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NATIONAL REPORT

ITALY

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State-of-the-art Report on Agroforestry (Task 1.1, M1-M12)

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1. General Introduction and Historical Context

Agroforestry—the deliberate integration of trees with crops and/or livestock within the same management unit (Nair 1993)—is both a long-standing land-use tradition and an emerging strategy for sustainable agriculture in Europe. Across the Mediterranean basin, agroforestry systems have historically combined agricultural production, livestock grazing and tree management, generating multifunctional landscapes that support biodiversity, soil conservation, climate resilience and rural livelihoods.

At the European scale, agroforestry covers approximately 15.4 million ha, corresponding to 3.6% of the EU territory and 8.8% of its utilised agricultural area (UAA), according to the LUCAS 2012 survey (den Herder et al. 2017). Agroforestry is particularly concentrated in Mediterranean countries, where traditional farming systems have long integrated trees into agricultural production. Spain, France, Greece and Italy together account for a substantial share of the European agroforestry area.

Italy ranks among the leading agroforestry countries in Europe, with an estimated 1.4 million ha of agroforestry land, making it the fourth-largest EU Member State by total area (den Herder et al. 2017). The country hosts the second-largest European area of fruit-tree-based arable agroforestry and high-value tree agroforestry, while extensive silvopastoral systems remain important in woodland landscapes. The highest concentrations occur in Sardinia and in central and southern Italy, reflecting the persistence of traditional Mediterranean land-use systems.

Italy's agroforestry heritage is deeply rooted in the mixed polyculture systems that characterised much of the country until the mid-twentieth century. Historical agricultural landscapes were dominated by integrated systems such as the *coltura promiscua*, where vines, fruit trees, cereals and livestock coexisted within the same production unit. In Tuscany, for example, specialised monocultures occupied only 2.8% of agricultural land in 1929 (Paris et al. 2019). Similar systems existed throughout the country, taking regionally distinct forms such as the *piantata* and *alberata* of northern and central Italy, olive-based polycultures in southern regions, and oak-based silvopastoral systems in Sardinia.

The post-war transition towards agricultural modernisation, mechanisation and land consolidation led to a rapid decline of these multifunctional systems. Large areas of traditional agroforestry were replaced by specialised monocultures, resulting in substantial losses of landscape diversity and associated ecological functions (Paris et al. 2019). Nevertheless, important remnants persist across the country, particularly in regions where agroforestry continues to provide environmental, cultural and economic benefits.

Today, agroforestry is receiving renewed attention in Italy as a strategy for addressing multiple challenges, including climate adaptation, biodiversity conservation, soil protection and rural development. Research and innovation projects such as AgroFig (PRIMA, 2025–2028) are contributing to this revival by exploring the potential of Mediterranean fig-based agroforestry systems and supporting the development of Living Labs that connect farmers, researchers and policy actors. The Italian experience therefore combines a rich historical legacy with growing contemporary interest, positioning agroforestry as a promising pathway towards more resilient and sustainable land-use systems.

2. Methodology

This report adopts a mixed-methods approach combining quantitative datasets, policy and grey literature, peer-reviewed scientific evidence, and stakeholder knowledge. The objective is to provide an integrated assessment of agroforestry in Italy, covering its historical development, current distribution, socio-economic performance, governance framework, ecosystem services and future development opportunities.

2.1 Official statistics and policy documents

Official statistics were used to characterise the evolution of Italian agriculture, agroforestry-related land-use trends and the current policy context. Sources include ISTAT agricultural census data and historical agricultural statistics (1861–2020), ISTAT agricultural economic accounts, the Common Agricultural Policy (CAP) monitoring documents, and implementation reports related to the Italian CAP Strategic Plan 2023–2027. Historical land-use trends are based primarily on the synthesis developed by Paris et al. (2019) from ISTAT datasets and landscape history studies.

The policy review covered European regulations, the Italian CAP Strategic Plan, regional implementation documents, and reports produced by national institutions involved in agroforestry promotion and rural development, including the Rete Rurale Nazionale, European Agroforestry Federation (EURAF) and regional paying agencies. Attention was given to identifying existing support measures, governance arrangements and institutional barriers affecting agroforestry adoption.

2.2 European and Mediterranean comparative evidence

To situate Italy within the broader European and Mediterranean context, the report draws on harmonised datasets and comparative studies. Estimates of agroforestry extent are primarily based on the LUCAS survey analysis of den Herder et al. (2017), currently the most comprehensive and comparable assessment of agroforestry extent and distribution across EU Member States because it records mixed land uses directly through field observations rather than assigning a single dominant land-cover category. Mediterranean-scale evidence on productivity, ecosystem services and economic performance was derived from recent reviews and meta-analyses, notably Scordia et al. (2023), allowing Italian findings to be interpreted within wider Mediterranean trends.

2.3 Scientific literature review

A targeted literature review was conducted using Google Scholar, Web of Science and Scopus. Searches included combinations of the keywords “agroforestry”, “Italy”, “Mediterranean”, “silvoarable”, “silvopastoral”, “olive agroforestry”, and “fig agroforestry”. The review focused on studies published between 2009 and 2025 and prioritised peer-reviewed publications providing primary Italian data, comparative Mediterranean analyses, policy assessments, and economic or value-chain evidence.

A total of approximately fifty scientific papers and book chapters were selected for analysis and extraction. Additional references were incorporated from cited studies, grey literature, and project documents. The literature was reviewed thematically to address five dimensions: (i) agroforestry extent and typologies, (ii) economic performance and value chains, (iii) ecosystem services, (iv) governance and policy frameworks, and (v) innovation and stakeholder networks.

The review also revealed several evidence gaps in geographical and thematic coverage, in farm-level economic data, and in long-term ecosystem-service monitoring, discussed in detail in Section 7.3.

2.4 Stakeholder engagement and Living Lab evidence

Scientific and statistical evidence was complemented by stakeholder knowledge generated through the AgroFig Living Lab process. Primary qualitative information was collected during the first AgroFig Living Lab Workshop held in Artimino (Tuscany) on 12 February 2026, involving farmers, researchers, technical advisors and institutional stakeholders.

Additional insights were obtained from the co-design workshops of the DigitAF project regional stakeholder roundtables organised in Tuscany during 2024–2025, and consultations with representatives of the Italian Agroforestry Association (AIAF). These sources were used to identify emerging challenges, innovation opportunities, stakeholder perspectives and practical experiences that are not yet fully documented in the scientific literature.

By combining statistical, scientific, policy and stakeholder evidence, the report provides a comprehensive, evidence-based overview of agroforestry in Italy while acknowledging the geographical and thematic limitations of the available data.

3. Bioclimatic Zoning, Typology and Key Agroforestry Systems

According to the LUCAS-based assessment by den Herder et al. (2017), the highest concentrations of agroforestry occur in Sardinia and in central and southern Italy, where traditional silvopastoral and tree-crop systems remain relatively widespread.

3.1 Bioclimatic Zones and Regional Distribution

3.1.1 Northern Italy: Alpine and Po Valley Systems

Northern Italy is characterised by intensive agricultural landscapes in the Po Valley and extensive mountain systems in the Alps. Agroforestry takes two main forms. In lowland areas, silvoarable systems integrate poplar, walnut or other timber species with cereals and forage crops, often with objectives linked to farm diversification, biomass production and ecological restoration. Traditional poplar cultivation, once widespread in the Po Valley, has declined substantially, stimulating interest in polycyclic tree-farming systems that combine timber, biomass and agricultural production (Facciotto et al. 2014).

In mountain areas, silvopastoral systems remain important, particularly larch wood pastures in Piedmont, Valle d'Aosta and Trentino-Alto Adige. These systems provide multiple functions, including livestock production, biodiversity conservation and landscape management.

Recent studies from Piedmont highlight the ecological benefits of introducing agroforestry elements into simplified agricultural landscapes. In intensive rice-growing areas, the incorporation of seminatural features and tree components has been shown to enhance biodiversity and ecological functionality at farm scale (Vagge et al. 2024).

3.1.2 Central Italy: Olive-Based and Mixed Agroforestry Systems

Central Italy hosts some of the most diverse and well-documented agroforestry systems in the country. Olive groves managed with grazing livestock, cover crops or intercrops are widespread in Tuscany, Umbria and Lazio, representing contemporary expressions of the historical *coltura promiscua* tradition. These systems combine agricultural production with ecosystem services such as soil protection, biodiversity conservation and landscape maintenance.

The region also contains important examples of silvoarable systems based on walnut, poplar and forage crops. Evidence from Umbria and Lazio suggests that agroforestry farms frequently rely on direct marketing channels and short supply chains, allowing producers to capture additional value from product differentiation (Rohrig et al. 2020).

From a policy perspective, several regional CAP instruments supporting agroforestry have been activated in Central Italy (see Section 5.1).

3.1.3 Southern Italy and the Islands: Traditional Mediterranean Agroforestry Landscapes

Southern Italy and the islands host the largest concentration of traditional Mediterranean agroforestry systems and account for a substantial share of the national agroforestry area. These systems are often characterised by high ecological complexity and strong links to local cultural heritage.

