The project Farming the Future – Building Rural Networks for Climate-Adaptive Agriculture - FARM LIFE - is co-funded by the LIFE Programme of the European Union under contract number LIFE17 CCA/NL/000093.

The Farm LIFE project aimed to transform European farming by combining trees, shrubs, crops and animals into sustainable systems. This method, called agroforestry, boosts biodiversity, improves soil health, manages drought, and increases farmers' income.

CONTENTS

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The project developed amongst others; customised farming plans, an online knowledge hub, online course, cost-benefit analysis tool and farmer networks to help European farmers switch to agroforestry. By bringing together farmers, researchers and policymakers, Farm LIFE showed that agroforestry can make farming more resilient and productive, benefiting both the environment and the farming community.

The challenge

Conventional farming methods have caused significant environmental and agricultural challenges. Soil degradation, loss of biodiversity and increased vulnerability to climate change are pressing issues that need addressing. Farmers face numerous bottlenecks in the transition towards climate-resilient agriculture, such as agroforestry. A lack of technical knowledge, inadequate business models, and navigating complex laws and regulations are some of the pressing challenges.

Challenges highlighted by initial surveys

- **Soil degradation**
  Soils were vulnerable to erratic weather events, such as droughts. Some soil properties related to nutrient availability and soil microbiome were not optimal.
- **Biodiversity loss**
  Habitat diversification was lower than it is now and the planting of trees have brought new species. The previous species composition was less diverse.
- **Climate vulnerability**
  Farms were increasingly affected by droughts and extreme weather, impacting crop yields.

Farmers faced and experienced limited knowledge about agroforestry techniques, bringing numerous challenges in the transition to agroforestry. Business model development and understanding legal frameworks were additional hurdles that needed to be overcome.

Image: FarmLife agroforestry.

The project

The Farm LIFE project aimed to develop and implement sustainable farming practices through innovative agroforestry approaches. By integrating trees, shrubs, crops and animals, the project sought to improve soil health, manage erratic weather conditions such as drought, and enhance biodiversity, all while increasing farmers' income.

Objectives and goals

- **Enhance soil health**
  Implement practices that restore and maintain soil fertility.
- **Increase biodiversity**
  Diversify the habitat to increase biodiversity by using agroforestry practices.
- **Manage climate risks**
  Develop strategies to mitigate the impacts of drought and extreme weather.
- **Improve farmer income**
  Create profitable, sustainable business models for farmers.

Scope and activities

- **Adaptive farm plans**
  Developed agroforestry farm plans tailored to specific conditions, supported by the INTACT cost-benefit analysis tool, helping farmers create profitable business models.
- **Co-creation and networking**
  Foster networks and partnerships among farmers, facilitating the implementation and upscaling of agroforestry.
- **Transition toolkit**
  Build an online knowledge hub offering comprehensive guidance on agroforestry implementation.
- **Future transition managers**
  Offer a Master's degree specialisation in agroforestry to prepare future agricultural managers.
- **Knowledge sharing**
  Develop an online course to disseminate agroforestry knowledge.
- **Value creation**
  Innovate agroforestry food products and branding strategies.
- **Policy integration** – Engage with policymakers to integrate agroforestry into political agendas and provide policy advice.

Image: Map highlights project locations.

Geography

The project was primarily implemented in the Netherlands and Belgium, with specific demonstration farms including Kwaalburgse Hoeve in Alphen (North Brabant), Netherlands, and other locations in 's-Hertogenbosch, Schijndel, and Velp in the Netherlands, and Lovendegem and Laakdal in Belgium.

Innovation

Agroforestry itself was the innovation, offering one of the most promising tools for restructuring traditional agricultural practices. The project demonstrated the potential of integrating trees and shrubs with crops and animals to create sustainable and resilient farming systems.

Activity

The Farm LIFE project undertook various activities to promote sustainable agroforestry practices and support farmers in their transition to climate-adaptive agriculture.

Project timeline and major milestones

17 → 18 — Initial planning and establishment of demonstration farms.

19 → 20 → 21 — Implementation of agroforestry practices and development of the Transition Toolkit.

22 → 23 → 24 — Evaluation, knowledge dissemination and policy integration.

Image: Timeline reflecting the three main stages of the project.

