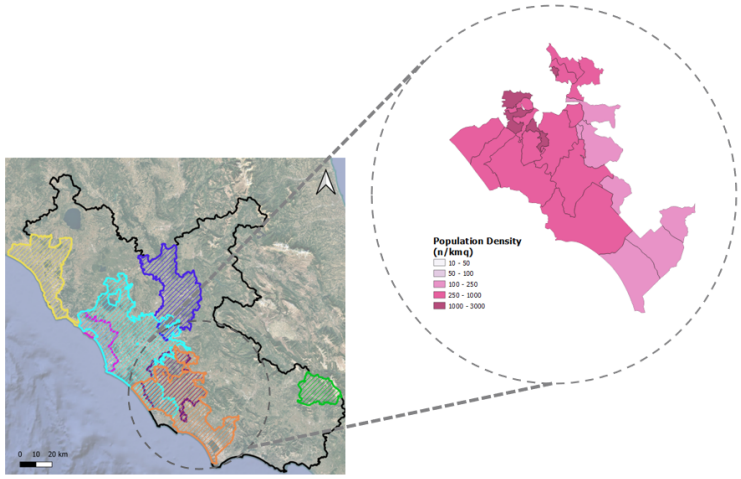


Figure 217 - Kiwi production agroecosystem boundaries

Castelli Romani agroecosystem

The geographical area of the Castelli Romani DOC designation is located in the central part of the Lazio region, mainly within the province of Rome and partly within the province of Latina. It encompasses the southern sector of the Agro Romano, the Alban Hills, the northeastern part of the Agro Pontino, and the upper Sacco River valley. Overall, the area covers 1,167.5 km2 and includes 26 municipalities, with a total population of 658,766 inhabitants and a population density of 564 inhabitants per km2. According to the OECD classification, 4% of the municipalities are rural. Despite the predominantly peri-urban character of the territory, agriculture continues to play a relevant role, with 19,712 people employed in the agricultural sector.

Viticulture represents one of the most characteristic agricultural activities of this area. The Castelli Romani DOC designation is historically based on grape varieties traditionally cultivated in the territory (Figure 218). For white wines, the main varieties include Malvasia di Candia, Malvasia del Lazio, and Trebbiano (in the Toscano, Verde, and Giallo types), while red wines are mainly produced

from Cesanese, Merlot, Montepulciano, and Sangiovese. The persistence of these varieties reflects the long-standing viticultural specialization of the area and its strong link with local pedoclimatic and historical conditions.

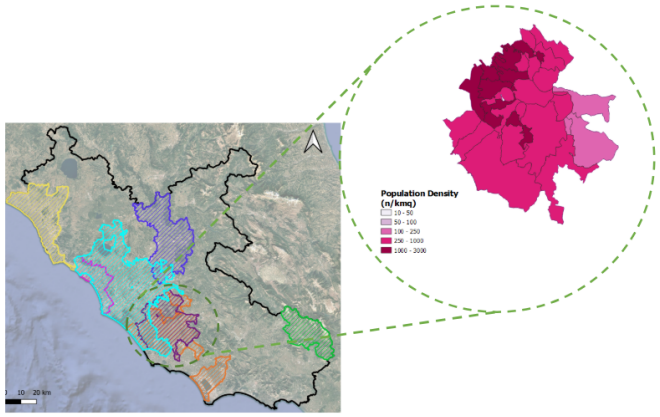


Figure 218 - Castelli Romani agroecosystem boundaries

The Arable farming agroecosystem of the Maremma Laziale

The Lazio Maremma, extending across the provinces of Viterbo and Rome, is an area in which agriculture continues to play a central role, both economically and in shaping the landscape. The study area covers 929.9 km2 and includes 6 municipalities, with a total population of 107,983 inhabitants and a population density of 117 inhabitants per km2. According to the OECD classification, 67% of the municipalities are rural. Within this territorial context, agriculture remains a significant component of the local economy, with 10,422 people employed in the agricultural sector.

From a physical and agronomic perspective, the area is characterized by wide flat or gently undulating landscapes, which provide favorable conditions for predominantly extensive farming systems. Land use is largely oriented toward cereals, fodder crops, sunflowers, and olive groves, alongside a considerable presence of livestock farming. This production pattern reflects the structural characteristics of the territory, where relatively low population density and broad agricultural spaces have supported the persistence of less intensive farming models.

In recent decades, the Lazio Maremma has also experienced an increase in organic and multifunctional farms, combining primary production with activities such as agritourism and landscape conservation. Overall, the area represents a rural agricultural system in which extensive production, environmental resources, and the diversification of farm activities are closely interconnected.

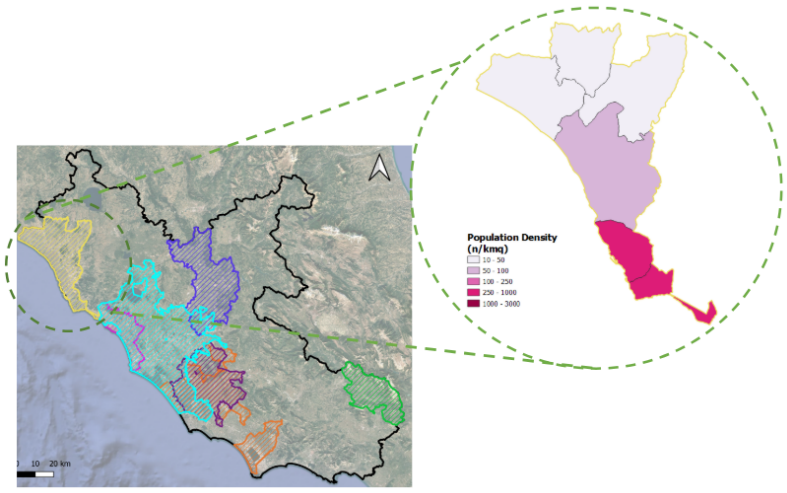


Figure 219 - The Arable farming agroecosystem of the Maremma Laziale

Olive-growing agroecosystem of the Sabina Hills

The Sabine Hills, located between the province of Rieti and the Metropolitan City of Rome, form a predominantly hilly area in which olive cultivation has long represented one of the main agricultural, cultural, and economic resources. The study area extends over 1,132.1 km2 and includes 45 municipalities, with a total population of 287,437 inhabitants and a population density of 254 inhabitants per km2. According to the OECD classification, 69% of the municipalities are rural. Within this territorial context, agriculture continues to play a significant role, employing 10,422 people.

Olive growing in this area has very deep historical roots, dating back to at least the 7th century BC. Over time, it has become a defining feature of the local landscape and of the region's agricultural identity. The production of extra virgin olive oil remains the most distinctive specialization of the area, combining economic importance with strong cultural and historical value.

This long-standing tradition is also reflected in the recognition of Sabina PDO olive oil, which in 1996 became the first extra virgin olive oil in Italy to obtain Protected Designation of Origin (PDO) status. The PDO production area includes 32 municipalities in the province of Rieti and 15 municipalities in the Metropolitan City of Rome, among them Palombara Sabina, Marcellina, Moricone, and Scandriglia. Overall, the Sabine Hills represent a rural olive-growing system in which agricultural production, territorial identity, and quality certification are closely interconnected.

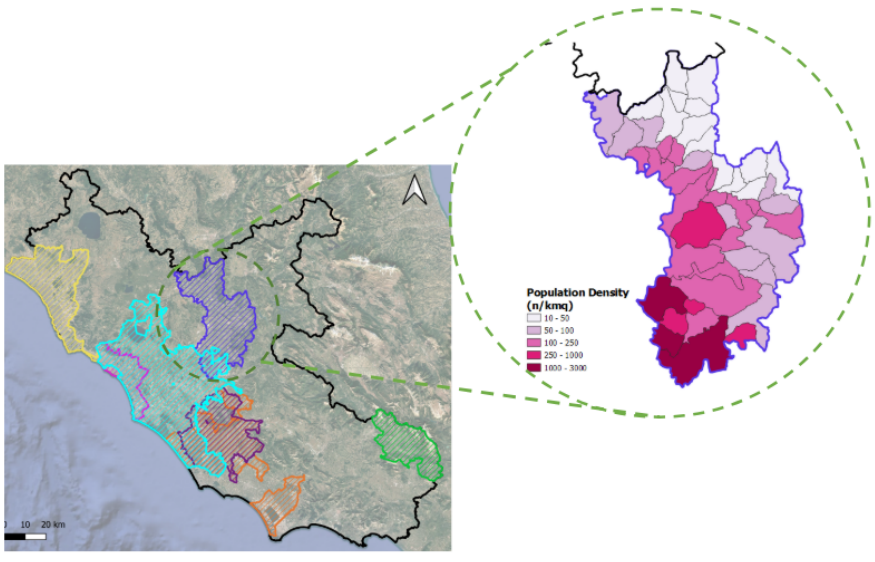


Figure 220 - Olive-growing agroecosystem of the Sabina Hills

Roman horticulture agroecosystem

The coastal strip of the Agro Romano represents one of the main examples of intensive horticulture in the Lazio region. The study area covers 373.8 km2 and includes 45 municipalities, with a total population of 161,309 inhabitants and a population density of 432 inhabitants per km2. According to the OECD classification, none of the municipalities in the area are classified as rural. Despite this predominantly peri-urban profile, agriculture remains present in the local economy, with 2,114 people employed in the agricultural sector.

From a territorial and agronomic perspective, the area is predominantly flat and benefits from a well-developed road infrastructure. Combined with favorable soil and climatic conditions and close proximity to the Roman market, these factors have supported the development of a highly productive and specialized agricultural system. Crop production is mainly oriented toward fast-growing, high-value vegetables, including lettuce, artichokes, fennel, carrots, and other horticultural products with strong commercial relevance.

Production systems are characterized by a marked degree of intensification, based on the targeted use of agricultural inputs, the widespread adoption of drip irrigation, close crop rotations, and, in some cases, successive seasonal cropping. Overall, this area reflects a model of agriculture strongly integrated into urban food markets, where accessibility, specialization, and production efficiency play a central role.

