ResAlliance

Type of solution: Management Sector: Agriculture, Agroforestry
Good practice(s): Management alternatives, Ecosystems services

Agroforestry innovations: multifunctional olive systems

Promoting multifunctional olive systems for sustainable olive farming in the Mediterranean region.

Multifunctional olive systems combining olive trees with livestock (silvopastoral).
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Multifunctional Olive Systems combining olive trees with cover crops (silvoarable).
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/// Context ///

Agroforestry in the Mediterranean region represents a sustainable land-use system that integrates trees and shrubs into agricultural landscapes, combining agriculture and forestry practices to enhance biodiversity, improve soil health and optimize water usage. This approach is particularly significant in olive farming systems in the Mediterranean, where the climate is posing challenges such as soil erosion, water scarcity and desertification. Agroforestry systems, which combine trees with crops (silvoarable) or livestock (silvopastoral), can help address these issues by offering shade, reducing evaporation and improving soil fertility through the accumulation of organic matter. As climate change exacerbates environmental stresses, the adoption of agroforestry in the Mediterranean is gaining recognition for its potential to enhance ecological stability, improve agricultural productivity and support rural livelihoods.

The "LIVINGAGRO – Cross Border Living Laboratories for Agroforestry" project (ENI CBC Med Programme 2014-2020) was designed to tackle challenges of knowledge and technology transfer in Mediterranean agriculture and forestry systems. By adopting an open innovation approach, a Living-Lab on "Multifunctional Olive Systems" (MOS) has been established through partnership

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agreements between public and private entities, aimed at fostering collaboration among innovators and stakeholders. MOS refers to olive farming systems that deliver multiple benefits beyond the primary goal of olive oil and olive production. These systems strive to achieve a balanced relationship between agricultural productivity and environmental stewardship, incorporating sustainable farming practices and innovative solutions essential for addressing the challenges of olive farming in the Mediterranean. Innovations in this field were driven by the need to optimize land use, reduce environmental impact and enhance the viability of rural economies. This approach not only boosts olive production but also enhances the ecological, economic and social functions of the system by providing critical ecosystem services such as carbon sequestration, habitat preservation and water management, making it a model for sustainable agriculture in the Mediterranean and beyond.

Challenges of olive farming in the Mediterranean: the role of agroforestry and multifunctional olive systems.

Multifunctional olive systems not only boost olive production but also enhances the ecological, economic and social functions of the system, making it a model for sustainable agriculture.

/// Solution for a Resilient Future ///

LIVINGAGRO has compiled a variety of tested innovations that could greatly benefit olive farmers. Innovation in agriculture and forestry refers to “a new or improved idea that provide economic, social or environmental advantages in rural practices”.

Examples of tested innovations that could help transform olive groves into multifunctional olive systems include:

1 – Re-Using Traditional Practices in Agroforestry

- Livestock grazing in olive agroforestry systems

In Greece, olive groves cover ~ 700,000 hectares, with 124,311 dedicated to agroforestry. These systems incorporate understory crops such as vegetables, cereals or pasture, which are typically planted at densities of 50-100 per hectare. Traditional agroforestry integrates grazing animals or beekeeping, using both wild and cultivated plants. Scattered olive trees support herbaceous plants for grazing whereas trees planted in rows 10 m apart, support growing cereals and legumes. Sowing happens from mid-October to mid-November, with animals grazing on the stubble afterward. Olive agroforestry may increase the profitability and sustainability of the farm by the production of biomass and grains from the understory crops while positively affecting olive tree productivity. It improves orchard health and diversifies income through olive products, animal husbandry and crop cultivation.

- Olive tree, wild asparagus and free-range chicken polyculture

Historically, olive trees were cultivated alongside other crops and animals. Shifting to olive monocultures led to decreased soil fertility and increased erosion. To address this, green mulching is currently being employed. Cultivating wild asparagus (Asparagus acutifolius) in the shade of olive trees can maintain ground cover and provide extra income. Asparagus can be grown in tree rows or between them, though the latter may complicate equipment use and weed control. Additionally, raising chickens in the orchard helps control weeds and offers further income. Raising chickens in two cycles annually

Multifunctional olive systems: an integrated approach for sustainable olive farming.

Multifunctional Olive Systems combining olive trees with free-range chicken.
Author: Andrea Pisanelli | © Educational use, non-commercial.

Multifunctional Olive Systems combining olive trees with Asparagus.
Author: Adolfo Rosati
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Wild asparagus, a shade-tolerant perennial, can be grown alongside olive trees. It thrives under the same climatic conditions, making it a low-impact crop that can boost local incomes.

helps reduce weeds and fertilizers. This polyculture approach has proven environmentally beneficial, improving productivity and potentially increasing income compared to separate cultivation methods.

2 – Intercropping and preparing for Climate Change in olive groves

Intercropping enhances the sustainability of olive groves by increasing biodiversity and stabilizing the soil. This reduces the trees’ susceptibility to both biotic and abiotic stresses caused by climate change.

- Olive trees intercropped with cereals and legumes

Historically, olive groves in central Greece were intercropped with cereals and legumes. Recently, there’s renewed interest in combining olive production with crops such as durum wheat, barley, vetch and/or chickpeas. Chickpeas (Cicer arietinum L.) improve soil health by fixing nitrogen, reducing fertilizer costs; while vetch, grown during the rainy season, boosts soil fertility and prevents nitrogen loss. These practices support sustainable farming in Mediterranean climates and can increase farmers’ income by providing nutritious high-quality crops.