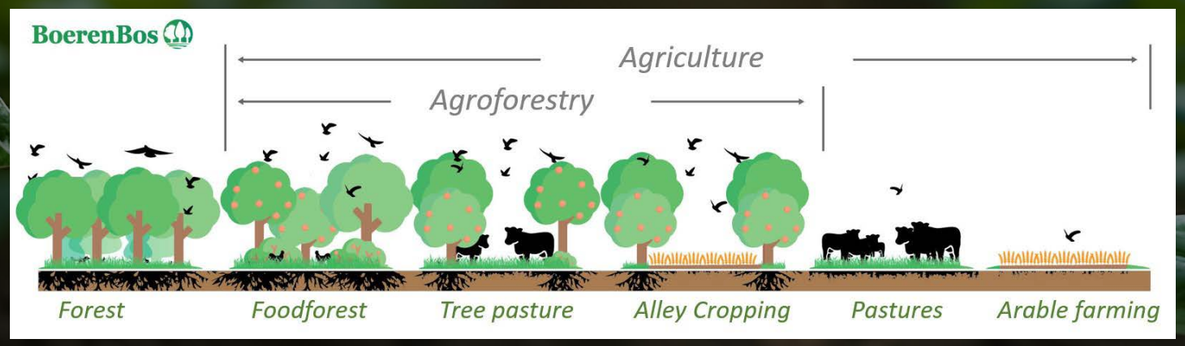
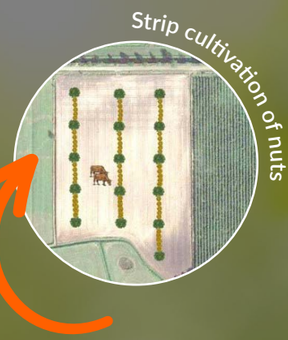
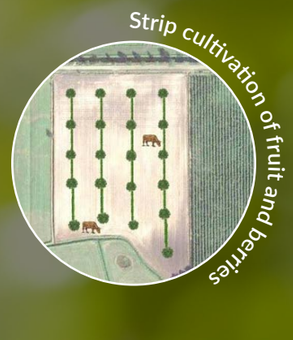


Image: Agroforestry and other forms of land management. Source: BoerenBos, translated by FSG.

Farm LIFE



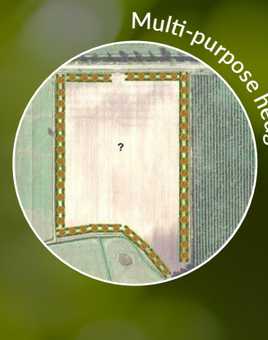


Adaptive farm plans

Developed customised agroforestry farm plans that helped farmers create profitable business models tailored to their specific conditions. These plans provided step-by-step guidance on integrating trees, shrubs, crops and animals into their farming systems.

Co-creation and networking

Fostered the creation of farmer networks and partnerships, facilitating the implementation, replication and upscaling of agroforestry practices in the Netherlands and Belgium. These networks provided a platform for knowledge exchange and mutual support among farmers.

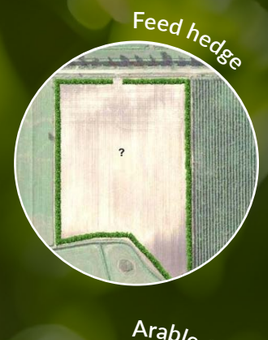


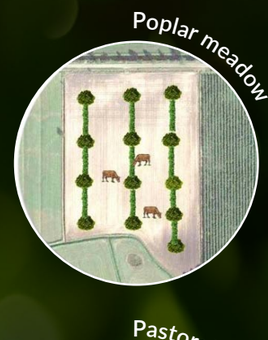
Transition toolkit

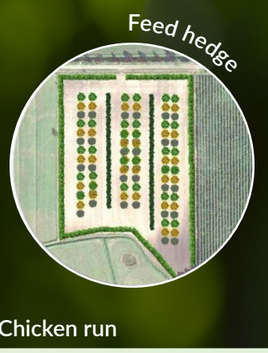
Built an online knowledge hub offering comprehensive information and resources on agroforestry. The toolkit included technical guidelines, business model templates and information on relevant laws and regulations, helping farmers navigate the transition to agroforestry.

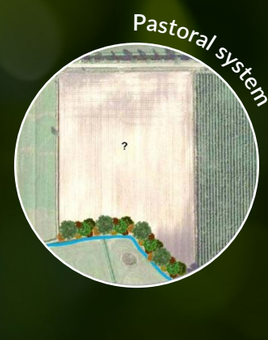
Future transition managers

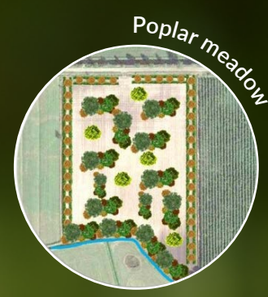
Offered a specialisation in agroforestry as part of a Master's degree programme. This initiative aimed to prepare future agricultural managers with the skills and knowledge needed to implement and promote sustainable farming practices.