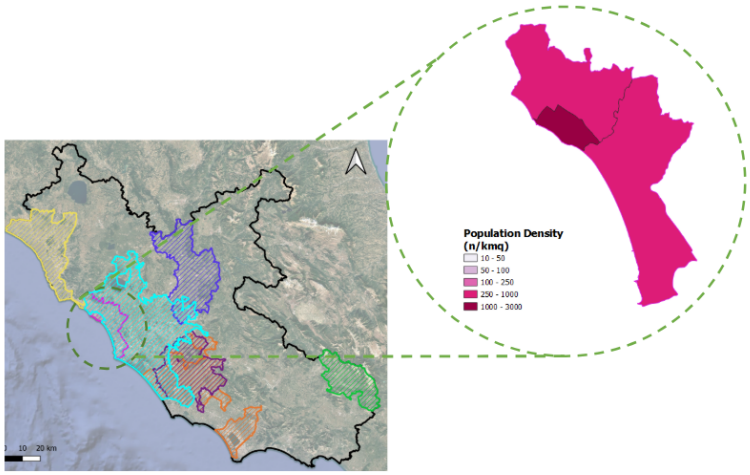


Figure 221 - Roman horticulture agroecosystem

Val di Comino agroecosystem

The Comino Valley is located in the province of Frosinone, in the southeastern part of the Lazio region, close to the Abruzzo Apennines and the Abruzzo, Lazio and Molise National Park. The area extends over 583.2 km2 and is characterized by a low demographic density, with 24,434 inhabitants and 42 inhabitants per km2. According to the OECD classification, 100% of the municipalities in the area are rural. Within this context, agriculture continues to play a relevant role in the local economy, accounting for 1,394 agricultural workers.

From a landscape perspective, the valley is marked by a mosaic of woodlands, pastures, and cultivated land, reflecting a long-established agricultural tradition that remains active. Livestock farming is one of the most deeply rooted and economically significant activities in the area. In

particular, cattle and sheep farming, often managed under extensive systems, is mainly practiced on hilly and mountainous pastures, where traditional husbandry methods contribute to the quality and distinctiveness of local production. Milk production supports an important cheesemaking tradition, including typical products such as marzolina, which has been recognized as a Slow Food Presidium, as well as other cheeses made from goat's and sheep's milk.

Alongside livestock farming, the area also supports the cultivation of cereals and vegetables, which are often marketed through short supply chains. Overall, the Comino Valley represents a predominantly rural agricultural system in which farming activities remain closely linked to local natural resources, traditional knowledge, and territorial identity.

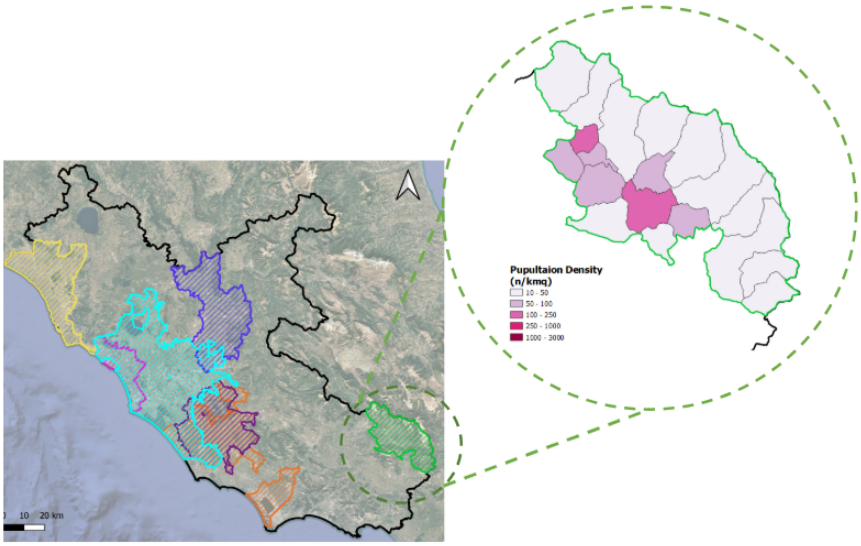


Figure 222 - Val di Comino agroecosystem

Dairy production agroecosystem

The area with the highest concentration of cow milk production is centered on the municipality of Rome and its surrounding towns. The study area covers 2,541.8 km2 and includes 15 municipalities, with a total population of 3,276,229 inhabitants and a population density of 1,289 inhabitants per km2. According to the OECD classification, 27% of the municipalities are rural. Despite the strong urban and peri-urban character of the area, agriculture continues to play a relevant role, with 17,923 people employed in the agricultural sector.

Within this territorial context, the dairy sector benefits from the proximity of the Centrale del Latte di Roma, which allows raw milk to be transported over short distances. This logistical advantage contributes to maintaining product quality and supports the efficiency of the local supply chain. Milk produced in the area is either bottled and marketed through large-scale retail distribution (GDO) or processed into a range of dairy products.

Overall, this area represents a peri-urban dairy production system in which agricultural activity is closely linked to urban demand, processing infrastructure, and short transport distances, all of which contribute to the economic relevance and functional organization of the sector.

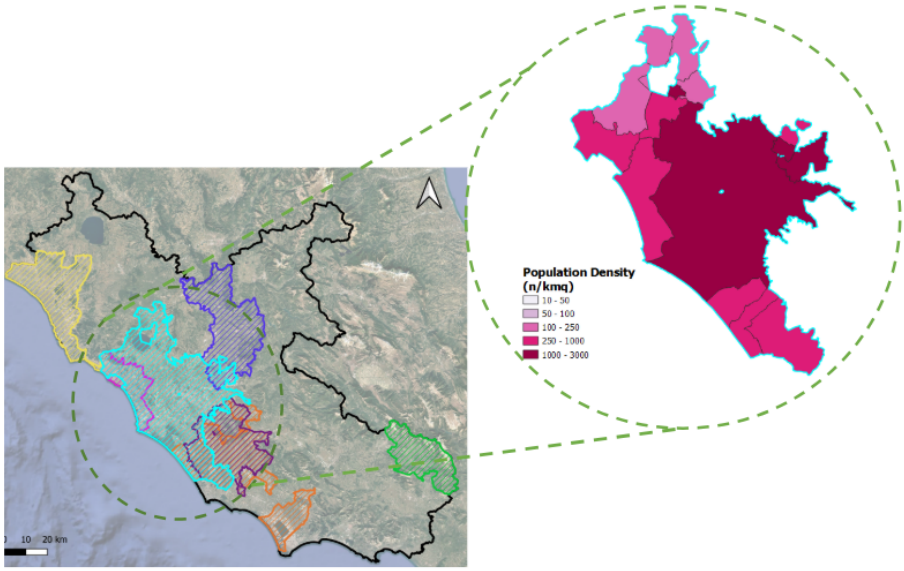


Figure 223 - Dairy production agroecosystem

12.6 Troodos

12.6.1 Key outputs from the pre-typology

The criteria used as dimensions in order to create the farm typology were the following

a. The economic size of the farm
b. Farm type
c. The region where the farm is located
d. The age of the farm manager

The data used for the construction of the typology have been the farm level data provided by the Integrated Administration and Control System (IACS) for year 2020, the latest available.

Economic Size and type of farm
The approach followed was the one agreed by the teams i.e. use the IACS data and to adopt the methodology applied in the Farm Accountancy Data Network (FADN) in order to construct the pre-typology.
The first step in this method is to calculate the Standard Output (SO) that is the monetized value of the produce[138] for each of the different products (crops and/or livestock) of the individual farm. For each product there is a regional coefficient provided by Eurostat which is estimated as the average of a 5-year period per ha cultivated or per head raised.

By multiplying the crop areas and the Livestock Units (LU, see Appendix 12.6.1) managed by the respective regional coefficient and adding the results, the overall economic size of the individual farm is calculated.

The economic sizes classes used in the FADN are shown in Table 37.

[138] It is worth noticing that direct payments under the CAP are not included in the calculations.

Table 37 - Farm classification according to farm size

CLASSES	LIMITS IN €
I	less than 2,000
II	from 2,000 to less than 4,000
III	from 4,000 to less than 8,000
IV	from 8,000 to less than 15,000
V	from 15,000 to less than 25,000
VI	from 25,000 to less than 50,000
VII	from 50,000 to less than 100,000
VIII	from 100,000 to less than 250,000
IX	from 250,000 to less than 500,000
X	from 500,000 to less than 750,000
XI	from 750,000 to less than 1,000,000
XII	from 1,000,000 to less than 1 500,000
XIII	from 1 500,000 to less than 3,000,000
XIV	from 3,000,000

In order to classify the farms according to farm type, we used the standardized methodology developed by the EU-FADN, that is Technical - Economic Orientation (TEO) of the farm. The criterion for this classification is the contribution of each product (crop or animal) in the formation of the total economic size of the farm i.e. the sum of all SOs. If a product or a combination of products accounts for more that $^2/_3$, ,of the total output then this farm is classified as specialist to the specific product or combination.

Dataset: The IACS data at the farm level were provided in two sets, the first included crop data and the second data concerning livestock. These data sets had different codification; hence joint statistical analysis was impossible. The analysis that follows is performed separately for the crop and livestock production.

Crop production

Economic size

The vast majority of the farms in the Troodos area are classified among the first two categories, that is their economic size is less than 4,000 € (Table 38). It is worth noticing that according to the Reg 1091/2018, farms of those sizes are not even included in the population from which the sample for FADN data collection is included hence they are not represented in the statistical results. That explains the decision not to use the FADN data in the Troodos region, since that would mean that 77.6% of the farms would be excluded.

Table 38 - Farms classified according to farm size in the Troodos area

ECONOMIC SIZE CLASSES	N	%
I (<2,000 €)	4,573	56.0
II (2,000 - <4,000)	1,768	21.6
III (4,000 -<8,000)	1,039	12.7
IV (8,000 -<15,000)	437	5.4
V (15,000 -<25,000)	159	1.9
VI (25,000 -<50,000)	126	1.5
VII (50,000 -<100,000)	51	.6
VIII (100,000 -250,000)	12	.1

IX (250,000 -<500,000)	2	.0
Total	8,167	100.0

In order to get an estimate of the natural size of the farms, in relation with their economic size class the Farmland distribution according to economic size was created. One can observe that very small farms, although they account for more than 55% of the farms in the area, they manage a little more than ¼ of farming land with an average of 8 ha per farm. While the relatively very large farms i.e. more than 15,000 € although accounting for less than 5% of the farms, manage more than 30% of the farming area. Hence, an agroecological project cannot stay indifferent for these farms, albeit few.

Table 39 - Farmland distribution according to economic size

ECONOMIC SIZE CLASSES	SUM (HA)		MEAN (HA)	MINIMUM (HA)	MAXIMUM (HA)
I (<2,000 €)	3,678.24	25.9%	0.804	.01	16.58
II (2,000 - <4,000)	2,325.12	16.4%	1.315	0.11	19.62
III (4,000 -<8,000)	2,244.35	15.8%	2.160	0.22	25.90
IV (8,000 -<15,000)	1,783.35	12.6%	4.081	0.31	49.67
V (15,000 -<25,000)	1,213.45	8.5%	7.6320	0.56	59.47
VI (25,000 -<50,000)	1,209.96	8.5%	9.603	0.89	105.84
VII (50,000 -<100,000)	916.01	6.5%	17.961	1.25	137.78
VIII (100,000 -250,000)	695.28	4.9%	57.940	4.55	216.19
IX (250,000 -<500,000)	130.92	0.9%	65.460	25.20	105.72
Total	**14,196.68**		**1.738**	**0.01**	**216.19**

Technical-economic orientations (TEO)

As mentioned above, according to the FADN methodology, in order to define the TEO of a farm was used i.e. if the SO of a specific product or mix of products accounts for more than $^2/_3$ of the overall SO of a specific farm, the farm is classified under the respective TEO.