In Sardinia, extensive oak-based silvopastoral systems combine cork oak, holm oak and downy oak with sheep and cattle grazing across approximately 400,000 ha, representing one of the largest agroforestry landscapes in Europe (Paris et al. 2019; Camilli et al. 2017). These systems share structural similarities with the Iberian *dehesa* and *montado* (Rigueiro-Rodríguez et al. 2009).

In Calabria and Sicily, traditional olive-based agroforestry systems play an important role in maintaining soil stability, biodiversity and landscape connectivity. Research indicates that the abandonment of these systems is associated with increased hydrogeological vulnerability, including higher risks of landslides and wildfires (Brunori et al. 2020). In Sicily, centuries-old olive trees also constitute important reservoirs of cultural and biological heritage (Ferrara et al. 2023).

3.2 Typology of Agroforestry Systems

Agroforestry systems are commonly classified according to the combination of components they integrate:

- Silvoarable systems, which combine trees with herbaceous crops (e.g., wheat, maize, legumes, vegetables) without livestock;
- Silvopastoral systems, which combine trees with grazing livestock;
- Agrosilvopastoral systems, which integrate trees, crops and livestock within the same management unit.

While this functional classification is useful for describing system structure, the diversity of Italian agroforestry is also shaped by its historical development and management objectives. Italian agroforestry systems range from traditional Mediterranean silvopastoral landscapes and mixed polycultures to modern silvoarable designs and innovative tree-farming models. While some systems remain widespread and economically important, others survive as landscape remnants or are currently being reintroduced through research and policy initiatives.

From this perspective, three broad categories can be distinguished: (i) traditional agroforestry systems, which evolved over centuries and remain closely linked to local cultural landscapes; (ii) modern agroforestry systems, developed to reconcile agricultural productivity with environmental objectives; and (iii) emerging systems and innovations promoted through recent research, bioeconomy and climate-adaptation agendas (see Table 3.1).

Traditional agroforestry systems are particularly important in central and southern Italy and on the islands. They include extensive free-range and semi-free-range livestock production systems in woodland and forest environments (eg. silvopastoral oak woodlands in Sardinia, chestnut and larch wood pastures in mountain areas), olive-based polycultures, and the historic coltura promiscua systems that once dominated large parts of the Italian countryside. These systems typically combine multiple outputs—including livestock products, olive oil, fruit, timber and non-wood forest products—while maintaining high levels of biodiversity and landscape heterogeneity.

Modern agroforestry systems are primarily represented by intensive silvoarable systems in the plains, where timber or fruit trees are integrated with annual crops. These systems are increasingly promoted in central Italy and the Po Valley as a means of improving land-use efficiency, carbon sequestration and farm diversification. Tree-covered arable land (*seminativi arborati*) and linear landscape elements such as hedgerows, shelterbelts and riparian buffer strips constitute intermediate forms that provide important ecological functions, particularly in intensively farmed landscapes.

Emerging agroforestry systems include polycyclic arboriculture and short-rotation forestry integrated with crops and/or livestock, as well as innovative fig-based systems. Although tree plantations and short-rotation forestry are not agroforestry systems per se, they become agroforestry configurations when combined with agricultural production on the same management unit. These approaches aim to diversify farm income while enhancing ecosystem services and are increasingly being explored through research and innovation projects such as AgroFig.

System type	Key species	Main regions	Primary products and functions

Silvopastoral systems	Oak (*Quercus spp.*), chestnut, larch + cattle, sheep, goats	Sardinia, Apennines, Alps	Meat, milk, wool, cork, non-wood forest products, biodiversity conservation
Olive-based agroforestry and *coltura promiscua*	Olive, vine, cereals, legumes, forage crops	Central and Southern Italy, Sicily	Olive oil (PDO/PGI), wine, forage, landscape conservation
Silvoarable systems (alley cropping)	Walnut, cherry, poplar + cereals and forage crops	Tuscany, Umbria, Lazio, Po Valley	Timber, fruit, annual crops, carbon sequestration
Tree-covered arable land (*seminativi arborati*)	*Quercus, Juglans, Castanea* + annual crops	Central and Southern Apennines	Nuts, timber, grain production, landscape value
Linear agroforestry systems	Mixed native trees and shrubs	Po Valley, hill and coastal areas	Habitat connectivity, erosion control, wind protection, biomass
Polycyclic arboriculture	Poplar, walnut, cherry and mixed timber species	Northern and Central Italy	Timber assortments, biomass, diversified farm income
Short-Rotation Forestry (SRF)	Poplar, willow	Po Valley and Northern Italy	Biomass and renewable energy production
Fig-based agroforestry *(experimental AgroFig model)*	*Ficus carica* (particularly cv. Dottato) with cereals, legumes or forage crops	Tuscany (Living Lab), Calabria, Campania, Puglia	Fresh and processed figs, ecosystem services, diversification, renewable energy production

Table 3.1. Main agroforestry system types currently documented in Italy. Adapted from den Herder et al. (2017), Paris et al. (2019) and subsequent Italian literature.

3.3 Key Species Associations: System Design and Agronomic Performance

Where available, performance indicators such as the Land Equivalent Ratio (LER), biomass productivity and carbon sequestration are reported to assess the degree of complementarity between system components. Economic performance, value chains and market opportunities are discussed separately in Section 4, while policy and governance aspects are addressed in Section 5.

As reported at the EU scale, the available evidence suggests that Italian agroforestry systems also generally outperform corresponding monocultures in terms of resource-use efficiency, environmental performance and resilience. However, quantitative economic data remain scarce for many system types, particularly silvopastoral systems and traditional Mediterranean polycultures.

3.3.1 Silvopastoral associations

Silvopastoral systems are the most extensive agroforestry systems in Italy and account for the majority of the country's estimated 1.4 Mha of agroforestry land (den Herder et al. 2017). They are particularly widespread in Sardinia as well as in Alpine and Apennine mountain areas characterised by larch- and chestnut-based grazing systems.

The dominant species associations combine *Quercus pubescens*, *Q. suber* and *Q. ilex* with sheep and cattle production in Mediterranean regions, while larch (*Larix decidua*) and chestnut (*Castanea sativa*) systems are typical of mountain environments. These systems generate multiple outputs, including meat, milk, wool, cork and other non-wood forest products, while also providing important ecosystem services such as biodiversity conservation, carbon storage, fire prevention and landscape management.

Recent studies highlight the ecological and productive benefits of integrating trees and livestock. Chestnut orchards managed with sheep grazing can contribute to pest regulation and soil carbon enhancement (Landi et al. 2016). Similarly, Sardinian oak wood pastures represent some of the most ecologically complex agricultural landscapes in the Mediterranean region (Camilli et al. 2017).

Recent research has also improved understanding of the trade-offs between tree cover and forage production. A systematic review by Ripamonti et al. (2025a), synthesising global evidence on agroforestry effects on forage yield and nutritive quality, found that increasing canopy density generally reduces herbage biomass because of shading, but can improve forage quality. Crude protein content increased under partial shade in grass-dominated swards, while grass-legume mixtures achieved the most favourable balance between yield and nutritional value. The review identified low tree density, strategic tree-row orientation and regular pruning as key management practices for maintaining productive silvopastoral systems.

New Italian evidence from a two-year on-farm study at Tenuta di Paganico (Grosseto, Tuscany) confirms the importance of considering seasonal trade-offs in Mediterranean environments (Ripamonti et al. 2025b). Maremmana cattle grazing in open pasture achieved higher average daily gains during spring (1.49 kg day^{-1} versus 1.25 kg day^{-1} in silvopastoral plots), reflecting greater forage availability in unshaded paddocks. During summer, however, the silvopastoral system provided substantial thermoregulatory benefits: hair cortisol concentrations, an indicator of chronic heat stress, were significantly lower in cattle grazing under tree cover (26.62 pg mg^{-1} versus 35.04 pg mg^{-1} in open pasture). These results suggest that, under Mediterranean conditions, the microclimatic buffering provided by trees may become increasingly important as heat waves and summer thermal stress intensify.

Despite their territorial importance and recognised environmental benefits, silvopastoral systems remain among the least studied agroforestry types in Italy from an economic perspective (see Section 4). Rosati et al. (2025) further identify regulatory uncertainty and limited advisory support as important constraints to the wider adoption of orchard grazing and other silvopastoral innovations (see Section 5.1).

3.3.2 Olive-based associations (Central and Southern Italy)

Among Italian agroforestry species, olive (*Olea europaea*) supports the widest range of documented agroforestry associations, including vegetables, forage crops, legumes and poultry. These systems are particularly widespread in Central and Southern Italy and represent one of the most mature expressions of Mediterranean agroforestry.

The best-documented example is the olive–wild asparagus (*Asparagus acutifolius*) association studied in Central Italy by Rezgui et al. (2024). The system achieved a Land Equivalent Ratio (LER) above 1, indicating more efficient land use than either component grown separately. Agronomic performance depends strongly on canopy management and pruning intensity, which determine light availability and asparagus productivity (Paolotti et al. 2023). The principal trade-off is increased labour demand, particularly during asparagus harvesting.

Additional associations focus on soil fertility and forage production. Grass-legume cover crop mixtures in Lazio olive orchards can produce 8–10 Mg ha^{-1} of dry matter while contributing to nitrogen cycling and weed suppression (Campiglia et al. 2005). Similarly, alfalfa integrated into Tuscan olive alley-cropping systems maintains good forage quality despite reductions in biomass caused by tree-crop competition (Mantino et al. 2021).