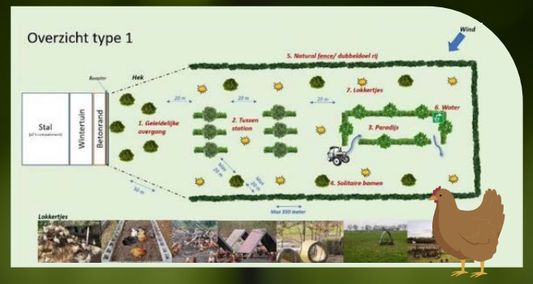








Chicken run



Knowledge sharing

Developed an online course on agroforestry, providing accessible education to farmers, consultants, agricultural students and other stakeholders. The course covered topics such as ecological interactions, tree species selection, planting techniques and agroforestry design.

Value creation and competitiveness

Innovated new agroforestry food products and developed branding strategies to enhance market competitiveness. These efforts aimed to create added value for agroforestry products and improve farmers' income.

Policy integration

Engaged with policymakers to bring agroforestry into political focus and provided policy advice for the Netherlands, Belgium and the EU. This involved advocating for supportive policies and funding mechanisms to promote agroforestry adoption.

Watch the Farm LIFE project video

Biodiversity

Soil life

In agroforestry farms, the Shannon diversity index—used to quantify the diversity of species within a community—for both fungi (mycorrhiza) and bacteria generally increased when comparing measurements taken during the baseline (2019) and monitoring (2023) sampling. High values (H' > 3) indicated significant diversity, reflecting a large number of species with relatively even abundances. The evenness observed suggests that no single species dominates the microbial community; instead, there is a balanced distribution of species.

The Farm LIFE projects' initial measurements showed a direct correlation with increased biodiversity and improved soil health which presents several associated benefits.

- **Healthy soil ecosystem**
  High diversity in soil fungi and bacteria is closely linked to soil health. These diverse microbial communities contribute to essential soil functions, including nutrient cycling, organic matter decomposition, disease suppression, and overall soil structure maintenance.
- **Resilience to environmental changes**
  Diverse microbial populations are more resilient to environmental shifts. They can adapt effectively to changes in temperature, moisture levels, or the introduction of pollutants or pathogens.
- **Complex interactions**
  High diversity fosters intricate interactions among species, such as symbiotic relationships, competition, and nutrient exchange. These interactions enhance soil fertility and promote plant health.
- **Functional redundancy**
  With diverse microbial communities, functional redundancy ensures that critical soil processes persist even if some species are lost or their populations decline.

Maintaining high microbial diversity in agroforestry systems is essential for sustainable soil management and overall ecosystem health.

Insect life

Agroforestry can create diverse habitats that support a wide range of insect species. During the project, increased numbers of individual insects were observed a few years after planting trees and shrubs. Specifically, there was a notable rise in populations of hoverflies and moths.

- **Hoverflies**
  Important for pollination and pest control.
- **Moths**
  Serve as a crucial food source for birds, bats, amphibians and small mammals. Increased diversity was observed, particularly species with an affinity for woody habitats.

Measuring impact

The Farm LIFE project implemented a comprehensive approach to measure the impact of its agroforestry practices. By monitoring various indicators, the project was able to assess the effectiveness and benefits of integrating trees and shrubs into agricultural systems.

Several methodologies were used to measure soil health, biodiversity and other key indicators.

- **Soil health**
  Monitored changes in soil fertility and structure to assess improvements in soil health.
- **Biodiversity**
  Tracked the number and variety of species present on farms, focusing on both plant and animal biodiversity.
- **Carbon sequestration**
  Measured the amount of carbon stored in trees and soil to evaluate the climate mitigation potential of agroforestry.
- **Water management**
  Assessed the effectiveness of agroforestry practices in improving water retention and reducing erosion.
- **Farmer income**
  Analysed economic benefits to farmers, including cost savings and increased revenue from diverse products.

Adaptation measures

A key tool used in the project was the Adaptation Measures Index to track the implementation and success of various agroforestry practices. This index included a detailed list of adaptation measures, each linked to a factsheet providing in-depth information.

Indicators of success

While the methodologies outlined above helped measure the impact of the project, the actual success of these measures is reflected in the indicators of success, such as improved soil health, increased biodiversity and enhanced farmer income. These indicators provide tangible evidence of the positive outcomes achieved through the Farm LIFE project.

Results and outcomes

The Farm LIFE project achieved significant results and demonstrated the numerous benefits of agroforestry practices. These outcomes highlight the project's success in addressing environmental and agricultural challenges while providing economic benefits to farmers.

Farmer survey results and insights

A survey conducted among farmers revealed valuable insights into their motivations, knowledge levels, and the challenges they faced in implementing agroforestry:

- **Motivations**
  Many farmers were motivated by the potential for increased biodiversity and improved soil health. Agroforestry was seen as a way to create more resilient farming systems.
- **Knowledge levels**
  The survey highlighted gaps in technical knowledge, particularly regarding agroforestry system design, pest and disease management and soil maintenance.
- **Implementation barriers**
  Farmers identified several barriers to implementing agroforestry:
  - a significant number cited a lack of technical knowledge as a major hurdle
  - developing viable business models for agroforestry was a common challenge
  - navigating complex laws and regulations was found to be difficult by many farmers.