This method applied in the Troodos area resulted in Classification of farms according to their TEO in Troodos.

Table 40 - Classification of farms according to their TEO in Troodos

TECHNICAL-ECONOMIC ORIENTATION	%
Vineyards	21.7
Fruit	17.5
Permanent & Vegetables	13.2
Olive	11.5
Vegetable	10.1
Mixed Permanent	8.9
Cereals	5.5
Mixed Annual	1.9
Feedstuff	0.6
Root	0.5
Flowers	0.3

The above classification covered the vast majority of the farms in the area (92%) while all other types accounted for smaller proportions of the farms in the area. Farms specialized in permanent crops such as vines, fruit trees, olives and their combination seem to be the prevailing farm types in the Troodos area, accounting more than 60% of the farms.

Furthermore, the distribution of farming land according to the technoeconomic orientation depicts a slightly different image: farms specialized in cereals and annual crops seem to manage a 28.7% of the land although they do not represent more than 7.5% of the farms.

Table 41 - Distribution of land according to farms' Technical-economic orientation

TECHNICAL-ECONOMIC ORIENTATION	MEAN (HA)	N	SUM (HA)	
VINEYARDS	1.469	1,702	2,500.64	18.1%
FRUIT	0.762	1,374	1,046.37	7.6%
PERMANENT & VEGETABLES	1.315	1,034	1,359.71	9.9%
OLIVE	0.787	906	713.12	5.2%
VEGETABLE	1.358	792	1,075.86	7.8%
MIXED PERMANENT	1.257	699	878.45	6.4%
CEREALS	4.749	434	2,061.13	14.9%
MIXED ANNUAL	12.775	149	1,903.43	13.8%
FEEDSTAFF	8.345	48	400.58	2.9%
ROOT	7.016	40	280.63	2.0%
FLOWERS	1.073	24	025.74	0.2%
TOTAL	17.587	7,848	13,802.34	88.7%

Consequently, there is a vast difference among the average area cultivated by the various TEO. Farms oriented towards mixed annual crops and feedstuff, followed by farms dedicated mainly to root crops and cereals seem to cultivate significantly above the average per farmland.

Spatial Distribution

The Troodos 125 communities within the study area, are located within 11 so called “Historic regions” and the distribution of farms in these regions is as presented in Table 42.

Table 42 - Farm distribution to Historical Regions

HISTORIC REGION	N	%
KRASOCHORIA	2,428	29.7
ASINOU	1,217	14.9
KOUMANDARIA	987	12.1
PITSILIA LIMASSOL	750	9.2
PITSILIA NICOSIA	689	8.4
SOLEA	686	8.4
LIMASSOL	456	5.6
MARATHASA	427	5.2
LARNAKA	235	2.9
ORINA THERETRA	209	2.6
NICOSIA	83	1.0
TOTAL	8,167	100.0

From Table 35 one can deduce that more than 50% of the farms are located within three Historical areas, namely Krasochoria, Koumandaria and Asinou, the former two covered predominantly by vineyards while the latter seems to be a more diverse area with olive groves, vegetables etc.

In terms of area covered it seems that Asinou due to the physical size of the farms located in the area covers far larger part of land, than the one the proportion of farms of the area would suggest (Land distribution per Historical region).

Table 43 - Land distribution per Historical region

HISTORICAL REGION	SUM		MEAN	MINIMUM	MAXIMUM
KRASOCHORIA	4,895.89	(34.5%)	20.16	.2	575.2
ASINOU	4,817.66	(33.9%)	39.59	.1	2,161.9
KOUMANDARIA	1,204.44	(8.5%)	12.20	.2	275.3
PITSILIA LIMASSOL	576.16	(4.1%)	7.68	.1	160.2
PITSILIA NICOSIA	490.90	(3.5%)	7.13	.1	116.0
SOLEA	863.67	(6.1%)	12.59	.1	622.1
LIMASSOL	495.66	(3.5%)	10.87	.3	115.7
MARATHASA	262.22	(1.8%)	6.14	.2	98.1
LARNAKA	345.62	(2.4%)	14.71	.2	152.3
ORINA THERETRA	156.81	(1.1%)	7.50	.3	73.9
NICOSIA	087.65	(0.6%)	10.56	.6	113.0
TOTAL	14,196.68		17.38		

Farm manager's age[139]

The distribution of farms according to their manager´s age (Table 44) reveals that almost half of the farm managers are beyond retirement age.

Table 44 - Farm distribution according to farm manager's age group

AGE GROUP	N	%
18_39	426	5.9
40_54	1,204	16.6
55_64	2,096	28.8
65_79	2,808	38.6
80_+	739	10.2
TOTAL OF PERSONS MANAGERS	7,273	100.0
LEGAL ENTITIES	894	
OVERALL TOTAL	8,167	

This of course could have consequences on their ability and/or willingness to adopt innovative practices.

Livestock production

Due to the lack of a common coding system for crop and livestock farms we decided to follow the approach used in the case of crop farms for livestock farms except that the age of the farm manager was not available in the data set used. Furthermore, we decided to treat differently bovine and pig farms due to their very limited number (10 and 5 respectively). Hence, applying the FADN standard methodology sheep and goat, from now on: livestock, farms were classified according to their economic size, their techno-economic orientation and, finally, their spatial distribution in the 11 historical regions.

Economic size

One can see that, in comparison with the crop farms, the distribution of farms oriented towards livestock breeding was much more even (Distribution of Livestock farms per Economic Size). Thus,

[139] It is worth noting that 894 farms or 10.9% of the total of the farms in the area, are run by legal entities and not physical persons.

while in the case of crop farms 90% of the farms were allocated to the three smaller categories, the proportion in the case of livestock farms the respective percentage fell to less than 40%.

Table 45 - Distribution of Livestock farms per Economic Size

Economic Size Classes	N	%
I (<2,000 €)	37	17.6
II (2,000 - <4,000)	18	8.6
III (4,000 -<8,000)	26	12.4
IV (8,000 -<15,000)	19	9.0
V (15,000 -<25,000)	25	11.9
VI (25,000 -<50,000)	22	10.5
VII (50,000 -<100,000)	22	10.5
VIII (100,000 -250,000)	38	18.1
IX (250,000 -<500,000)	3	1.4
Total	210	100.0

While the number of animals bred by the three smaller sized farms constituted less than 2.5% of the total livestock population (Livestock population according to Economic Size). Hence small and very small farms accounted for a very small part of the livestock in the Troodos area.

Table 46 - Livestock population according to Economic Size

Economic Size classes		Sheep	Goats	Total	
I (<2,000 €)	Sum	22	75	97	0.29%
	Mean	2.8	2.9	3.1	
	Minimum	1	1	1	
	Maximum	6	6	6	
II (2,000 - <4,000)	Sum	65	105	170	0.51%
	Mean	7.2	8.1	9.4	
	Minimum	1	1	7	
	Maximum	12	12	13	
III (4,000 -<8,000)	Sum	104	400	504	1.52%
	Mean	9.5	18.2	19.4	
	Minimum	1	8	13	
	Maximum	24	25	25	
IV (8,000 -<15,000)	Sum	242	442	684	2.06%
	Mean	20.2	27.6	36.0	
	Minimum	1	4	27	
	Maximum	47	47	47	
V (15,000 -<25,000)	Sum	376	1228	1604	4.83%
	Mean	41.8	55.8	64.2	
	Minimum	7	22	50	
	Maximum	76	77	77	
VI (25,000 -<50,000)	Sum	992	1467	2459	7.41%
	Mean	66.1	81.5	111.8	
	Minimum	1	34	82	
	Maximum	145	160	160	
VII (50,000 -<100,000)	Sum	1607	3920	5527	16.66%

	Mean	123.6	196.0	251.2	
	Minimum	22	73	167	
	Maximum	274	320	320	
VIII (100,000 -250,000)	Sum	7683	10979	18662	56.24%
	Mean	264.9	354.2	491.1	
	Minimum	2	79	321	
	Maximum	745	755	800	
IX (250,000 -<500,000)	Sum	1223	2252	3475	10.47%
	Mean	407.7	750.7	1158.3	
	Minimum	252	432	832	
	Maximum	571	1031	1602	
Total	Sum	12314	20868	33182	
	Mean	113.0	122.0	162.7	
	Minimum	1	1	1	
	Maximum	745	1031	1602	

Technical-economic Orientation

The prevailing orientation were the specialized in goat breeding farms (Table 47) while even in the cases where mixed systems were encountered the number of goats slightly exceeded that of sheep bred (Table 48). The prevalence of goats is a natural consequence of the mountainous character of the study area.

Table 47 - Distribution of livestock farms per TEO

Technical-economic Orientation	Frequency	%
Sheep	41	20.1
Goat	127	62.3
Mixed Sheep and Goat	36	17.6
Total	204	100.0

Table 48 - Number of Animals per TEO

Technical-economic Orientation		Sheep	Goats	Total
Sheep	Sum	6,165	381	6,546
	Mean	150.4	47.6	159.7
	Minimum	1	1	1
	Maximum	745	155	745
Goat	Sum	939	14,713	15,652
	Mean	29.3	115.9	123.2
	Minimum	1	1	1
	Maximum	252	789	1,041
Mixed Sheep and Goat	Sum	5,210	5,774	10,984
	Mean	144.7	160.4	305.1
	Minimum	2	2	4
	Maximum	571	1,031	1,602
Total	Sum	12,314	20,868	33,182
	Mean	113.0	122.0	162.7

	Minimum	1	1	1
	Maximum	745	1,031	1,602

Spatial Distribution

Finally, examining the spatial distribution of sheep and goats farms and population, the area of Krasochoria, followed by Asinou and in a lesser extent Solea, seem to gather 84.9% and 94.5% of the farms and livestock population respectively (Table 49 & Table 50).