Livestock integration has also been explored. A Life Cycle Assessment conducted by Paolotti et al. (2016) demonstrated that integrating broiler chickens into olive orchards reduces environmental impacts while improving nutrient cycling through the annual return of approximately 180 kg N ha^{-1} from manure.

Across the available studies, olive-based agroforestry consistently demonstrates higher land-use efficiency, greater production diversification and improved ecological performance than specialised olive monocultures. These benefits are accompanied by increased management complexity and labour requirements, highlighting the need for technical support and appropriate market incentives.

3.3.3 Silvoarable and tree-farming associations (Northern and Central Italy)

Silvoarable systems in Northern and Central Italy are the most quantitatively documented agroforestry type in the Italian literature. *Populus* × *euramericana* clone I-214 is the best-studied tree component. Economic scenario analysis based on field survey data from the Po Valley (Prevosto 1971, re-analysed with current prices by Rosso et al. 2021) demonstrates that poplar integrated with cereal crops (wheat and rice) yields a positive economic balance when tree rows are positioned along field borders, thereby minimising the light competition that constitutes the primary deterrent to agroforestry adoption at northern latitudes. Profitability is directly related to poplar wood market price and row orientation (Rosso et al. 2021).

A distinctive Italian development is polycyclic arboriculture, which combines tree species with different rotation lengths within the same management unit (Facciotto et al. 2014). Although not an agroforestry system per se, it can be combined with crops or livestock to increase farm diversification. Short cycles of 2–3 years supply biomass for energy; intermediate cycles yield packaging and industrial material; longer rotations produce high-value timber. This staggered production structure reduces exposure to fluctuations in individual wood markets. In its specialised form of Short Rotation Forestry (SRF), based mainly on poplar and willow, these systems can produce 10–22 t ha^{-1} yr^{-1} of dry biomass and sequester an estimated 13–19 t CO_2 ha^{-1} yr^{-1} under Northern Italian conditions (Facciotto et al. 2014).

Walnut (*Juglans regia*) in association with cereals or forage legumes is documented as a component of silvoarable farms in Tuscany, Umbria and Lazio (Rohrig et al. 2020), and is listed among the typological species in national agroforestry inventories (den Herder et al. 2017). However, no published Italian study provides site-specific agronomic or economic performance data for walnut-based silvoarable systems; this is an identified evidence gap.

Overall, silvoarable and tree-farming systems demonstrate strong potential for combining agricultural production, timber generation, renewable energy supply and climate regulation, making them among the most promising agroforestry models for future scaling in Italy.

3.3.4 Fig-based associations (AgroFig focus)

Fig-based agroforestry is gaining renewed attention as a climate-resilient option for Mediterranean marginal and semi-arid areas. *Ficus carica* was domesticated over 11,000 years ago (Kislev et al., 2006) and has long played a central role in Mediterranean food systems, agroecological knowledge, and rural livelihoods (Zohary and Hopf, 2000). Despite this long-standing importance, fig cultivation in Italy has declined sharply, from approximately 60,000 ha in the 1950s to fewer than 2,000 ha today (Conti, 2023; ISTAT, 2022), driven by rural depopulation, erosion of cooperative market infrastructure, and the spread of the invasive fig weevil *Aclees taiwanensis* Kono, for which no effective registered control exists (Farina et al., 2021). This decline is reflected at national scale, where production fell from approximately 45,000 tonnes in 1983 to around 11,000 tonnes in 2013, alongside an estimated 80% reduction in cultivated area (Mafrica, 2021), and is embedded in the broader transition away from traditional Mediterranean polycultural systems (Paris et al., 2019). Today, production is concentrated in Calabria, Campania, and Puglia, while smaller areas such as Tuscany retain local varieties and traditional management practices.

Despite this decline, *Ficus carica* remains highly suitable for diversified low-input systems due to its deep rooting capacity and tolerance to drought, salinity, calcareous soils, and marginal conditions. These traits enable productive use of land where other fruit species often underperform, making fig a relevant option for the rehabilitation of abandoned or underutilised agricultural areas under climate change scenarios.

However, evidence on integrated fig-based agroforestry systems remains limited. Existing research focuses primarily on germplasm characterisation, orchard management, and product valorisation rather than system-level performance. The AgroFig project addresses this gap by generating empirical evidence on the agronomic, ecological, and socio-economic performance of fig-based associations under field conditions.

In the absence of extensive fig-specific studies, Mediterranean intercropping research provides relevant design insights. Tramacere et al. (2024) report higher dry matter production in grass–legume mixtures compared to monocultures under shaded conditions, while Tramacere et al. (2025) highlight the suitability of the nitrogen-fixing legume *sulla* (*Hedysarum coronarium*) in rainfed Mediterranean environments. Although not derived from fig systems, these findings inform the AgroFig Living Lab, where fig trees are intercropped with legumes and other species to evaluate productivity and system functioning.

Italy also retains an exceptionally rich fig genetic heritage, with more than 300 documented cultivars, though many local genotypes remain insufficiently characterised (Giordano et al., 2025). Recent studies on Tuscan germplasm provide the first integrated characterisation of 15 cultivars from the Carmignano area (Prato, Tuscany). Giordano et al. (2025) show that leaf morphometric traits combined with machine learning enable reliable cultivar discrimination, supporting field identification and certification. In parallel, Petruccelli et al. (2025) combine genetic (SSR) and phytochemical analyses, revealing substantial inter-cultivar variation in total polyphenols (14.1–36.6 mg GAE/g DW), flavonoids, and total sugars. This diversity supports cultivar-specific labelling and differentiated value chains based on measurable quality attributes. The cultivar Dottato—used in the Fichi di Cosenza DOP and in the AgroFig Living Lab (see Section 5.3)—is among the most significant Italian varieties and shows some of the highest sugar contents in the Tuscan germplasm (Petruccelli et al., 2025).

Overall, fig-based agroforestry emerges as a promising strategy for Mediterranean landscape restoration, combining climate resilience, agrobiodiversity conservation, soil protection, and production diversification, while enabling value creation through quality schemes and differentiated markets (see Section 4).

4. Value Chain, Market Opportunities and Economic Dynamics

Agroforestry systems generate value through a combination of diversified production, product differentiation, ecosystem services and territorial identity. However, the economic evidence available for Italy remains fragmented and concentrated in a limited number of case studies. Compared with the growing body of research documenting environmental and agronomic benefits, relatively few studies have quantified profitability, market performance or consumer demand. Nevertheless, the available evidence suggests that agroforestry can improve farm resilience by diversifying income sources, reducing exposure to market volatility and enabling access to premium value chains linked to environmental quality, local identity and cultural heritage.

4.1 Economic Performance and Value Creation

Available economic evidence indicates that agroforestry systems can outperform comparable monocultures when the combined value of multiple outputs is considered. The economic advantage derives less from maximising individual yields than from diversification, risk reduction and the ability to access differentiated markets.

One of the best-documented examples is the olive–wild asparagus (*Olea europaea–Asparagus acutifolius*) association analysed by Rezgui et al. (2024). The system generated gross income approximately 50% higher than olive monoculture, while economic simulations demonstrated greater resilience to increases in production costs and market fluctuations. Net Present Value (NPV) remained positive under production cost increases of up to 15%, whereas olive monoculture became economically unviable with a 10% increase in costs or a 5% reduction in product prices. The economic advantage arises from the complementary use of resources and the presence of an additional annual income stream that reduces dependence on olive oil markets.

Evidence from silvopastoral systems points in a similar direction, although quantitative assessments remain limited. Rohrig et al. (2020), analysing eight silvopastoral farms in Umbria and Lazio, found that diversification of products and marketing channels contributed significantly to farm viability. However, the authors also highlight the absence of detailed profitability assessments for most Italian silvopastoral systems, despite their importance within the national agroforestry landscape.

Tree-based agroforestry systems such as poplar, walnut and mixed timber plantations operate under a different economic logic. Returns are distributed over longer periods, with annual agricultural production complemented by medium- and long-term revenues from timber and biomass. Facciotto et al. (2014) argue that polycyclic arboriculture reduces financial risk by combining species with different rotation lengths, thereby generating staggered income streams and reducing dependence on individual wood markets.

Overall, the available evidence suggests that the economic performance of agroforestry systems is closely linked to diversification. By combining multiple products, production cycles and market channels, agroforestry can enhance resilience in the face of climatic, economic and market uncertainties.

4.2 Short Supply Chains and Product Differentiation

The available Italian evidence indicates that successful agroforestry farms rarely compete as commodity producers. Instead, they rely on short food supply chains, direct marketing and product differentiation to capture added value.

Rohrig et al. (2020) found that all eight silvopastoral farms studied in Umbria and Lazio participated in at least one alternative distribution channel, including farm shops, direct sales, home deliveries and subscription systems. These channels allowed producers to obtain higher prices, strengthen traceability and communicate product quality directly to consumers. However, only a minority of farms actively promoted the environmental benefits associated with silvopastoral management, suggesting that a potentially important source of added value remains largely untapped.