- Olive tree-avocado intercropping

Historically, olives were grown with other trees to naturally control pests, but this practice has declined, leading to an increase in pesticide use. By planting avocados between olive trees, biodiversity is restored, natural pest control is improved and farmers’ incomes rise due to higher avocado sales. In a Koroneiki olive grove, avocado trees are strategically planted in a 3.5 x 7 m layout, with Bacon avocados used for pollination. Ensuring a sufficient water supply is essential. This method enhances farm productivity, reduces erosion,

Chickpeas are cost-effective high-protein food and feed source. They improve soil fertility by fixing nitrogen, reducing need for fertilizers and protecting soil and water from nitrogen contamination.

Multifunctional Olive Systems combining olive trees with chickpeas.
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boosts carbon storage, improves microclimates and creates better wildlife habitats, often leading to decreased pesticide use.

- Grafted olive trees resistant to the effects of climate change

The development of new, resilient olive cultivars will help expand cultivation areas, enhance resilience to climate change and improve the quality of olive oil and table olives.

Certain olive cultivars are more resilient to the effects of climate change and should be used as rootstocks for grafting with popular olive varieties to create new, stress-tolerant cultivars. Traditional varieties like Lefkolia, Arvanitolia and Leccino known for their resistance to salinity and drought, are ideal for this purpose. These rootstocks undergo thorough genetic, morphological and stress tolerance evaluations before grafting. The development of new, resilient olive cultivars will help expand cultivation areas in Greece, enhance climate change resilience and improve the quality of olive oil and table olives. This initiative will also provide valuable information for the olive industry both in Greece and internationally.

/// Always Moving Forward ///

Strategic steps with focus on continuous collaboration between all stakeholders, monitoring, evaluation, adaptive management and scaling successful models are needed in order to ensure the sustainability of olive farming in the Mediterranean.

By advancing the following steps, stakeholders can address future challenges, promote the adoption of multifunctional olive systems for sustainable land management and contribute to broader sustainable development goals in the region.

1 – Promote sustainable land management

- Encourage the adoption of agroecological practices that enhance biodiversity, soil health and water management.
- Implement integrated pest management strategies to reduce reliance on chemical inputs and promote ecological balance.
- Promote techniques such as terracing, mulching and efficient irrigation to conserve soil and water resources.
- Promote land-use planning that integrates agroforestry with other rural development activities such as tourism and conservation.

2 – Strengthen stakeholder collaboration

- Create regular forums for dialogue among farmers, government agencies, researchers, NGOs and private sector entities to foster collaboration and share best practices.
- Create networks for farmers to share experiences, challenges and solutions related to adopting best practices.
- Form partnerships between academic institutions, international organizations and local communities to conduct studies on the long-term impacts of these innovations.

Strategic steps to ensure the long-term success and sustainability of multifunctional olive systems in the Mediterranean.

3 – Implement continuous monitoring and evaluation

- Establish comprehensive monitoring systems to track the environmental, social, and economic impacts of olive farming practices.
- Conduct regular assessments to evaluate the effectiveness of implemented strategies and adapt them based on findings.
- Promote transparent data sharing among stakeholders to facilitate informed decision-making.

4 – Promote adaptive management practices

- Design flexible management plans that can be adjusted based on monitoring results and changing conditions.
- Integrate climate resilience strategies into management plans to address the impacts of climate change on olive farming.

Multifunctional Olive Systems combining olive trees with a mixture of barley and common vetch.
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Multifunctional Olive Systems combining olive trees with Avocado.
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5 – Scale successful models

- Identify successful models from pilot projects and develop strategies for scaling them up across broader regions.
- Adapt and replicate successful innovations in similar agroecosystems.

6 – Support policy and regulatory frameworks

- Work with policymakers to create supportive regulatory frameworks and incentives for sustainable olive farming.
- Develop and enforce standards for sustainable practices and certification schemes to ensure compliance and promote market access.

7 – Foster research and innovation

- Invest in research to develop climate-resilient cultivars, new technologies and practices that enhance the sustainability of olive farming.
- Create innovation hubs where researchers, farmers, and entrepreneurs can collaborate on developing and testing new innovations.

Cooperation allowed to increase the project's operational spin-offs and transferability of the system and methodologies.

The VISTOCK System was developed to manage beef cattle grazing in a rational and sustainable way.

8 – Promote market access and value addition

- Strengthen the value chain by supporting smallholders in accessing markets, adding value to products and improving marketing strategies.
- Promote fair trade practices to ensure that farmers receive fair compensation for their products.
- Develop eco-tourism initiatives that showcase agroforestry systems, providing additional income streams for rural communities.

9 – Improve awareness, capacity building and education

- Conduct campaigns to raise awareness about the importance of multifunctional olive systems and their benefits.
- Develop training programs that cover all aspects of agroforestry, intercropping and polyculture practices.
- Provide training and resources to farmers and other stakeholders to adopt and scale successful practices.
- Develop educational programs for schools and communities to foster a culture of sustainability from a young age.

Multifunctional Olive Systems combining olive trees with vetch as cover crops.
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Further information

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