Table 49 - Spatial distribution of livestock farms

Historic Region	N	%
Asinou	29	14.2
Koumandaria	7	3.4
Krasochoria	123	60.3
Larnaka	4	2.0
Limassol	6	2.9
Nicosia	3	1.5
Orina Theretra	2	1.0
Pitsilia Limassol	10	4.9
Pitsilia Nicosia	11	5.4
Solea	9	4.4
Total	204	100.0

Table 50 - Number of Animals per Historical Region

Historical region	Sum		Mean	Minimum	Maximum
Asinou	4,891	14.7%	168.655	1	485
Koumandaria	457	1.4%	65.286	4	253
Krasochoria	24,820	74.8%	201.789	1	1,602
Larnaka	581	1.8%	145.250	22	437
Limassol	86	0.3%	14.333	4	27
Nicosia	87	0.3%	29.000	12	40
Orina Theretra	6	0.0%	3.000	2	4
Pitsilia Limassol	351	1.1%	35.100	4	183
Pitsilia Nicosia	229	0.7%	20.818	1	65
Solea	1,674	5.0%	186.000	1	588
Total	33,182		162.657	1	1,602

An attempt to construct a typology for Troodos

Crop production

Plotting the two main dimensions of the proposed typology i.e. the farm economic size and the Technical-economic orientation (Table 51) one can see some patterns emerging, that could be useful for the design of the next steps of the research. In the case of olive groves and the cereals, the bulk of the farms are classified among the smallest size categories. Vineyards, fruit, mixed permanent and permanent & vegetables are more evenly distributed between the three smaller categories (I (<2,000 €), II (2,000 - <4,000 €), III (4,000 -<8,000 €) while for other TEOs e.g. Vegetables, fruit & vegetables and mixed annual crops the distribution spread across the different economic size classes.

Table 51 - Crop farm distribution according to their TEO and Economic size

Techno-economic orientation	Economic Size classes								
	I	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VIII*	*IX*
Vineyards	842	440	274	99	25	13	7	2	0
	49.5%	25.9%	16.1%	5.8%	1.5%	,8%	,4%	,1%	0.0%
Fruit	626	433	209	86	13	6	1	0	0
	45.6%	31.5%	15.2%	6.3%	,9%	,4%	,1%	0.0%	0.0%
Permanent & Vegetables	410	321	185	81	24	11	2	0	0
	39.7%	31.0%	17.9%	7.8%	2.3%	1.1%	,2%	0.0%	0.0%
Olive	888	16	1	0	1	0	0	0	0
	98.0%	1.8%	,1%	0.0%	,1%	0.0%	0.0%	0.0%	0.0%
Vegetables	158	226	170	74	59	69	31	5	0
	19.9%	28.5%	21.5%	9.3%	7.4%	8.7%	3.9%	,6%	0.0%
Mixed Permanent	354	207	98	32	7	1	0	0	0
	50.6%	29.6%	14.0%	4.6%	1.0%	,1%	0.0%	0.0%	0.0%
Cereals	348	48	21	7	5	4	1	0	0
	80.2%	11.1%	4.8%	1.6%	1.2%	,9%	,2%	0.0%	0.0%
Fruit and Vegetables	25	63	51	39	14	7	2	0	0
	12.4%	31.3%	25.4%	19.4%	7.0%	3.5%	1.0%	0.0%	0.0%
Mixed Annual	27	32	34	15	13	17	7	2	2
	18.1%	21.5%	22.8%	10.1%	8.7%	11.4%	4.7%	1.3%	1.3%
Feedstuff	20	6	7	5	5	1	1	1	0
	43.5%	13.0%	15.2%	10.9%	10.9%	2.2%	2.2%	2.2%	0.0%
Root	8	13	9	4	2	1	2	0	1
	20.0%	32.5%	22.5%	10.0%	5.0%	2.5%	5.0%	0.0%	2.5%
Flowers	0	1	11	4	3	3	1	1	0
	0.0%	4.2%	45.8%	16.7%	12.5%	12.5%	4.2%	4.2%	0.0%
Total	**4254**	**1768**	**1039**	**437**	**159**	**126**	**51**	**12**	**2**
	54.2%	**22.5%**	**13.2%**	**5.6%**	**2.0%**	**1.6%**	**,6%**	**,2%**	**,0%**

In order to facilitate the stratification of the sampling procedure; Table 52 and Table 53 show the distribution of technical-economic orientations across historical regions.

Table 52 - Crop Farm distribution according to their TEO and the area located

Technical-economic orientation	Historical region										
	Asinou	Koumandaria	Krasochoria	Larnaka	Limassol	Nicosia	Marathasa	Orina Theretra	Pitsilia Limassol	Pitsilia Nicosia	Solea
VINEYARDS	41	395	794	8	10	9	30	58	107	231	19
	2.4%	23.2%	46.7%	,5%	,6%	,5%	1.8%	3.4%	6.3%	13.6%	1.1%
FRUIT	114	68	144	23	46	8	281	88	358	68	176
	8.3%	4.9%	10.5%	1.7%	3.3%	,6%	20.5%	6.4%	26.1%	4.9%	12.8%
PERMANENT & VEGETABLES	167	185	150	32	32	11	37	33	181	138	68
	16.2%	17.9%	14.5%	3.1%	3.1%	1.1%	3.6%	3.2%	17.5%	13.3%	6.6%
OLIVE	184	90	229	54	78	15	22	7	8	49	170
	20.3%	9.9%	25.3%	6.0%	8.6%	1.7%	2.4%	,8%	,9%	5.4%	18.8%
VEGETABLES	147	88	118	70	77	17	34	12	32	102	95
	18.6%	11.1%	14.9%	8.8%	9.7%	2.1%	4.3%	1.5%	4.0%	12.9%	12.0%
MIXED PERMANENT	119	125	117	13	14	10	22	26	130	86	37
	17.0%	17.9%	16.7%	1.9%	2.0%	1.4%	3.1%	3.7%	18.6%	12.3%	5.3%
CEREALS	210	4	185	0	2	1	0	0	0	12	20
	48.4%	,9%	42.6%	0.0%	,5%	,2%	0.0%	0.0%	0.0%	2.8%	4.6%
FRUIT & VEGETABLES	38	17	13	13	11	1	14	5	55	14	20
	18.9%	8.5%	6.5%	6.5%	5.5%	,5%	7.0%	2.5%	27.4%	7.0%	10.0%
MIXED ANNUAL	93	3	21	0	1	1	1	1	2	6	20
	62.4%	2.0%	14.1%	0.0%	,7%	,7%	,7%	,7%	1.3%	4.0%	13.4%
FEEDSTAFF	17	0	23	0	2	0	0	0	0	0	4
	37.0%	0.0%	50.0%	0.0%	4.3%	0.0%	0.0%	0.0%	0.0%	0.0%	8.7%
ROOT	26	1	0	0	0	0	1	1	1	2	8
	65.0%	2.5%	0.0%	0.0%	0.0%	0.0%	2.5%	2.5%	2.5%	5.0%	20.0%
FLOWERS	1	1	1	0	0	0	1	0	20	0	0
	4.2%	4.2%	4.2%	0.0%	0.0%	0.0%	4.2%	0.0%	83.3%	0.0%	0.0%
TOTAL	**1160**	**971**	**2237**	**226**	**445**	**78**	**423**	**207**	**744**	**683**	**674**
	14.8%	**12.4%**	**28.5%**	**2.9%**	**5.7%**	**1.0%**	**5.4%**	**2.6%**	**9.5%**	**8.7%**	**8.6%**

Table 53 - Crop Farm distribution according to their TEO and managers' age

Technical-economic orientation	Age group (EXCLUDING OVER 80 YEARS OLD)					Total	
	Company	18_39	40_54	55_64	65_79		
VINEYARDS	61	102	295	520	576	1554	21.8%
	3.9%	6.6%	19.0%	33.5%	37.1%	100.0%	
FRUIT	101	49	191	338	536	1215	17.0%
	8.3%	4.0%	15.7%	27.8%	44.1%	100.0%	
PERMANENT & VEGETABLES	83	46	131	267	403	930	13.0%
	8.9%	4.9%	14.1%	28.7%	43.3%	100.0%	
OLIVE	157	18	117	218	318	828	11.6%
	19.0%	2.2%	14.1%	26.3%	38.4%	100.0%	
VEGETABLES	172	33	93	155	264	717	10.0%
	24.0%	4.6%	13.0%	21.6%	36.8%	100.0%	
MIXED PERMANENT	41	29	92	182	288	632	8.9%
	6.5%	4.6%	14.6%	28.8%	45.6%	100.0%	
CEREALS	18	66	73	126	118	401	5.6%
	4.5%	16.5%	18.2%	31.4%	29.4%	100.0%	
FRUIT & VEGETABLES	28	9	20	47	73	177	2.5%
	15.8%	5.1%	11.3%	26.6%	41.2%	100.0%	
MIXED ANNUAL	4	17	27	35	56	139	1.9%
	2.9%	12.2%	19.4%	25.2%	40.3%	100.0%	
FEEDSTAFF	5	9	6	15	10	45	0.6%
	11.1%	20.0%	13.3%	33.3%	22.2%	100.0%	
ROOT	1	0	5	10	21	37	0.5%
	2.7%	0.0%	13.5%	27.0%	56.8%	100.0%	
FLOWERS	2	1	8	4	9	24	0.3%
	8.3%	4.2%	33.3%	16.7%	37.5%	100.0%	
TOTAL	**862**	**407**	**1151**	**2011**	**2704**	**7135**	
	12.1%	**5.7%**	**16.1%**	**28.2%**	**37.9%**	**100.0%**	

Finally, following the same procedure was followed for the sheep and goats farms of the area (Table 54).

Table 54 - Livestock farms' distribution according to TEO and Economic Size

TECHNO-ECONOMIC ORIENTATION	Economic Size classes								
	I	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VIII*	*IX*
Sheep	5	6	4	5	4	5	3	9	0
	12.2 %	14.6 %	9.8%	12.2 %	9.8%	12.2 %	7.3%	22.0 %	0.0%
Goat	24	11	21	10	18	11	13	18	1
	18.9 %	8.7%	16.5 %	7.9%	14.2 %	8.7%	10.2 %	14.2 %	,8%
Mixed	2	1	1	4	3	6	6	11	2
	5.6%	2.8%	2.8%	11.1 %	8.3%	16.7 %	16.7 %	30.6 %	5.6%
Total	31	18	26	19	25	22	22	38	3
	15.2 %	8.8%	12.7 %	9.3%	12.3 %	10.8 %	10.8 %	18.6 %	1.5%

For the facilitation of the sample selection procedure the following frame (Table 55) was constructed.

Table 55 - Livestock farms' distribution according to TEO and location

TECHNO-ECONOMIC ORIENTATION	Historical Region									
	Asinou	Koumandaria	Krasochoria	Larnaka	Limassol	Nicosia	Orina Theretra	Pitsilia Limassol	Pitsilia Nicosia	Solea
Sheep	4	2	30	0	0	0	0	1	1	3
	9.8%	4.9%	73.2%	0.0%	0.0%	0.0%	0.0%	2.4%	2.4%	7.3%
Goat	17	4	69	4	5	3	2	8	10	5
	13.4%	3.1%	54.3%	3.1%	3.9%	2.4%	1.6%	6.3%	7.9%	3.9%
Mixed	8	1	24	0	1	0	0	1	0	1
	22.2%	2.8%	66.7%	0.0%	2.8%	0.0%	0.0%	2.8%	0.0%	2.8%
Total	**29**	**7**	**123**	**4**	**6**	**3**	**2**	**10**	**11**	**9**
	14.2%	**3.4%**	**60.3%**	**2.0%**	**2.9%**	**1.5%**	**1.0%**	**4.9%**	**5.4%**	**4.4%**

Limitations and sampling adjustments

Table 56 presents the distribution of farm size and the number of holdings across different age groups of farm managers.