Similar dynamics are evident in silvopastoral systems in Veneto. Bondesan et al. (2016) document the growing importance of farm-level pork processing and salami production linked to tree-based livestock systems. Products are marketed primarily through farmers' markets, farm shops and Solidarity Purchasing Groups (SPGs). The Veneto region hosts approximately 80 farmers' markets involving more than 450 producers and generating an estimated annual turnover of EUR 15 million. SPGs contribute an additional EUR 5 million annually. Within these networks, fresh pork and processed salami account for approximately 30% of purchases by value, three times their share in conventional farm markets, indicating that informed and ethically motivated consumers actively support differentiated production systems.

These examples illustrate a broader pattern. Agroforestry products derive much of their value from attributes that are difficult to capture in conventional commodity markets, including biodiversity conservation, landscape stewardship, local identity and traditional production methods. Direct marketing and short supply chains allow producers to communicate these attributes and retain a larger share of the final product value.

4.3 Consumer Awareness and Willingness to Pay

Consumer awareness represents both an opportunity and a constraint for agroforestry market development. The principal limitation appears not to be consumer opposition to agroforestry products but rather a lack of familiarity with agroforestry as a production system.

The only published quantitative Italian study addressing this issue (Bondesan et al. 2016) surveyed 387 consumers affiliated with nine SPGs in Veneto. Prior to receiving information about agroforestry, 74% of respondents reported limited knowledge of its environmental benefits. Following a brief explanation, respondents identified nutrient leaching reduction (67%), carbon sequestration (43%) and animal welfare improvements (37%) as the most important benefits associated with agroforestry systems.

The awareness gap directly influences willingness to pay. While 54% of respondents were unwilling to pay a premium for agroforestry pork products, 34% expressed willingness to pay 10–15% more and 12% were willing to pay premiums of 20–25%. These findings are particularly significant given that agroforestry pork products already sell at prices substantially above conventional alternatives. Bondesan et al. (2016) therefore conclude that modest additional premiums are achievable, provided that consumers receive clear information and credible evidence regarding environmental and social benefits.

The study also highlights a key challenge for market positioning. Italian consumers are already exposed to numerous quality signals, including Protected Designation of Origin (PDO), Protected Geographical Indication (PGI) and organic certification schemes. In this context, agroforestry is not yet recognised as an independent quality attribute. The case of traditional extensive systems such as Cinta Senese illustrates this dynamic: consumers tend to reward breed identity, geographical origin, and perceived traditional rearing conditions, while the production system itself (including its agroforestry or silvo-pastoral components) remains largely implicit in market communication.

4.4 Structural Barriers to Market Development

Several structural barriers continue to constrain the economic development of agroforestry worldwide, and in Italy in particular.

A first challenge concerns information asymmetry. Gold et al. (2009) describe agroforestry markets as a "black box" in which producers often have limited knowledge of consumer preferences, willingness to pay, competitor strategies and market opportunities. This problem is particularly acute for novel or emerging agroforestry products, for which standardised market information is often unavailable.

A second barrier relates to farm fragmentation and organisational capacity. Many agroforestry producers operate at relatively small scales and lack access to marketing cooperatives, processing infrastructure or distribution networks. Without horizontal collaboration, individual farms struggle to achieve the critical mass necessary to access wholesale, export or food-service markets (Mosquera-Losada et al., 2018).

A third constraint concerns supply consistency. Agroforestry systems frequently produce seasonal, small-volume or highly specialised products, making it difficult to satisfy buyers requiring continuous supply throughout the year. This challenge is especially relevant for retailers and processors operating at larger scales (Moreno et al. 2018).

A fourth barrier is market recognition. Italy already possesses one of the world's most developed systems of food quality certification, with more than 300 PDO and PGI products alongside a mature organic sector (European Commission DOOR/eAmbrosia database). Agroforestry therefore enters an already crowded premium market in which consumers may experience label fatigue and where additional certification schemes face substantial communication challenges.

Rosati, Borek and Canali (2020) argue that agroforestry and organic agriculture should be viewed as complementary rather than competing strategies. Agroforestry contributes directly to nutrient cycling, soil fertility and ecological pest regulation, while organic certification provides an established market framework capable of capturing at least part of the environmental value generated by agroforestry systems. Joint promotion may therefore represent a more effective strategy than the development of stand-alone agroforestry certification schemes.

4.5 Emerging Revenue Streams Beyond Agricultural Production

The economic value of agroforestry increasingly extends beyond agricultural products to include ecosystem services and rural diversification activities.

Carbon sequestration represents one of the most promising opportunities: Italian agroforestry systems generate substantial carbon stocks and sequestration rates (see Section 6.1 for detailed evidence), suggesting significant potential for participation in voluntary carbon markets. Although no Italian agroforestry project has yet established a formal carbon-credit scheme, the technical basis for quantifying carbon storage is increasingly available.

Similarly, the application of the i-Tree methodology in Northern Italy (Alali et al. 2025) demonstrates that long-term quantification of ecosystem services is feasible. Such approaches could support future payment schemes linked to carbon storage, biodiversity conservation, air quality improvement and climate regulation (Torralba et al. 2016).

Agritourism provides an additional source of diversification (ISTAT 2024). Many Italian agroforestry farms already operate within multifunctional rural economies where agricultural production is combined with hospitality, educational activities, local food processing and landscape-based tourism. These activities can generate substantial supplementary income while strengthening links between consumers and agroforestry landscapes.

Although these emerging revenue streams remain relatively underdeveloped, they represent an important area for future innovation and diversification.

4.6 The Italian Fig Value Chain: Challenges and Opportunities

The fig sector illustrates both the challenges and opportunities associated with the Italian, and Mediterrenean more broadly, agroforestry value chains. While national production has declined significantly over recent decades, figs retain strong links to local identity, traditional knowledge and quality-based market differentiation.

The sector displays a bifurcated structure. Fresh fig production is concentrated primarily in Puglia and oriented towards export markets including France, Germany, Austria, Belgium and the United Kingdom. In contrast, the processed fig sector is centred in Calabria and Campania and focuses on dried figs and traditional value-added products (Stillitano et al. 2015, Monaco et al. 2024).

Competition from imported dried figs represents a major challenge. Turkey supplies approximately 78% of Italian dried fig imports, followed by Greece and other Mediterranean producers (Mafrica 2021). Italian producers therefore face strong competition from lower-cost production systems and cannot compete primarily on volume or price.

Product differentiation consequently becomes essential. Recent studies by Petruccelli et al. (2025) and Giordano et al. (2025) provide the first integrated genetic and phytochemical characterisation of 15 Tuscan fig cultivars, documenting significant differences in polyphenol content, antioxidant activity and sugar composition. These findings provide a scientific basis for cultivar-specific marketing, nutritional claims and the strengthening of geographical indication schemes.

Sector analyses identify four strategic priorities for strengthening competitiveness: valorisation of autochthonous cultivars, modernisation of crop management, improvements in shelf-life and logistics, and reinforcement of quality-label frameworks (Mafrica, 2021). Agroforestry adds a further dimension by combining fig production with ecosystem-service provision and complementary productive activities, such as intercrops and livestock integration. This diversification can generate multiple revenue streams while linking fig production to biodiversity conservation, carbon sequestration, landscape management, and soil protection, thereby creating additional opportunities for differentiation in environmentally sensitive market segments.

Quality schemes play a central role in this strategy. Italy currently hosts two PDO fig products—*Fico Bianco del Cilento* and *Fichi di Cosenza*—alongside several Slow Food Presidia and other territorial quality initiatives (Table 4.1). These schemes support the conservation of local germplasm, strengthen territorial branding and facilitate access to premium markets.

From a value-chain perspective, successful Italian fig producers typically pursue either vertical integration—combining production, processing, direct sales, agritourism and food events—or horizontal cooperation through producer associations, DOP consortia and local development initiatives. Both approaches provide the critical mass, visibility and market access necessary to compete in high-value niche markets.

For fig-based agroforestry, this context is particularly favourable. By combining climate resilience, agrobiodiversity conservation, local varieties and measurable ecosystem services, fig-based agroforestry has the potential to occupy a distinctive position within emerging premium markets for sustainable Mediterranean foods.

Label	**Designation**	**Region (prov.)**	**Year**	**Operators / main characteristics**
DOP	Fico Bianco del Cilento	Campania (SA)	2006	42 operators; pear-shaped yellow-amber fruit; consumed fresh, dried or stuffed with dried fruit
DOP	Fichi di Cosenza	Calabria (CS)	2011	36 operators; cv. Dottato; crocette, ficotti, braids; Consorzio Fico Essiccato del Cosentino
Slow Food Presidio	Fico secco di Carmignano	Tuscany (PO)	--	Municipalities of Carmignano and Poggio a Caiano; annual sales at the Benvenuto Fico Secco event
Slow Food Presidio	Fico secco reale di Atessa	Abruzzo (CH)	--	Native cultivar Reale; organic farming; supported by GAL Maiella Verde
Slow Food Presidio	Fico monnato di Prignano Cilento	Campania (SA)	--	Manual peeling of fresh fruit; traditional sun-drying
Slow Food Arca del Gusto	Fico mandorlato di S. Michele Salentino	Puglia (BR)	--	Almond-stuffed fig with aromatic flavouring; traditional artisan production

Table 4.1. Italian quality label frameworks for fig products. Sources: Qualigeo (DOP data); Fondazione Slow Food (Presidia and Arca del Gusto data). Operator counts as of 2021.