Table 56 - Farm size (surface) and number of farms per farmers' age

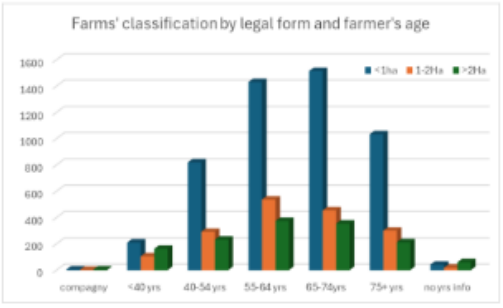
	Farms								Surface							
categories	No	compagny	<40 yrs	40-54 yrs	55-64 yrs	65-74yrs	75+ yrs	no info	No	compagny	<40 yrs	40-54 yrs	55-64 yrs	65-74yrs	75+ yrs	no info
<1ha	5.058	6	210	820	1.431	1.515	1.034	42	2.567,1	4,3	103,7	426,0	729,4	751,7	532,7	19,4
1-2Ha	1.709	3	105	292	537	454	300	18	2.416,2	3,9	149,4	417,6	755,9	643,9	421,3	24,2
>2Ha	1.400	6	162	232	374	354	212	60	9.213,5	50,2	1.209,3	1.574,0	2.384,3	1.784,7	1.308,2	902,9
total	**8.167**	**15**	**477**	**1.344**	**2.342**	**2.323**	**1.546**	**120**	**14.196,7**	**58,4**	**1.462,3**	**2.417,5**	**3.869,5**	**3.180,3**	**2.262,2**	**946,5**

	Farms (%)								Surface (%)							
categories	No	compagny	<40 yrs	40-54 yrs	55-64 yrs	65-74yrs	75+ yrs	no info	No	compagny	<40 yrs	40-54 yrs	55-64 yrs	65-74yrs	75+ yrs	no info
<1ha	*62*	*40,0*	*44,0*	*61,0*	*61,1*	*65,2*	*66,9*	*35,0*	*18,1*	*7,4*	*7,1*	*17,6*	*18,8*	*23,6*	*23,5*	*2,0*
1-2Ha	*21*	*20,0*	*22,0*	*21,7*	*22,9*	*19,5*	*19,4*	*15,0*	*17,0*	*6,7*	*10,2*	*17,3*	*19,5*	*20,2*	*18,6*	*2,6*
>2Ha	*17*	*40,0*	*34,0*	*17,3*	*16,0*	*15,2*	*13,7*	*50,0*	*64,9*	*85,9*	*82,7*	*65,1*	*61,6*	*56,1*	*57,8*	*95,4*
total	**100**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**

	Farms								Surface (ha)							
categories	No	compagny	<40 yrs	40-54 yrs	55-64 yrs	65-74yrs		75+ yrs	No	compagny	<40 yrs	40-54 yrs	55-64 yrs	65-74yrs		75+ yrs
<1ha	5.058	6	210	820	1.431	1.515	1.034	42	2.567,1	4,3	103,7	426,0	729,4	751,7	532,7	19,4
1-2,5 Ha	2.060	3	134	349	636	545	373	20	3.195,1	3,9	213,8	543,3	976,8	844,9	583,9	28,5
>2,5 Ha	1.049	6	133	175	275	263	139	58	8.434,5	50,2	1.144,8	1.448,3	2.163,4	1.583,8	1.145,6	898,5
total	**8.167**	**15**	**477**	**1.344**	**2.342**	**2.323**	**1.546**	**120**	**14.196,7**	**58,4**	**1.462,3**	**2.417,5**	**3.869,5**	**3.180,3**	**2.262,2**	**946,4**

	Farms (%)								Surface (%)							
categories	No	compagny	<40 yrs	40-54 yrs	55-64 yrs	65-74yrs	75+ yrs	no info	No	compagny	<40 yrs	40-54 yrs	55-64 yrs	65-74yrs	75+ yrs	no info
<1ha	*62*	*40*	*44*	*61*	*61*	*65*	*67*	*35*	*18*	*7*	*7*	*18*	*19*	*24*	*24*	*2*
1-2,5 Ha	*25*	*20*	*28*	*26*	*27*	*23*	*24*	*17*	*23*	*7*	*15*	*22*	*25*	*27*	*26*	*3*
>2,5 Ha	*13*	*40*	*28*	*13*	*12*	*11*	*9*	*48*	*59*	*86*	*78*	*60*	*56*	*50*	*51*	*95*
total	***100***	***100***	***100***	***100***	***100***	***100***	***100***	***100***	***100***	***100***	***100***	***100***	***100***	***100***	***100***	***100***

Number of farms | Total farm surface



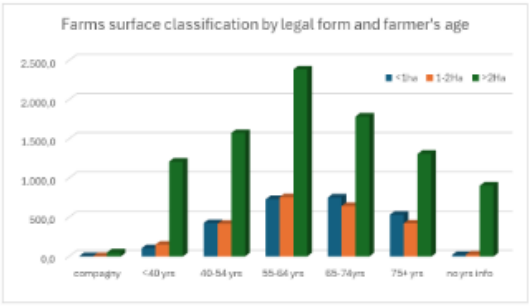


Table 57 and Table 58 show the estimated spatial distribution of the farm population sample across regions and age-groups.

Table 57 - Crop sample

1	Vegetables		147	88	118	70	77	17	34	12	32	102	95		12
			18.6%	*11.1%*	*14.9%*	*8.8%*	*9.7%*	*2.1%*	*4.3%*	*1.5%*	*4.0%*	*12.9%*	*12.0%*		
			0	1	1	2	2	0	1	1	2	1	1	12	
	company									1	1			*2*	
	18-39			1		1	1				1	1		*5*	
	40-54				1	1	1							*3*	
	55-64								1				1	*2*	
	total		0	1	1	2	2	0	1	1	2	1	1	12	
2	Fruit		114	68	144	23	46	8	281	88	358	68	176		14
			8.3%	*4.9%*	*10.5%*	*1.7%*	*3.3%*	*0.6%*	*20.5%*	*6.4%*	*26.1%*	*4.9%*	*12.8%*		
			0	0	1	1	0	0	2	1	6	1	2	14	
	company								1		2			*3*	
	18-39		0		0	1				1	3		1	*6*	

	40-54								1		1		1	3	
	55-64			0	1							1		2	
	total		0	0	1	1	0	0	2	1	6	1	2	14	
3	Fruit & Vegetables		38	17	13	13	11	1	14	5	55	14	20		10
			18.9%	*8.5%*	*6.5%*	*6.5%*	*5.5%*	*0.5%*	*7.0%*	*2.5%*	*27.4%*	*7.0%*	*10.0%*		
			0	0	1	2	1	0	1	0	4	1	0	10	
	company								1		1			2	
	18-39										2	1		3	
	40-54					2	1							3	
	55-64				1						1			2	
	total		0	0	1	2	1	0	1	0	4	1	0	10	
4	Permanent & Vegetables		167	185	150	32	32	11	37	33	181	138	68		12
			16.2%	*17.9%*	*14.5%*	*3.1%*	*3.1%*	*1.1%*	*3.6%*	*3.2%*	*17.5%*	*13.3%*	*6.6%*		
				2	1	2	1	0	0	0	3	2	1	12	
	company					1					1			2	
	18-39					1					2	2		5	
	40-54			1	1		1							3	
	55-64			1									1	2	
	total		0	2	1	2	1	0	0	0	3	2	1	12	
5	Mixed Permanent		119	125	117	13	14	10	22	26	130	86	37		10
			17.0%	*17.9%*	*16.7%*	*1.9%*	*2.0%*	*1.4%*	*3.1%*	*3.7%*	*18.6%*	*12.3%*	*5.3%*		
			0	3	4	0	0	0	0	0	2	1	0	10	
	company			1							1			2	
	18-39			1	1						1			3	
	40-54			1	2									3	
	55-64				1							1		2	
	total		0	3	4	0	0	0	0	0	2	1	0	10	
6	Flowers		1	1	1	0	0	0	1	0	20	0	0		7
			4.2%	*4.2%*	*4.2%*	*0.0%*	*0.0%*	*0.0%*	*4.2%*	*0.0%*	*83.3%*	*0.0%*	*0.0%*		
			0	0	0	0	0	0	0	0	7	0	0	7	
	company										1			1	
	18-39										2			2	
	40-54										2			2	
	55-64										2			2	
	total		0	0	0	0	0	0	0	0	7	0	0	7	
7	Vineyards		41	395	794	8	10	9	30	58	107	231	19		14
			2.4%	*23.2%*	*46.7%*	*0.5%*	*0.6%*	*0.5%*	*1.8%*	*3.4%*	*6.3%*	*13.6%*	*1.1%*		
			0	3	7	0	0	0	1	0	1	2	0	14	

	company			1	2								3	
	18-39			1	3				1		1		6	
	40-54			1	1							1	3	
	55-64				1							1	2	
	total	0	3	7	0	0	0	1	0	1	2	0	14	
	Olive	184	90	229	54	78	15	22	7	8	49	170		12
		20.3%	*9.9%*	*25.3%*	*6.0%*	*8.6%*	*1.7%*	*2.4%*	*0.8%*	*0.9%*	*5.4%*	*18.8%*		
8		3	2	3	0	1	0	0	0	0	0	3	12	
	company	1										2	3	
	18-39		1	1		1						1	4	
	40-54	1	1	1									3	
	55-64	1		1									2	
	total	3	2	3	0	1	0	0	0	0	0	3	12	
	Cereals	210	4	185	0	2	1	0	0	0	12	20		10
		48.4%	*0.9%*	*42.6%*	*0.0%*	*0.5%*	*0.2%*	*0.0%*	*0.0%*	*0.0%*	*2.8%*	*4.6%*		
9		5	0	4	0	0	0	0	0	0	0	1	10	
	company	1		1									2	
	18-39	1		2									3	
	40-54	2		1									3	
	55-64	1										1	2	
	total	5	0	4	0	0	0	0	0	0	0	1	10	
	Mixed Annual	93	3	21	0	1	1	1	1	2	6	20		9
		62.4%	*2.0%*	*14.1%*	*0.0%*	*0.7%*	*0.7%*	*0.7%*	*0.7%*	*1.3%*	*4.0%*	*13.4%*		
10		3	0	5	0	0	0	0	0	0	0	1	9	
	company			1									1	
	18-39	1		2									3	
	40-54	1		1								1	3	
	55-64	1		1									2	
	total	3	0	5	0	0	0	0	0	0	0	1	9	
	Feedstuff	17	0	23	0	2	0	0	0	0	0	4		5
		37.0%	*0.0%*	*50.0%*	*0.0%*	*4.3%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*8.7%*		
11		1	0	4	0	0	0	0	0	0	0	0	5	
	company			1									1	
	18-39			2									2	
	40-54	1											1	
	55-64			1									1	
	total	1	0	4	0	0	0	0	0	0	0	0	5	
	Root	26	1	0	0	0	0	1	1	1	2	8		7

1 2		*65.0%*	*2.5%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*2.5%*	*2.5%*	*2.5%*	*5.0%*	*20.0%*		
		5	0	0	0	0	0	0	0	0	0	2	7	
	company	1										1	*2*	
	18-39	2											*2*	
	40-54	1										1	*2*	
	55-64	1											*1*	
	total	5	0	0	0	0	0	0	0	0	0	2	7	
	Total	1160	971	2237	226	445	78	423	207	744	683	674		122
		14.8%	*12.4%*	*28.5%*	*2.9%*	*5.7%*	*1.0%*	*5.4%*	*2.6%*	*9.5%*	*8.7%*	*8.6%*		
		17	11	31	7	5	0	5	2	25	8	11	122	
	company	3	2	5	1	0	0	2	1	7	0	3	*24*	
	18-39	4	4	11	3	2	0	1	1	12	4	2	*44*	
	40-54	6	4	8	3	3	0	1	0	3	1	3	*32*	
	55-64	4	1	7	0	0	0	1	0	3	3	3	*22*	
	total	17	11	31	7	5	0	5	2	25	8	11	122	

Table 58 - Livestock sample

TECHNO-ECONOMIC ORIENTATION		Historical Region										
	TOTAL	Asinou	Koumandaria	Krasochoria	Larnaka	Limassol	Nicosia	Orina Theretra	Pitsilia Limassol	Pitsilia Nicosia	Solea	SAMPLE
Sheep	41	4	2	30	0	0	0	0	1	1	3	3
		9.80 %	4.90 %	73.20 %	0.00 %	0.00 %	0.00 %	0.00 %	2.40 %	2.40 %	7.30 %	
		1	0	2	0	0	0	0	0	0	0	3
	18-39			1								1
	40-54			1								1
	55-64	1										1
	total	1	0	2	0	0	0	0	0	0	0	3
Goat	127	17	4	69	4	5	3	2	8	10	5	9
		13.40 %	3.10 %	54.30 %	3.10 %	3.90 %	2.40 %	1.60 %	6.30 %	7.90 %	3.90 %	
		1	0	5	0		0	0	1	1	1	9
	18-39			3								3
	40-54	1		1						1	1	4
	55-64			1					1			2
	total	1	0	5	0	0	0	0	1	1	1	9
Mixed	36	8	1	24	0	1	0	0	1	0	1	3
		22.20 %	2.80 %	66.70 %	0.00 %	2.80 %	0.00 %	0.00 %	2.80 %	0.00 %	2.80 %	
		1	0	2	0	0	0	0	0	0	0	3

	18-39	1		1								2	
	40-54			1								1	
	55-64											0	
	total	1	0	2	0	0	0	0	0	0	0	3	
Total	204	29	7	123	4	6	3	2	10	11	9		15
		14.20 %	3.40 %	60.30 %	2.00 %	2.90 %	1.50 %	1.00 %	4.90 %	5.40 %	4.40 %		
		3	0	9	0	0	0	0	1	1	1	15	
	18-39	1	0	5	0	0	0	0	0	0	0	6	
	40-54	1	0	3	0	0	0	0	0	1	1	6	
	55-64	1	0	1	0	0	0	0	1	0	0	3	
	total	3	0	9	0	0	0	0	1	1	1	15	

Table 59 - Crop final sample per type (TEO) and age

Techno-economic orientation	Company	18_39	40_54	55_64	total	
Vegetables	2	5	3	2	**12**	
Fruit	3	6	3	2	**14**	
Fruit & Vegetables	2	3	3	2	**10**	
Permanent & Vegetables	2	5	3	2	**12**	
Mixed Permanent	2	3	3	2	**10**	
Flowers	1	2	2	2	**7**	65
Vineyards	3	6	3	2	**14**	
Olive	3	4	3	2	**12**	26
Cereals	2	3	3	2	**10**	
Mixed Annual	1	3	3	2	**9**	
Feedstaff	1	2	1	1	**5**	
Root	2	2	2	1	**7**	31
Total	**24**	**44**	**32**	**22**	**122**	

Table 60 - Estimated spatial distribution of the farm population sample across regions and age-groups

Historical region	Crop farms	Compagny	age: 18-39	age: 40-54	age: 55-64	Livestock farms
Asinou	17	3	4	6	4	3
Koumandaria	11	2	4	4	1	0
Krasochoria	31	5	11	8	7	9
Larnaka	7	1	3	3	0	0
Limassol	5	0	2	3	0	0
Nicosia	0	0	0	0	0	0
Marathasa	5	2	1	1	1	0
Orina Theretra	2	1	1	0	0	0
Pitsilia Limassol	25	7	12	3	3	1
Pitsilia Nicosia	8	0	4	1	3	1
Solea	11	3	2	3	3	1
Total	**122**	**24**	**44**	**32**	**22**	**15**

Table 61 - Farms per Community and Historical Region

Historical region	Community	Crop farms	Livestock farms
Asinou	Agia Marina Xyliatou	102	7
	Agios Georgios Kafkalou	139	2
	Vyzakia	108	3
	Kato Koutrafas	125	7
	Nikitari	171	5
	Xyliatos	150	
	Orounta	220	3
	Pano Koutafas	42	
	Potami	160	3
Koumandaria	Agios Georgios	43	1
	Agios Konstantinos	62	
	Agios Mamas	127	
	Agios Pavlos	29	1
	Apsiou	69	3
	Gerasa	48	
	Doros	48	1
	Zoopigi	65	
	Koro Chorio	154	
	Kapilio	61	
	Laneia	62	
	Louvaras	73	
	Monagri	45	1
	Silicone	101	

Krasochoria	Agios Ambrosios	61	6
	Agios Therapon	104	4
	Alassa	25	7
	Apesia	103	4
	Arsos Limassol	74	1
	Vasa Kilaniou	78	1
	Vouni	88	
	Gerovasa	18	
	Dora	91	17
	Kato Kivides	16	10
	Kissousa	16	1
	Koilani	155	1
	Korfi	46	5
	Kouka	7	
	Limnatis	201	1
	Lofou	43	3
	Mathikoloni	66	
	Malia	30	3
	Omodos	128	
	Pano Kivides	134	5
	Paramytha	117	7
	Pachna	417	35
	Pera Pedi	19	
	Potami	32	2
	Suni	108	4
	Spitali	45	1
	Trimiklini	51	
	Limassol Fasoula	155	4
Larnaka	Agioi Vavatsinias	72	
	Vavatsinia	45	1
	Melini	60	1
	Odou	58	2
Limassol	Arakapas	141	2
	Pieron	48	
	Eptagonia	103	1
	Kellaki	58	
	Prastio Kellakiou	35	
	Sanida	34	
	Sykoptetra	37	2
Nicosia	Agios Epiphanios Orinis	83	3
Marathasa	Agios Dimitrios	24	
	Gerakies	24	
	Kalopanagiotis	93	
	Kaminoria	12	
	Kampos	44	
	Lemithos	20	
	Moutoullas	31	

	Milikouri	5	
	Oikos	10	
	Palaiomylos	23	
	Pedoulas	30	
	Prodromos	47	
	Tris Elies	18	
	Tsakistra	46	
Orina Theretra	Kato Platres	39	
	Mandria Limassol	83	
	Moniatis	24	1
	Pano Platres	8	
	Foeni	55	1
Pitsilia Limassol	Agios Theodoros	43	1
	Agios Ioannis	54	1
	Agridia	54	
	Agros	125	5
	Asbestos	27	
	Dymes	105	
	Kato Mylos	36	
	Kyperounta	87	
	Pelendri	159	3
	Potamitissa	46	
	Chandria	14	
Pitsilia Nicosia	Alithinou	4	
	Alona	58	
	Apliki Orinis	5	
	Askas	61	
	Gurri	61	
	Kampi	26	
	Lagoudera	38	1
	Lazanias	5	
	Livadia Nicosia	16	1
	Palaichori Morphou	31	
	Palaichori Orinis	106	2
	Platanistasa	66	1
	Polystypos	21	
	Sarandi	32	
	Farmakas	88	3
	Fikardou	35	
	Fterikoudi	36	3
Solea	Ag. Epifanios Soleas	22	
	Ag. Theodoros Soleas	35	
	Agia Irene Nicosia	19	
	Galata	32	
	Evrychou	114	3
	Kakopetria	28	
	Kaliana	44	
	Katahydra	58	2

	Korakou	71	
	Linou	56	
	Sinaoros	3	
	Spilia	38	
	Temvria	50	1
	Flassou	92	2
	Kannabia	24	1

Table 62 - Coefficients for the calculation of Livestock Units per species and age/size of animal[140]

Type of animal	Characteristic of animal	Coefficient
Bovine animals	Less than 1 year old	0,400
	1 to less than 2 years old	0,700
	Male, 2 years old and over	1,000
	Heifers, 2 years old and over	0,800
	Dairy cows	1,000
	Non-dairy cows	0,800
Sheep and goats		0,100
Pigs	Piglets, live weight of under 20 kg	0,027
	Breeding sows, live weight 50 kg and over	0,500
	Other pigs	0,300
Poultry	Broilers	0,007
	Laying hens	0,014
	Other poultry	
	Turkeys	0,030
	Ducks	0,010
	Geese	0,020
	Ostriches	0,350
	Other poultry fowls n.e.c.	0,001
Rabbits, breeding females		0,020

[140] REGULATION (EU) 2018/1091 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 18 July 2018 on integrated farm statistics and repealing Regulations (EC) No 1166/2008 and (EU) No 1337/2011

12.7 Methods for developing farming system typologies - review

This appendix documents the narrative review of farming-system classifications introduced in Section 10.1. A *Web of Science* search combining the keyword groups (“farming system*” OR “farm system*” OR “agricultural system*” OR agroecosystem*) AND (classification OR typology OR typologies OR categorization) AND (Europe OR “European Union” OR EU) returned 246 records. After screening against a grid covering (1) the conceptualization of farming systems, (2) data and indicators, (3) classification methodology, and (4) usefulness for policy and sustainability assessment, a subset of 20 papers was retained. The 20 selected papers are listed below, and their review attributes are summarized in the table that follows.