5. Governance, Legal Framework and Stakeholder Networks

The development of agroforestry in Italy is shaped by a complex multi-level governance system involving European regulations, the Common Agricultural Policy (CAP), national forestry and agricultural strategies, and regional implementation authorities (Table 5.1). While agroforestry has been formally recognised within European rural development policy for almost two decades, implementation in Italy has remained limited and uneven. Evidence from the literature and discussions conducted during the first AgroFig Living Lab workshop suggest that the main challenges lie less in the absence of policy instruments than in the complexity of governance arrangements, differences in regional implementation, limited institutional coordination, and regulatory uncertainties that may discourage adoption. These factors can affect farmers' ability to access available support measures and integrate agroforestry into existing farm management systems.

5.1 CAP Support for Agroforestry: Progress and Persistent Limitations

Agroforestry was first explicitly recognised within the CAP through Council Regulation (EC) No 1698/2005, which introduced Measure 222 to support the establishment of agroforestry systems on agricultural land. In principle, the measure represented a major policy innovation, recognising agroforestry as a distinct land-use category capable of combining agricultural production with environmental benefits.

In practice, however, uptake in Italy was extremely limited. Pisanelli et al. (2012) identified two principal obstacles. The first was a structural contradiction within CAP architecture itself. Under the Single Farm Payment system (Regulation EC No 1782/2003), the introduction of trees could reduce the area classified as eligible agricultural land (Utilised Agricultural Area, UAA), thereby reducing direct payments. This created a disincentive for farmers to establish agroforestry systems despite the availability of dedicated support measures. The issue became known as the "UAA paradox": a policy instrument designed to encourage agroforestry simultaneously penalised farmers through the direct payment system.

The second obstacle was the lack of technical support and advisory services. Surveys conducted among farmers and agricultural technicians in Umbria and Veneto revealed limited familiarity with agroforestry system design, application procedures and management requirements. The absence of specialised extension services significantly reduced the capacity of farmers to access available support schemes (Pisanelli et al. 2012).

The 2014–2020 CAP programming period sought to strengthen agroforestry support through Measure 8.2 under Regulation (EU) No 1305/2013. Nevertheless, implementation remained highly uneven. Only five Italian regional authorities activated the measure — Basilicata, Marche, Puglia, Umbria and Veneto — and actual uptake was even more concentrated: recorded expenditure across the entire programming period amounted to approximately EUR 1.3 million on around 1,200 hectares, with real farm-level implementation concentrated in Puglia and Veneto (Rivieccio et al. 2024). Analyses by Pisanelli, Marandola et al. (2013) and Perali et al. (2013) concluded that the principal barriers were not financial but institutional, including administrative fragmentation, limited regional commitment and the absence of coordinated national strategies.

The current CAP Strategic Plan (2023–2027) provides new opportunities for agroforestry through rural development interventions, eco-schemes and environmental measures. However, several regulatory inconsistencies remain unresolved. Rosati et al. (2025) highlight a particularly important contradiction affecting orchard systems: eco-schemes supporting permanent crops often subsidise grass cover management while restricting or discouraging livestock grazing. As a result, public funds may support mechanical mowing while limiting the development of silvopastoral practices capable of delivering equivalent or greater environmental benefits at lower cost.

Additional regulatory uncertainty concerns the integration of livestock within orchards and tree-crop systems. Italy currently lacks harmonised national guidance regarding grazing management and livestock withdrawal periods before harvest, creating uncertainty for both farmers and advisory services.

Under the current 2023–2027 CAP Strategic Plan, each of Italy’s 21 regional authorities implements its own Complementary Rural Development Programme (CSR). Approximately 25–30 % of regional authorities have activated dedicated agroforestry interventions. The principal support instruments are SRD05.3 (establishment of agroforestry systems on agricultural land) and SRA28.3 (annual maintenance payments for established systems). To date, five regions — Tuscany, Piedmont, Umbria, Veneto and Puglia — have activated both establishment and maintenance support; Sicily has activated SRD05.3 for establishment only, without the companion maintenance measure. Campania and Friuli

Venezia Giulia have activated related afforestation and arboriculture measures (SRD05.1/SRD05.2) without specifically targeting agroforestry systems under SRD05.3. Financial allocations per region range from approximately EUR 0.2 to EUR 9 million, yet no region had recorded any expenditure in the first two years of implementation (2023–2024) (Rivieccio et al. 2024; AIAF 2026). In Tuscany, the CSR SRD05.3.1 establishment intervention offered up to EUR 6,500 ha^{-1} (call closed in August 2024), while the SRA28.3 maintenance payment of EUR 800 ha^{-1} $year^{-1}$ remains open.

Overall, the Italian experience demonstrates that the presence of CAP support measures alone is insufficient to stimulate widespread adoption. Although the incentive itself is becoming increasingly substantial, it is not sufficient on its own. Effective implementation depends on coherent regulations, specialised advisory services and administrative structures capable of translating policy objectives into practical opportunities for farmers.

5.2 National Governance and Regional Fragmentation

Unlike several European countries that have developed dedicated agroforestry strategies, Italy does not possess a unified national framework specifically addressing agroforestry. Responsibility is divided between agricultural and forestry policy domains, while implementation is largely delegated to regional authorities (Table 5.1). This institutional configuration reflects the broader decentralisation of Italian rural development policy but creates significant challenges for coordination and policy coherence.

The National Forestry Strategy (2022) recognises agroforestry as a relevant instrument for climate adaptation, biodiversity conservation and sustainable land management. However, the strategy remains largely strategic in nature and does not establish binding implementation mechanisms, quantitative targets or dedicated monitoring systems for agroforestry development.

At the operational level, agroforestry governance is characterised by considerable regional heterogeneity. Each region retains substantial autonomy in designing and implementing CAP interventions, resulting in divergent priorities, funding levels and eligibility criteria (the second pillar is managed at the national level, with funds then cascading down to the regions, which decide how to allocate and use them). Some regions have incorporated agroforestry within broader environmental and climate strategies, while others have given priority to more conventional agricultural investments. Consequently, access to support depends heavily on geographical location rather than on a coherent national vision.

Governance level	Main actor(s)	Role
EU	European Commission	CAP regulatory framework; cross-compliance and eligibility rules
National	MASAF (Ministry of Agriculture)	CAP Strategic Plan 2023–2027; National Forestry Strategy (2022)
Regional	Regional Authorities (CSR)	Implementation: rural development interventions (SRD05.3, SRA28.3)
Advisory / civil society	AIAF, CREA, universities, Rete Rurale Nazionale	Technical knowledge transfer; research; stakeholder networking

Table 5.1. Multi-level governance framework for agroforestry in Italy.

The absence of a national coordination mechanism also limits knowledge exchange and policy learning across regions. Experiences generated through successful initiatives are not systematically transferred, and regional administrations frequently develop agroforestry measures independently. This contributes to uneven implementation and reduces the overall effectiveness of public support.

Several organisations have attempted to address this governance gap. The Rete Rurale Nazionale has played an important role in disseminating technical knowledge, documenting best practices and supporting dialogue among researchers, policymakers and practitioners. Similarly, the Italian Agroforestry Association (AIAF), research institutions and European projects such as AGFORWARD, DigitAF and AgroFig contribute to strengthening technical capacity and stakeholder networks. However, these initiatives largely operate through voluntary collaboration and project-based funding rather than through permanent institutional arrangements.

As a result, Italy currently presents a paradoxical situation. Scientific evidence supporting agroforestry is growing, policy instruments formally exist, and stakeholder interest is increasing. Yet adoption remains constrained by fragmented governance, uneven regional implementation and persistent regulatory ambiguities. Strengthening coordination between agricultural and forestry policies, improving advisory services and ensuring greater consistency across regional programmes therefore represent key priorities for the future development of agroforestry in Italy. Table 5.2 summarizes governance strengths and weaknesses of Italian agroforestry.

Dimension	Strengths	Weaknesses
EU framework	CAP recognition since 2005	Low uptake of dedicated measures
National policy	Agroforestry recognised in National Forestry Strategy	No dedicated national agroforestry strategy
Regional implementation	Some regions actively support agroforestry (e.g. Tuscany)	Strong territorial disparities
Advisory services	Growing expertise through projects and networks	Insufficient extension capacity
Stakeholder coordination	AIAF, Rete Rurale, research projects	No formal national coordination mechanism

Table 5.2. Main governance strengths and weaknesses of Italian agroforestry

The recent development of agroforestry in Italy has been driven less by dedicated national programmes than by a succession of European and Mediterranean research and innovation projects. These initiatives have played a crucial role in generating scientific evidence, developing participatory methodologies, establishing stakeholder networks and testing agroforestry innovations under real farming conditions. Together, they have created an emerging innovation ecosystem that increasingly compensates for the absence of a dedicated national agroforestry coordination framework.

Three complementary layers can be identified. First, large European research projects established the methodological and scientific foundations of contemporary agroforestry research. Second, current Living Lab initiatives—including AgroFig and DigitAF—are generating new evidence on adoption pathways, governance mechanisms and system performance. Third, recent monitoring and planning studies provide increasingly sophisticated tools for assessing ecosystem services and identifying remaining governance gaps.

5.3 The AgroFig Living Lab and the Current Innovation Ecosystem

AgroFig (PRIMA Programme, 2025–2028; coordinated by the University of Pisa) represents the principal research and innovation initiative underpinning this report and currently constitutes the main platform for fig-based agroforestry experimentation in Italy. The project investigates the agronomic, ecological, socio-economic and governance dimensions of fig-based agroforestry systems, with particular emphasis on Mediterranean marginal areas and climate-resilient farming strategies.

The Italian Living Lab is centred on the demonstration site in Carmignano (Tuscany), where the cultivar Dottato is evaluated in association with herbaceous crops. Research addresses five themes: (i) adoption barriers and drivers; (ii) system design and performance; (iii) fig trait optimisation relevant to production and quality; (iv) ecosystem-service provision under medium-term scenarios; and (v) governance for wider adoption.

AgroFig builds upon a sequence of previous projects — FIGGEN (fig genetic diversity characterization), AGROMIX (mixed farming and agroecological design) and DigitAF (digital tools and the Italian Seed Living Lab) — illustrating the progressive transition from isolated experimentation towards integrated innovation platforms. Its participatory methodology follows approaches first developed under AGFORWARD (see Section 5.4).

5.4 Foundational European Research Networks

The modern development of Italian agroforestry research is closely linked to AGFORWARD (FP7, 2014–2017), which remains the most influential European project to date. Beyond generating scientific evidence, it established the methodological foundations and stakeholder networks upon which subsequent initiatives have been built, and catalysed agroforestry's re-emergence within Italian bioeconomy debates (Facciotto et al. 2014).

Italian case studies in Sardinia, Umbria and Veneto confirmed generally positive stakeholder perceptions of agroforestry's environmental and productive functions, while identifying management complexity as the main concern (Camilli et al. 2017). Burgess and Rosati (2018) identified three lasting contributions relevant to the Italian context: improved classification of European systems; participatory methods integrating scientific and practitioner knowledge; and a durable trans-European network connecting researchers, farmers and policymakers.

More recently, the COSMOS project (PRIMA, 2024–2028) has expanded this perspective to the Mediterranean scale through coordinated experimentation involving high-value agroforestry species across twelve sites, including Italy. Together, these projects demonstrate the increasing integration of Italian agroforestry research within European and Mediterranean innovation networks.

5.5 Monitoring, Assessment and Planning Tools

Recent studies indicate that Italian agroforestry research is increasingly moving beyond demonstration towards the development of monitoring, assessment and planning tools capable of supporting policy and management decisions.

Alali et al. (2025) applied the i-Tree methodology in Northern Italy and demonstrated the feasibility of quantifying ecosystem-service provision over a thirty-year time horizon. The study provides one of the first Italian examples of systematic valuation of agroforestry-related ecosystem services, including carbon sequestration and environmental regulation functions. Such approaches may eventually support payments for ecosystem services and other outcome-based policy instruments.

Similarly, Vagge et al. (2024) demonstrated that agroforestry elements can act as biodiversity buffers within highly simplified agricultural landscapes. Their study in the western Po Plain showed that the introduction of seminatural features on a limited proportion of farm area produced measurable improvements in ecological indicators, highlighting the potential of agroforestry as a landscape-scale restoration strategy.

At the same time, monitoring studies reveal persistent governance and planning gaps. Focacci et al. (2025) found that only four of 140 Italian municipalities examined had incorporated urban or peri-urban agroforestry into voluntary planning instruments. Although the study focuses on urban contexts, the finding illustrates a broader challenge: scientific evidence and pilot experiences are accumulating more rapidly than their integration into planning and policy frameworks. This implementation gap remains one of the principal constraints to agroforestry mainstreaming in Italy.

Evidence from the DigitAF project — a multi-actor assessment spanning seven EU countries and six Living Labs, including the Italian Living Lab in Italy, where the AgroFig case study is developed— indicates that farmers who have been exposed to digital advisory tools generally rate their perceived usefulness highly, while overall awareness of available tools remains low (Tranchina et al., 2024b). The main barriers to digitalisation uptake identified across the participating Living Labs were high investment costs, administrative burden, and uncertainty about whether digitally-enabled agroforestry management would qualify for CAP support. These findings suggest that targeted demonstration programmes and simplified administrative pathways, such as those being piloted through the Italian Living Lab network, could significantly accelerate the uptake of digital tools in agroforestry practice.

5.6 Stakeholder Networks and the Italian Fig Agroforestry System

The development of fig-based agroforestry depends upon interactions among a diverse set of actors operating across production, processing, research, governance and market domains. Analysis of the AgroFig First Living Lab Workshop (Artimino, February 2026), together with evidence from Mafrica (2021) and AGFORWARD stakeholder frameworks (Camilli et al. 2017), allows the identification of six major actor categories within the Italian fig agroforestry system: primary producers, processors, quality-certification and territorial-branding organisations, research and advisory institutions, public administrations, and consumer or civil-society networks (Table 5.3).

The structure of the sector reflects the broader characteristics of Italian agroforestry. Knowledge generation is relatively strong, supported by universities, research centres and European projects. Quality differentiation mechanisms are also well developed through PDO schemes, Slow Food Presidia and local branding initiatives. However, organisational coordination within the production sector remains comparatively weak.

A particularly important structural limitation is the absence of a national producer organisation or cooperative structure connecting fig producers across the principal production regions of Calabria, Campania, Puglia and Tuscany. While broader agricultural cooperative systems such as Confcooperative, Legacoop Agroalimentare and Fedagripesca provide institutional frameworks for collective action, fig production remains highly fragmented and largely organised at local scale.

This fragmentation has practical implications for market development. Small and geographically dispersed producers often face difficulties in achieving the scale required for wholesale distribution, export logistics, collective branding and coordinated marketing strategies. Similar constraints have been identified by Gold et al. (2009) as recurrent barriers affecting niche agroforestry sectors internationally.

The evidence reviewed in this report therefore suggests that future development of the Italian fig agroforestry sector will depend not only on technical innovation but also on stronger organisational capacity. Producer coordination, value-chain integration and sustained interaction among research, policy and market actors are likely to be as important as agronomic advances in determining the long-term viability of fig-based agroforestry systems.

Stakeholder category	**Key examples and organisations**	**Role in the fig value chain and agroforestry**	**Operational scale**
Primary producers (small and medium)	Az. Agr. il Fico (Agropoli SA); Funicchitto (Ogliastro Cilento SA); La Ruelle (Atessa CH); Az. Agr. Orlandi Fiorella (Carmignano PO -- Living Lab AgroFig); other members of the associazione dei produttori del fico secco di Carmignano	Production of fresh, dried and processed figs; management of traditional and experimental agroforestry systems; participation in Living Labs	Farm level

Stakeholder category	**Key examples and organisations**	**Role in the fig value chain and agroforestry**	**Operational scale**
Medium to large specialised enterprises	Fikissimi (~100 ha, Puglia); Donnaloia Fico (Fasano BA); Feudo San Giacomo (Puglia); I Giardini di Pomona (Cisternino BR), Buccelletti Agro (Castiglion F. AR)	Large-scale specialised production; varietal innovation and conservation; export of fresh figs to France, Germany, Austria, Belgium and the UK	Farm / regional
Artisan processors	Traditional processing facilities in the provinces of Cosenza and Salerno	Drying, stuffing and packaging; crocette, ficotti, braids and fig salami; preservation of local traditional processing techniques	Local
PDO protection consortia	Consorzio Fico Bianco del Cilento PDO (42 operators); Consorzio Fico Essiccato del Cosentino PDO (36 operators)	Protection and promotion of the PDO brand; definition of production specifications; supply chain oversight; liaison with the Ministry of Agriculture, Food Sovereignty and Forestry (MASAF) and the EU Commission for access to differentiated premium markets	Regional / national
Slow Food Networks	Presidia: Carmignano (PO), Atessa (CH), Prignano Cilento (SA); Arca del Gusto: S. Michele Salentino (TA)	Promotion of native genetic heritage; premium consumer communication; distribution through Salone del Gusto and Condotte; access to international niche markets	National / international
Local Action Groups (LAG)	GAL Valle del Crati (Calabria); GAL Maiella Verde (Abruzzo)	Support for the establishment of PDO consortia; access to EAFRD funds for rural development; linkages between producers, research institutions and regional programmes; territorial animation	Sub-regional
Research institutions	UNIPI (AgroFig); Dept. of Agriculture UNRC and UNIBA; CREA, CRSFA Basile Caramia	Research on agronomy, fig genetics (FIGGEN), LCA, value chain economics; Living Lab management	National / European
Public administrations	Tuscany Region/ARTEA; Calabria Region; Campania Region; MASAF (Rome)	CAP/RDP 2023-2027 programming; eco-schemes; agroforestry measures (SRD05.3.1, SRA28.3); support for PDO/PGI certification; national strategic orientation	Regional / national
Cooperatives and producer organisations	Fedagripesca; Confcooperative Agroalimentare; local cooperatives (absent from the fig sector at national level)	Supply aggregation; access to wholesale and mass retail channels; technical and logistical services; strengthening producer bargaining power — a role currently insufficiently developed in the fig sector	Regional / national

Stakeholder category	Key examples and organisations	Role in the fig value chain and agroforestry	Operational scale
Consumer networks and alternative distribution	Solidarity Purchasing Groups (GAS); farmers' markets; AIAB; Slow Food local chapters, Agrocepi Toscana	Distribution of agroforestry products through short supply chains; informed premium consumers; premium potential through communication of the production system's ecosystem value	Local / national

Table 5.3. Stakeholder typology for the Italian fig agroforestry system. Sources: Mafrica 2021; Camilli et al. 2017; AgroFig First Living Lab Workshop, Artimino, 12 February 2026; Qualigeo (DOP data); Fondazione Slow Food (Presidia data).