Selection of papers

1. Aldezabal, A; Pardo, I; Garmendia, E; del Prado, A; Pardo, G (2026). Integrating grassland typification, species identity-based agroecological and environmental indicators to improve livestock production system assessment. Agricultural Systems. https://doi.org/10.1016/j.agsy.2026.104715
2. Tsiligiridis, T; Ainali, K (2025). Integrating Statistical and Earth AgriData in Small Farming Systems for Food Security. Agriengineering. https://doi.org/10.3390/agriengineering7030054
3. Ayala, MC; Groot, JCJ; Kilcline, K; Grace, C; Kennedy, J; Moran, B; de Boer, IJM; Ripoll-Bosch, R (2024). Characterizing beef and sheep farming systems to customize sustainability interventions and policy implementation. Journal Of Environmental Management. https://doi.org/10.1016/j.jenvman.2024.121900
4. Václavík, T; Beckmann, M; Bednár, M; Brdar, S; Breckenridge, G; Cord, AF; Domingo-Marimon, C; Gosal, A; Langerwisch, F; Paulus, A; Roilo, S; Sarapatka, B; Ziv, G; Cejka, T (2024). Farming system archetypes help explain the uptake of agri-environment practices in Europe. Environmental Research Letters. https://doi.org/10.1088/1748-9326/ad4efa
5. Rubio-Delgado, J; Schnabel, S; Lavado-Contador, JF; Schmutz, U (2024). Small woody features in agricultural areas: Agroforestry systems of overlooked significance in Europe. Agricultural Systems. https://doi.org/10.1016/j.agsy.2024.103973
6. Gobin, A; Van Herzele, A (2023). A Data-Driven Farm Typology as a Basis for Agricultural Land Use Decisions. Land. https://doi.org/10.3390/land12112032
7. Beckmann, M; Didenko, G; Bullock, JM; Cord, AF; Paulus, A; Ziv, G; Václavík, T (2022). Archetypes of agri-environmental potential: a multi-scale typology for spatial stratification and upscaling in Europe. Environmental Research Letters. https://doi.org/10.1088/1748-9326/ac9cf5
8. Escribano, M; Horrillo, A; Mesías, FJ (2022). Greenhouse gas emissions and carbon sequestration in organic dehesa livestock farms. Does technical-economic management matters?. Journal Of Cleaner Production. https://doi.org/10.1016/j.jclepro.2022.133779
9. Pacheco-Romero, M; Kuemmerle, T; Levers, C; Alcaraz-Segura, D; Cabello, J (2021). Integrating inductive and deductive analysis to identify and characterize archetypical social-ecological systems and their changes. Landscape And Urban Planning. https://doi.org/10.1016/j.landurbplan.2021.104199
10. Olén, NB; Roger, F; Brady, M; Larsson, C; Andersson, GKS; Ekroos, J; Caplat, P; Smith, HG; Dänhardt, J; Clough, Y (2021). Effects of farm type on food production, landscape openness, grassland biodiversity, and greenhouse gas emissions in mixed agricultural-forestry regions. Agricultural Systems. https://doi.org/10.1016/j.agsy.2021.103071
11. Höglind, L; Hansson, H; Manevska-Tasevska, G (2021). Questioning the dichotomy: A Latent profile analysis of ecological management practices in Swedish agriculture. Journal Of Environmental Management. https://doi.org/10.1016/j.jenvman.2021.113770
12. Fanelli, RM (2019). A new classification of European Union regions: A decision support tool for policymakers. Spanish Journal Of Agricultural Research. https://doi.org/10.5424/sjar/2019171-13481

13. Blanco-Penedo, I; Sjöström, K; Jones, P; Krieger, M; Duval, J; van Soest, F; Sundrum, A; Emanuelson, U (2019). Structural characteristics of organic dairy farms in four European countries and their association with the implementation of animal health plans. Agricultural Systems. https://doi.org/10.1016/j.agsy.2019.03.008
14. Guiomar, N; Godinho, S; Pinto-Correia, T; Almeida, M; Bartolini, F; Bezák, P; Biró, M; Bjorkhaug, H; Bojnec, S; Brunori, G; Corazzin, M; Czekaj, M; Davidova, S; Kania, J; Kristensen, S; Marraccini, E; Molnár, Z; Niedermayr, J; O'Rourke, E; Ortiz-Miranda, D; Redman, M; Sipilainen, T; Sooväli-Sepping, H; Sumane, S; Surová, D; Sutherland, LA; Tcherkezova, E; Tisenkopfs, T; Tsiligiridis, T; Tudor, MM; Wagner, K; Wästfelt, A (2018). Typology and distribution of small farms in Europe: Towards a better picture. Land Use Policy. https://doi.org/10.1016/j.landusepol.2018.04.012
15. Gelasakis, AI; Rose, G; Giannakou, R; Valergakis, GE; Theodoridis, A; Fortomaris, P; Arsenos, G (2017). Typology and characteristics of dairy goat production systems in Greece. Livestock Science. https://doi.org/10.1016/j.livsci.2017.01.003
16. Lazzerini, G; Dibari, C; Merante, P; Pacini, GC; Moschini, V; Migliorini, P; Vazzana, C (2015). Identification and mapping the high nature value farmland by the comparison of a combined and species approaches in Tuscany, Italy. Italian Journal Of Agronomy. https://doi.org/10.4081/ija.2015.676
17. Ripoll-Bosch, R; Joy, M; Bernués, A (2014). Role of self-sufficiency, productivity and diversification on the economic sustainability of farming systems with autochthonous sheep breeds in less favoured areas in Southern Europe. Animal. https://doi.org/10.1017/S1751731113000529
18. Nainggolan, D; Termansen, M; Reed, MS; Cebollero, ED; Hubacek, K (2013). Farmer typology, future scenarios and the implications for ecosystem service provision: a case study from south-eastern Spain. Regional Environmental Change. https://doi.org/10.1007/s10113-011-0261-6
19. Moreno-Pérez, OM; Arnalte-Alegre, E; Ortiz-Miranda, D (2011). Breaking down the growth of family farms: A case study of an intensive Mediterranean agriculture. Agricultural Systems. https://doi.org/10.1016/j.agsy.2011.03.007
20. Andersen, E; Elbersen, B; Godeschalk, F; Verhoog, D (2007). Farm management indicators and farm typologies as a basis for assessments in a changing policy environment. Journal Of Environmental Management. https://doi.org/10.1016/j.jenvman.2006.04.021

Paper	Aim of the study	Data source & temporal coverage	Method	Variables / Indicators	Main results / Typologies produced
Aldezabal, A et al. (2026)	Sustainability assessment methodology for redesigning livestock production system. to develop and apply a methodological framework that integrates agroecological indicators with conventional sustainability metrics to classify and redefine farm typologies in a dairy sheep grazing system.	Data were collected through farmer interviews and field surveys, and afterwards they were used in Life Cycle Assessment (LCA).	Interviews Vegetation survey LCA Cluster analyses were used to identify distinct farm typologies.	Technical, productive, economic, and environmental indicators were combined with fine-scale ecological data, including floristic composition of lowland and upland semi-natural grasslands.	Four farm typologies were identified: (1) the most productive, (2) the most environmentally friendly and feeding-autonomous, (3) farms with intermediate performance across multiple indicators, and (4) the most eco-friendly.
Tsiligiridis, T et al. (2025)	unveils the role of small farming plots (less than 5 ha) in the context of food security. It determines their contribution by estimating the spatial distribution (location), the crop types (diversity), the crop area extent (acreage), and the yield (production), factors that remain unclear, mainly because the official statistical offices rarely include them in surveys. It provides stakeholders with the appropriate tools to accurately and timely acquire crop type map information and objectively quantify their crop production capabilities.	Approaches based on the Land Parcel Identification System (LPIS) of the Integrated Administration and Control System (IACS) applied by many countries in Europe are proved useful in providing information on location, diversity, and acreage but not crop production per farm owner applying and eligible for receiving subsidies	Remote Sensing (RS) a key tool to evaluate land use and agricultural development variations over a period.		
Ayala, MC et al. (2024)	focus on the Irish beef and sheep farming sectors and used a wide range of structural, socio-economic, and environmental indicators to develop a farm typology.	data from the 2019 Teagasc National Farm Survey (NFS). The NFS uses a random, nationally representative sample of around a thousand farms (of various types) and provides information on farm structure (i.e., farm and herd size), socioeconomic characteristics (i.e., labour requirements or gross margins) and environmental performance (i.e., GHG emissions or nutrient balances).	To identify explanatory variables and group farms in homogeneous types we performed a principal component and cluster analysis (PCA and CA) in SPSS version 29 (IBM Company, Chicago, IL, USA). In the PCA factors were extracted using a Direct-Oblimin rotation and we applied Bartlett's sphericity test and the KMO measure of sampling adequacy to test sampling validity (Modernel et al., 2018). In the end, we obtained nine principal components (PCs) that were assigned a theme based on the variables included in each of them. We then used the scores of the PCs as variables to perform the CA. We used hierarchical clustering, following Ward's method (Modernel et al., 2018) and conducted an ANOVA test, both to determine if there were significant differences between clusters and to help decide which would be the appropriate number of clusters.		identification of six distinct farm types: Small Cattle Farms, Extensive Sheep Farms, Medium-size Sheep Farms, Medium-size Cattle Farms, Medium-size Mixed Farms, and Intensive Cattle Farms.
Václavík, T et al. (2024)					
Rubio-Delgado, J et al. (2024)	LUCAS 2015 dataset was analysed across EU member states to identify, characterise, and determine the extent and distribution of AFSWF classes and the variety of SWF types in agricultural lands.	LUCAS 2015 dataset	categories established based on the classes of land cover + density maps		four categories of AFSWF were established based on the classes of land cover within agricultural areas where SWF are present The typology and relevance of the AFSWF categories and the SWF types were analysed and mapped at country level and by biogeographical regions. The spatial distribution of AFSWF and the different types of SWF were analysed using density maps.
Gobin, A et al. (2023)	to identify a datadriven farm typology by combining participatory methods, multivariate statistical modeling and spatiotemporal parcel-based land cover analysis between 2000 and 2020		Previous literature reviews have consistently highlighted the variety of methodologies and variables used to develop farm typologies Farm characteristics were derived from a farm questionnaire and related to multi-annual parcel-based land cover analysis to identify farm typologies (Figure 1). Multivariate statistical methods were used to establish a data-driven farm typology,		