6. Ecosystem Services: Evidence from Italy and the Mediterranean

A substantial body of European and Mediterranean research demonstrates that agroforestry systems can provide multiple ecosystem services simultaneously, including carbon sequestration, soil protection, biodiversity conservation, water regulation and improved land-use efficiency. These benefits underpin many of the environmental arguments supporting agroforestry within the European Green Deal, the CAP and climate adaptation strategies.

For Italy, however, the evidence base remains uneven. While biodiversity conservation and landscape functions are relatively well documented, quantitative assessments of carbon dynamics, hydrological regulation and ecosystem-service valuation remain limited. In several areas, Italian studies confirm broader Mediterranean patterns, but significant knowledge gaps persist regarding economic valuation, long-term monitoring and system-specific performance. This section reviews the available evidence and identifies the principal areas where further research is required.

6.1 Carbon Sequestration and Climate Regulation

Carbon sequestration is among the most frequently cited environmental benefits of agroforestry, yet it is also one of the areas where the distinction between demonstrated and assumed benefits is particularly important.

At the European scale, agroforestry systems have been estimated to sequester between 0.09 and 7.29 t C ha^{-1} yr^{-1}, depending on climate, species composition, management intensity and system configuration (Rosati 2019; Kay et al. 2019). These values reflect both above-ground biomass accumulation and increases in soil organic carbon stocks.

Italian evidence confirms that tree-based agricultural systems can represent substantial carbon reservoirs. Using the i-Tree assessment framework, Alali et al. (2025) estimated average above-ground woody carbon stocks of 75.4 t C ha^{-1} in Northern Italian silvoarable systems, with values ranging from 50.4 to 101.6 t C ha^{-1} depending on tree density and species composition. Their 30-yr scenario analysis further showed that traditional mixed orchard systems generated the highest levels of carbon sequestration and atmospheric pollutant removal among the management options assessed.

Additional evidence comes from poplar-based Short Rotation Coppice (SRC) systems in the Po Valley. Facciotto et al. (2014) report greenhouse-gas absorption rates between 13 and 19 t CO_2 ha^{-1} yr^{-1}, highlighting the significant mitigation potential of tree-based production systems integrated within agricultural landscapes.

Below-ground carbon dynamics represent a second major component of climate regulation. International studies consistently demonstrate increases in soil organic carbon under agroforestry management (Cardinael et al. 2015; Rosati 2019), resulting from increased biomass inputs, root turnover and reduced soil disturbance. However, direct measurements remain scarce in Italy, and no published studies have specifically assessed soil carbon accumulation in fig-based agroforestry systems or Mediterranean silvopastoral systems under Italian conditions.

Despite growing scientific evidence regarding biophysical carbon storage, important gaps remain. No published Italian study has quantified the economic value of carbon sequestration generated by agroforestry systems under voluntary carbon markets or emerging carbon-farming schemes — an aspect discussed further in Section 4.5. Similarly, the transaction costs, monitoring requirements and feasibility of carbon-credit participation for small and medium-sized Italian farms remain largely unexplored. Long-term modelling of agroforestry carbon stocks under climate-change scenarios is also lacking.

Consequently, while the climate-mitigation potential of agroforestry is well established scientifically, its translation into economic incentives and climate-policy instruments remains at an early stage in Italy.

6.2 Productivity, Resource Use Efficiency and Climate Resilience

One of the most persistent misconceptions regarding agroforestry is the assumption that the introduction of trees necessarily reduces agricultural productivity. The available Mediterranean evidence suggests a more nuanced picture.

The most comprehensive assessment is provided by the meta-analysis of Scordia et al. (2023), which synthesised results from 36 experimental agroforestry trials across Mediterranean environments. The analysis found an overall negative effect of trees on understorey crop yields, primarily due to competition for light. Tree cover, tree species and crop species were all significant determinants of crop performance, whereas management interventions generally had weaker effects, with fertilisation representing the main exception.

These findings demonstrate that yield reductions can occur at the crop level, particularly under dense tree canopies or poorly adapted species combinations. However, the analysis also highlights a crucial distinction between crop yield and overall system productivity.

Across the majority of studies reviewed, the Land Equivalent Ratio (LER) exceeded one, indicating that agroforestry systems produced more total output per unit area than equivalent monocultures occupying separate land parcels. In other words, while individual crop yields may decline, the combined production of trees and crops generally results in more efficient use of land resources.

This finding is particularly relevant in Mediterranean environments, where increasing climatic variability is expected to intensify drought stress, heat waves and extreme weather events. Under such conditions, facilitative interactions between trees and crops—including microclimatic buffering, shade provision, improved water retention and reduced evapotranspiration—may become increasingly important.

Italian case studies support these broader Mediterranean conclusions. In Central Italy, Rezgui et al. (2024) demonstrated positive economic and productive performance for olive–wild asparagus systems, reporting both a Land Equivalent Ratio greater than one and gross revenues approximately 50% higher than olive monoculture. In Northern Italy, Rosso et al. (2021) found that silvoarable systems integrating poplar and wheat could achieve positive economic returns under appropriate spatial configurations.

The available evidence therefore suggests that agroforestry should be evaluated primarily as a multifunctional production system rather than through comparisons based solely on individual crop yields.

6.3 Soil Protection, Erosion Control and Hydrological Functions

Among the ecosystem services documented in Italy, soil protection represents one of the most consistently demonstrated benefits of agroforestry systems.

Historical agroforestry landscapes evolved partly in response to the need to stabilise slopes, reduce erosion and maintain soil fertility under Mediterranean conditions. Recent studies suggest that the decline of these systems has often been accompanied by increased environmental vulnerability.

In the Northern Apennines, Brandolini et al. (2023) used Unit Stream Power-based Erosion Deposition (USPED) modelling to evaluate the consequences of abandoning the traditional *alberata emiliana* system. Their results indicate that landscape simplification and removal of tree elements significantly increased soil losses processes, while restoration scenarios substantially reduced erosion risk.

A similar pattern emerges in Southern Italy. Brunori et al. (2020) analysed land-use changes in traditional olive polyculture systems in Calabria between 1990 and 2012 and found that abandonment was associated with higher frequencies of landslides and wildfires. In contrast, areas where traditional agroforestry structures persisted maintained greater geomorphological stability, higher soil fertility and lower environmental vulnerability.

At the process level, agroforestry systems are also known to influence nutrient cycling and water quality. Tree root systems can intercept nutrients leaching below the rooting depth of annual crops, thereby reducing nitrogen losses and improving nutrient-use efficiency (Woltz et al. 2018; Pavlidis & Tsihrintzis 2018). Although this mechanism is well established internationally, quantitative assessments remain limited for Italian agroforestry systems.

Hydrological regulation represents another area where evidence remains comparatively scarce. While numerous international studies suggest positive effects on infiltration, runoff reduction and water retention, few Italian studies have directly quantified these functions under different agroforestry configurations. Consequently, hydrological benefits are plausible and consistent with broader scientific understanding but remain insufficiently documented at national scale.

6.4 Biodiversity Conservation and Landscape Functions

Biodiversity enhancement is arguably the ecosystem service for which the Italian evidence base is strongest.

At the European and Mediterranean scale, meta-analyses consistently demonstrate that agroforestry systems support higher levels of plant, insect and vertebrate diversity than comparable monoculture systems (Torralba et al. 2016; Varah et al. 2013). The coexistence of trees, crops and grassland habitats creates structural heterogeneity that increases habitat availability and ecological connectivity.

Italian studies provide multiple examples across contrasting agroecological contexts. In Sicily, Ferrara et al. (2023) examined olive agroforestry from Roman antiquity to the present, framing centuries-old olive trees as living archives of biocultural heritage and highlighting how the ecological memory of traditional management practices has ensured the long-term resilience of these agroecosystems. In Calabria, Brunori et al. (2020) showed that traditional olive polyculture systems maintain landscape complexity and low levels of fragmentation compared with simplified agricultural land uses. In Sardinia, oak-based silvopastoral systems support plant and animal communities comparable to those found in semi-natural woodland ecosystems (Camilli et al. 2017).

The most rigorous quantitative assessment currently available for Italy is provided by Vagge et al. (2024) in the western Po Plain. Using a multi-scale landscape ecology approach, the authors evaluated a 144-ha organically managed agroforestry rice farm and demonstrated that the introduction of seminatural elements — including hedgerows, treelines and small wetlands — on only 4% of the agricultural area increased farm-scale biodiversity indices by an average of 9%. Biological Territorial Capacity—a synthetic indicator of ecological functionality—increased from 1.47 to 1.61 Mcal ha^{-1} yr^{-1}.

These findings are particularly significant because they demonstrate that relatively small investments in ecological infrastructure can generate measurable biodiversity benefits even within highly simplified agricultural landscapes. They also illustrate the potential role of agroforestry as a landscape-restoration strategy capable of contributing simultaneously to biodiversity conservation, ecological connectivity and agricultural production.