			which was compared with a farm typology based on economic production activities. We evaluated the results of the questionnaire survey and multivariate statistics (PCA - No-hyerarchical cluster) with parcel information from the Land Parcel Identification System (LPIS) databases, which is part of the Integrated Administration and Control System (IACS),		
Beckmann, M et al. (2022)	We here provide a spatial classification approach for identifying archetypal patterns of agri-environmental potential in Europe based on machine-learning clustering of 17 variables on bioclimatic conditions, soil characteristics and topographical parameters.		We used self-organizing maps (SOMs; Kohonen 2001) to cluster the selected multi-dimensional data into archetypal patterns of agri-environmental potential. SOMs are based on artificial neural networks following a competitive learning algorithm with an input layer (input variables) and an output layer (clusters). The method allows visualization of complex data by reducing their dimensionality to a predefined two-dimensional output space (map) of k neurons (or nodes), clustering observations (e.g. grid cells) based on their similarity. We improve existing typologies by (a) including more recent biophysical data (e.g. agriculturally-important soil parameters), (b) employing a fully data-driven approach that reduces subjectivity in identifying archetypal patterns, and (c) providing a scalable approach suitable both for the entire European continent as well as smaller geographical extents.	17 variables used for classification of agri-environmental archetypes: seven climate derived from WorldClim v2 (Fick and Hijmans 2017), eight soil-related variables originating from the SoilGrids dataset (Hengl et al 2017), and two topographic parameters derived from the Global Multi-resolution Terrain Elevation Data (Amatulli et al 2018).	The resulting archetypes can be used to support spatial stratification, upscaling and designation of more spatially-targeted agricultural policies, such as those in the context of the EU's Common Agricultural Policy post-2020.
Escribano, M et al. (2022)	to analyse various organic cattle farming systems from the point of view of their technical-economic management, but also on the environmental impact caused by their greenhouse gas (GHG) emissions.	34 organic meat cattle dehesa farms located in the southwest of Spain were studied.	PCA for the technical-economic management LCA for the GHG emissions and carbon sequestration a principal component analysis devised four factors that explained the technical-economic management model of these farms in terms of their level of dependence on subsidies, production intensification, feeding practices and productivity. The farms were then divided into three clusters whose main differences came from the size of the farms, the intensification level and the joint rearing of cattle with other livestock species. On the other hand, GHG emissions and carbon sequestration levels for each of these clusters were calculated using the life cycle assessment methodology.		
Pacheco-Romero, M et al. (2021)			Archetype analysis to identify social-ecological systems (SESs).		
Olén, NB et al. (2021)		spatially explicit agricultural information from the IACS database and from the national register of livestock holdings, retrieved from the Swedish Board of Agriculture. Data for calculated landscape openness (from the European Digital Elevation Model from Copernicus (https://land.copernicus.eu/imagery-in-situ/eu-dem/eu-de m-v1.1), tree height	We used the farm typology method described above on a time series of IACS and livestock data (2008–2016) to analyse how the farming systems in the three regions have changed over time. We used data from the median year 2012 to carry out the ensuing analysis.	We assigned each farm in the study regions (Fig. 1) to a type based on its livestock holdings and use of agricultural land.	We have developed a spatially explicit approach for mapping a large population of farms to farm types based on their major production activities, and related those production activities to their potential for providing food, landscape openness, and grassland biodiversity while limiting their GHG emissions. Our results show that there is not one single farm type, as described or presently configured, that would

		data from Swedish Forest Agency, and road/trail data from The Swedish Land Survey Authority (Lantm¨ateriet).) Data for grassland biodiversity from the Swedish survey of seminatural grassland habitats (TUVA) provided by the Swedish Board of Agriculture.			simultaneously maximize food production, grassland biodiversity, and landscape openness, whilst reducing GHG emissions. Development of farm types (D: Dairy, GL: Grazing livestock, FC: Field Crop, M: Mixed, G: Granivores) over time for all the study regions combined
Höglind, L et al. (2021)	This study investigates heterogeneity in farmer uptake of management practices the current organic classification system is too narrow and does not account for the full heterogeneity of the ecological practices that are prevalent in the agricultural sector.		using factor analysis for dimension reduction and Latent Profile Analysis (LPA) for identification of farmer segments. seemingly unrelated regression		The findings reveal four farmer profiles with a varying degree of use of chemicals and ecological, alternative, or mixed management approaches. we find that being certified according to the Swedish organic certification scheme KRAV, or the EU organic label, does not have an impact on a farmer's profile, suggesting that the data do not support the organic/conventional dichotomy. Instead, age, farming income and geographical location are to a greater degree the key factors in determining the larger farmer profile compared with the smaller, more diversified farmer profiles.
Fanelli, RM (2019)	The classification of agricultural and territorial systems is essential to improve the comparability of regions for the development programmers of the Common Agricultural Policy (CAP), to give new tools of intervention to policymakers and to increase farmers' knowledge.		The main factors that differentiate agricultural systems in EU regions from one another were identified with the application of principal component analysis, while the classification of the same regions in homogeneous groups was carried out through hierarchical cluster analysis.	It considers two specific sets of environmental and socio-economic indicators provided by the Farm Accountancy Data Network (FADN).	
Blanco-Penedo, I et al. (2019)	to classify the diversity of organic dairy farms in four European countries according to their structural characteristics and investigate the association of these farm types with implementation of herd health plans.	Data for the analysis came from a survey of 192 organic farms from France, Germany, Spain and Sweden and contained farm and farmer descriptions from which the typologies were derived.	A Multiple Correspondence Analysis (MCA), followed by Agglomerative Hierarchical Clustering (AHC), was used to classify the farms.		Three farm groups were identified by AHC using the factor scores derived from the MCA. Cluster 1, the most numerous group (56.7% of the sample), had medium herd sizes with moderate use of pasture and moderate intensity of input use. Cluster 2, representing 17.7% of the sample, were the most extensive system and mainly of very small farm size. Cluster 3 (25.5% of the sample and only found in Sweden), had an intensive management approach, but relatively low stocking rate. The analysis also showed that organic dairy farms adopted differentiated strategies towards economic assets and animal health status, according to group membership.
Guiomar, N et al. (2018)	Assessing the real role of small farms presents the result of a novel classification of small farms at NUTS-3 level in Europe, according to the relevance of small farms in the agricultural and territorial context of each region, and based on a typology of small farms considering different dimensions of farm size.	extensive data collection and variables selected according to European wide expert judgement Data at NUTS-3 level for all European countries except for Germany (NUTS-2 level due to data availability) (Fig. 1) on the Utilized Agricultural Area2 (UAA) and on the Number of Holdings3 (hereafter Number of Farms, NF) distributed by structural and by economic size classes were extracted from EUROSTAT	advanced cluster procedures The non-parametric Wilcoxon rank sum test was applied to compare the distribution of the number of small farms and the area covered by these farms, The clValid package for R (Brock et al., 2008) was used to select the clustering algorithm from five clustering methods: divisive analysis (DIANA), partition around the medoids (PAM), clustering large applications (CLARA), self-organizing tree algorithm (SOTA) and modelbased clustering (MODEL).	Utilized agricultural area Percentage of utilized agricultural area Total number of farms UAA in small farms (< 5 ha of UAA) UAA in small farms (< 8 ESUa)) Percentage of UAA covered by UAAstructural Percentage of UAA covered by UAAeconomic Percentage of the region covered by UAAstructural Percentage of the region covered by UAAeconomic Number of small farms (< 5 ha of UAA) Number of small farms (< 8 ESUa)) Percentage of small farms (< 5 ha of UAA) Percentage of small farms (< 8 ESUa)) Farm density Small farm density Mean size of farms Mean size of small farms (< 5 ha of UAA) Total labour force Total family labour forcec) Proportion of the family labour force Number of farms in mountain	8 clusters

				areas Land use in agriculture in mountain areas	
Gelasakis, AI et al. (2017)	to classify dairy goat farms into representative typologies.		The farms were classified using a multivariable statistical approach including principal component analysis and cluster analysis. The differences between clusters were assessed using oneway ANOVA and $\chi 2$ test and the profitability of farms was estimated.		We identified four clusters that shared common characteristics and major differences. Cluster 1 (26 farms, 25.2%) included large, semi-intensive, high producing and investing farms. Cluster 2 (50 farms, 48.5%) included semi-extensive, low-input, traditional farms. Cluster 3 (12 farms, 11.7%) included medium-sized, semi-intensive, low replacement rate farms. Cluster 4 (15 farms, 14.6%) included semiextensive, low-input, traditional farms, producing heavy weight kids carcasses.
Lazzerini, G et al. (2015)	identification, classification and mapping of high nature value farmlands (HNVfs) is becoming an overriding concern.	Corine land cover map (CLC) for the year 2006 Statistical data on UAA, UFA as well as on livestock were retrieved from the agriculture statistics (ISTAT, 2010), which is available at municipality level.	In this study, two different approaches, namely combined approach and species-based approach, were used to spatially identify HNVfs (type 1, 2 and 3) across Tuscany region (Italy).		
Ripoll-Bosch, R et al. (2014)	to typify the farms and elucidate the existing links between economic performance and certain sustainability indicators (i.e. productivity, self-sufficiency and diversification).	direct interviews with 30 farms (73% of the farmers belonging to the breeders association).	With a principal component analysis, three factors were obtained explaining 77.9% of the original variance. This factors were named as inputs/self-sufficiency, which included the use of on-farm feeds, the amount of variable costs per ewe and economic performance; productivity, which included lamb productivity and economic autonomy; and productive orientation, which included the degree of specialisation in production. A cluster analysis identified the following four groups of farms: high-input intensive system; low-input self-sufficient system; specialised livestock system; and diversified crops-livestock system.		A cluster analysis identified the following four groups of farms: high-input intensive system; low-input self-sufficient system; specialised livestock system; and diversified crops-livestock system.
Nainggolan, D et al. (2013)	1 develop a typology of farmers according to the characteristics of their households and farm management 2 analyse the link between farmer typology and the farmers' responses to a number of scenarios				
Moreno-Pérez, OM et al. (2011)		data for this analysis was provided by both indepth semi-structured interviews and a survey undertaken between February and April 2009.	Finally, multivariate techniques of analysis were performed to superimpose these layers of information. Concretely, a combination of Multiple Correspondence Analysis (MCA) and K-means clustering was performed with SPSS (16.0). The former, similar to Factor Analysis for numerical variables, optimally summarizes a set of categorical variables into a small number of them called dimensions.	Using this knowledge, a two-step cluster analysis was conducted with SPSS 16.0 in order to identify groups of holdings which were homogeneous in their structural features. The grouping variables were, on the one hand, the greenhouse and the outdoor surface of the farm (as continuous, non-correlated variables), and on the other hand, a categorical variable made up by the levels of greenhouse technology defined above.	holdings have been primarily divided into the following broad groups: Unifamily farms Vertical multifamily farms Horizontal multifamily farms farm types based on cluster analysis (K-mean): 1. Patrimony or conservatively-led farms 2. 'Individual' farms 3. Expansive farms with succession 4. Multifamily farm businesses
Andersen, E et al. (2007)	paper focuses on the assessment of farm management indicators and argues that typologies are a necessary tool for comprehensive environmental assessments.	FADN dataset.	the economically based EU farm typology used in FADN (2007) is presented. Secondly, an alternative approach based on an extension of the EU farm typology with environmental criteria is presented.	To test the environmental relevance of the extension to the initial EU farm typology presented the stratifying variables intensity and land use are presented in combination with selected farm management indicators for two selected EU farm types: field crop farms and dairy cattle farms.	

TAPELine

Transitioning to
Agroecology

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