Overall, biodiversity enhancement represents the ecosystem service most consistently documented across Italian agroforestry systems. Future research priorities lie less in demonstrating the existence of biodiversity benefits than in quantifying their economic value, understanding long-term ecological trajectories and identifying the management practices that maximise positive outcomes across different agroecological contexts.

7. Barriers, Knowledge Gaps and Strategic Recommendations

The evidence reviewed in this report indicates that agroforestry possesses significant potential to contribute to climate adaptation, biodiversity conservation, soil protection and rural development in Italy. The scientific basis supporting these benefits is increasingly robust, particularly for biodiversity enhancement, landscape restoration and multifunctional land use. At the same time, adoption remains limited relative to the country's historical agroforestry heritage and ecological potential.

The principal constraints identified in the literature are not primarily biophysical. Rather, they relate to governance fragmentation, regulatory inconsistencies, limited technical support, insufficient economic information and weak market recognition. Several of these barriers have persisted across successive CAP programming periods despite the growing availability of scientific evidence and policy instruments.

This section synthesises the main barriers identified throughout the report, highlights remaining knowledge gaps and proposes strategic actions grounded in the available evidence.

7.1 Institutional and Policy Barriers

The most consistently documented institutional obstacle is the so-called UAA paradox — described in detail in Section 5.1 — whereby the establishment of trees can reduce the area classified as eligible agricultural land, thereby reducing direct payments. This structural disincentive contributed to the limited uptake of Measure 222 (2007–2013) and the uneven implementation of Measure 8.2 (2014–2020).

Additional regulatory inconsistencies continue to affect adoption. Rosati et al. (2025) highlight tensions between certain eco-scheme requirements for permanent crops and the integration of livestock grazing within orchards, potentially limiting the development of silvopastoral systems. Similarly, the absence of harmonised national guidance regarding grazing management and livestock withdrawal periods creates uncertainty for farmers, advisors and regional administrations.

Governance fragmentation represents a second major challenge. As discussed in Section 5.2, Italy lacks a dedicated national agroforestry strategy and responsibility is largely devolved to regional authorities, resulting in substantial variation in support availability, implementation quality and policy coherence. Addressing this structural fragmentation — for example through a national coordination mechanism linking agricultural, forestry and environmental policy — is therefore a prerequisite for more effective future programming.

Overall, the available evidence suggests that policy support for agroforestry is constrained less by the absence of instruments than by regulatory inconsistencies, institutional fragmentation and implementation challenges.

7.2 Knowledge, Advisory and Market Barriers

The literature consistently identifies deficiencies in technical support and knowledge exchange as important barriers to adoption. Surveys conducted among farmers and agricultural advisors in Central and Northern Italy found that limited familiarity with agroforestry design, management and funding opportunities represented a significant obstacle to implementation (Pisanelli et al. 2012). Similar conclusions emerged from participatory research conducted under AGFORWARD, where stakeholders generally perceived agroforestry benefits positively but expressed concerns regarding management complexity and technical requirements (Camilli et al. 2017). These Italian findings are consistent with the global systematic evidence assembled by Tranchina et al. (2024a), who reviewed 31 categories of adoption barrier across the international agroforestry literature and identified limited farmer knowledge and experience, inadequate technical support, and market access constraints as the three most consistently reported obstacles to adoption worldwide — suggesting that the challenges documented in Italy are structural rather than exceptional.

Economic uncertainty further constrains adoption, as discussed in detail in Section 4. Enterprise-level cost-benefit analyses remain scarce and geographically concentrated, leaving farmers without reliable information regarding establishment costs, maintenance requirements, expected returns and risk profiles under Italian conditions.

Both barriers were directly confirmed by the AgroFig First Living Lab Workshop (Artimino, 12 February 2026; n=27): lack of knowledge and training emerged as the dominant adoption barrier, cited by 22 out of 27 respondents, while economic uncertainty at farm scale — particularly the absence of reliable data on investment costs, payback periods and profitability — was consistently identified as the second most important constraint. Participants additionally highlighted poor familiarity with available CAP incentive schemes (SRA28.3, SRD05.3.1) as a barrier that is significant yet potentially addressable through targeted advisory support.

Market-related barriers are equally important. Agroforestry products are generally marketed through existing quality schemes, direct sales or short supply chains rather than through dedicated agroforestry labels. Consequently, environmental and social benefits associated with agroforestry management are rarely communicated explicitly to consumers. Evidence from Veneto indicates that consumer awareness of agroforestry remains low, with 74% of surveyed consumers reporting little prior knowledge of agroforestry systems (Bondesan et al. 2016). At the same time, the same study found measurable willingness to pay for agroforestry products once environmental benefits were explained, suggesting that market constraints are linked more closely to information asymmetries and product recognition than to lack of consumer interest.

Agronomic uncertainty also remains a factor. Mediterranean evidence demonstrates that understorey crop yields can decline under certain tree densities and species combinations (Scordia et al. 2023), even when overall land-use efficiency remains positive. The limited availability of long-term Italian performance data therefore contributes to risk perceptions among farmers considering conversion.

7.3 Key Evidence and Remaining Knowledge Gaps

Evidence reviewed in Sections 3–6 demonstrates that Italian agroforestry systems can simultaneously deliver productive, environmental and social benefits. The strongest evidence concerns biodiversity enhancement, soil protection and land-use efficiency, whereas economic performance and long-term ecosystem-service valuation remain comparatively under-documented (see Section 4 for economic details).

- Italy hosts approximately 1.4 million ha of agroforestry land, placing it among the leading EU Member States by total area (den Herder et al. 2017). Systems are concentrated in Sardinia and in Central and Southern Italy.

- Land Equivalent Ratios consistently exceed one across Mediterranean meta-analyses, confirming that agroforestry systems use land more efficiently than equivalent monocultures, despite occasional reductions in individual crop yields (Scordia et al. 2023; Rezgui et al. 2024).

• Biodiversity enhancement is the most robustly documented Italian benefit. Studies across contrasting contexts demonstrate positive impacts on plant, arthropod and vertebrate communities, with even small seminatural-infrastructure investments producing measurable improvements (Vagge et al. 2024; Ferrara et al. 2023; Brunori et al. 2020).

• Four principal knowledge gaps persist: enterprise-level economic assessments; economic valuation of ecosystem services; long-term monitoring of system performance and resilience; and comparative evidence on the effectiveness of different policy instruments and advisory approaches.

• Several of these gaps are directly addressed by AgroFig research activities in Tuscany, providing a basis for improved evidence in future reporting periods.

7.4 Strategic Recommendations

The evidence reviewed in this report suggests that Italy possesses the ecological conditions, scientific knowledge and market opportunities necessary to support a significant expansion of agroforestry systems. Realising this potential will require coordinated action across policy, research, advisory and market domains.

Recommendation 1. Improve policy coherence within CAP implementation

European and national authorities should address regulatory inconsistencies that continue to discourage agroforestry adoption, particularly those affecting eligibility for direct payments and the integration of livestock within tree-based systems. Greater alignment between agroforestry objectives and CAP implementation rules represents a prerequisite for wider uptake.

Recommendation 2. Strengthen advisory services and technical capacity

Regional administrations, professional associations and research institutions should invest in specialised agroforestry training programmes targeting agronomists, forestry technicians and extension services. Existing Living Lab infrastructures, including AgroFig and DigitAF, provide practical platforms for testing and disseminating such approaches.

Recommendation 3. Generate robust economic evidence for farmers

Future research should prioritise system-specific economic assessments, including establishment costs, profitability, labour requirements and risk profiles. Particular attention should be given to fig-based agroforestry systems, where current evidence remains limited despite growing policy and research interest.

Recommendation 4. Improve market recognition of agroforestry products

Producer organisations, quality-label bodies and regional authorities should explore mechanisms for communicating the environmental and social attributes of agroforestry products. This may include voluntary certification approaches, integration within existing territorial quality schemes or targeted consumer-awareness initiatives.

Recommendation 5. Strengthen national coordination

Consideration should be given to establishing a national agroforestry coordination mechanism capable of linking agricultural, forestry and environmental policy domains. Such a mechanism could facilitate knowledge exchange among regions, improve policy coherence and support implementation of existing measures (ex, supporting AIAF coordination role).

Recommendation 6. Develop ecosystem-service valuation frameworks

Research institutions and public authorities should prioritise the economic valuation of ecosystem services generated by agroforestry systems, including carbon sequestration, biodiversity conservation, erosion control and hydrological regulation. Such evidence would strengthen the basis for future agri-environmental payments, carbon-farming initiatives and nature-based financing mechanisms.

Taken together, the evidence reviewed in this report indicates that agroforestry systems can deliver multiple environmental, productive and social benefits under Italian conditions. The strongest evidence concerns biodiversity enhancement, soil protection, climate adaptation and land-use efficiency, whereas important questions regarding economic performance, long-term monitoring and scaling-up pathways remain insufficiently documented.

Italy retains one of Europe's richest agroforestry heritages and continues to host a wide diversity of multifunctional systems. Realising the full potential of this heritage will depend on strengthening policy coherence, technical support, market recognition and stakeholder coordination, thereby creating the conditions for the wider integration of agroforestry within agricultural and rural-development strategies.

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