The insights gathered from this survey provided a foundation for the project's activities, guiding the development of resources and support systems tailored to the farmers' needs.

Nutritional yield comparisons

Nutrient yields of agroforestry companies can vary greatly, with both higher and lower yields compared to monoculture nutrient values, which is highly dependent on the cropping plan of the companies.

Nutritional values	Diversified Agroforestry			Monoculture			
	Koekoek	Kwaalburgse Hoeve	Bosboom	Blue-berries	Plumbs	Walnuts	Pears
Energy yields (1000 kcal/ha)	32621	16854	17273	5460	10000	19415	20189
g of vitamin B1/ha	**14**	**9,3**	**8,6**	**2,1**	**5,0**	**10,2**	**3,7**
g of vitamin B2/ha	**6,1**	**2,7**	**8,3**	**3,2**	**7,5**	**3,0**	**7,3**
g of vitamin B3/ha	**91**	**34**	**95**	**32**	**125**	**39**	**73**
g of vitamin C/ha	**1538**	**108**	**16526**	**1050**	**1250**	**36**	**1101**

The differences in energy and vitamins B and C yield per ha depend on the amount and density of food producing plants , and the types of plant present in each farm.

These comparisons highlight the potential of agroforestry to improve nutritional yields and vitamin content per ha, contributing to more diverse and resilient agricultural production systems. By integrating various crops with trees and shrubs, agroforestry systems can enhance the quantity of food produced.

Environmental impact studies

The environmental benefits of agroforestry were evident in the project's life cycle assessment (LCA) studies.

Product comparison	Environmental impact metrics
Plant-based protein cheese vs. Dairy cheese	**Lower Environmental impact despite higher use**
Land Use	Plant-based cheese had a 95% reduction in land use compared to conventional dairy cheese
Energy Use	Plant-based cheese had 117% higher energy use
Greenhouse Gas Emissions	60% lower for plant-based cheese
Water Use	124% lower for plant-based cheese
Agroforestry walnuts vs. Conventional walnuts	**Lower environmental impact with combined land use**
Greenhouse Gas Emissions	120 to 428% lower for agroforestry walnuts
Water Use	100% lower for agroforestry walnuts
Fossil Fuel Use	99% lower for agroforestry walnuts

- **Plant-based protein cheese vs. Dairy cheese**
  Producing cheese from walnuts in agroforestry systems demonstrated a significant reduction in greenhouse gas emissions, water use and land use compared to conventional dairy cheese despite higher energy use.
- **Agroforestry walnuts vs. Conventional walnuts**
  Agroforestry systems for walnut production showed lower environmental impacts due to the efficient use of combined land resources, reduced inputs of water and fossil fuels, and increased carbon sequestration.

These studies highlight the potential of agroforestry systems to reduce environmental impacts and contribute to more sustainable agricultural practices. By integrating trees and shrubs with traditional crops, agroforestry not only enhances biodiversity and soil health but also offers viable alternatives to conventional agricultural products.

Agro farm forestry label

The project introduced the Agro Farm Forestry (AFF) label, certifying farms that practice agroforestry according to the project's guidelines:

- **Certification process**
  Farms are assessed annually based on nine golden rules covering soil improvement, biodiversity enhancement, carbon sequestration and water management.
- **Benefits**
  The label helps farmers market their products and demonstrate their commitment to sustainable practices.

Online course (E Academy Agroforestry)

Farm LIFE project developed the E Academy Agroforestry, a free online course designed to introduce agroecological approaches, such as agroforestry, to farmers who wish to transform their conventional agricultural system into a climate-resilient one.

- **Course content**
  Six e-learning modules cover topics such as ecological interactions, tree species selection, planting techniques and agroforestry design.
- **Accessibility**
  The course is accessible to anyone interested in learning about agroforestry, promoting knowledge dissemination and practical application.

Bottlenecks faced by farmers

The project identified and addressed several bottlenecks that farmers encountered in implementing agroforestry:

- **Technical knowledge**
  Gaps in understanding system design, perennial crop management and soil maintenance were common.
- **Business models**
  Farmers struggled with developing viable business models, finding markets for agroforestry products, and forming partnerships.
- **Regulations**
  Navigating laws and regulations, including subsidies and support mechanisms, was challenging for many farmers.

Land equivalent ratio (LER)

The Land Equivalent Ratio (LER) is a measure of productivity in agroforestry systems compared to conventional monocultures. The project achieved an average LER of 1.3, indicating that **agroforestry systems are 30% more productive in utilising land resources compared to traditional monocultures.**

Farmer income increases

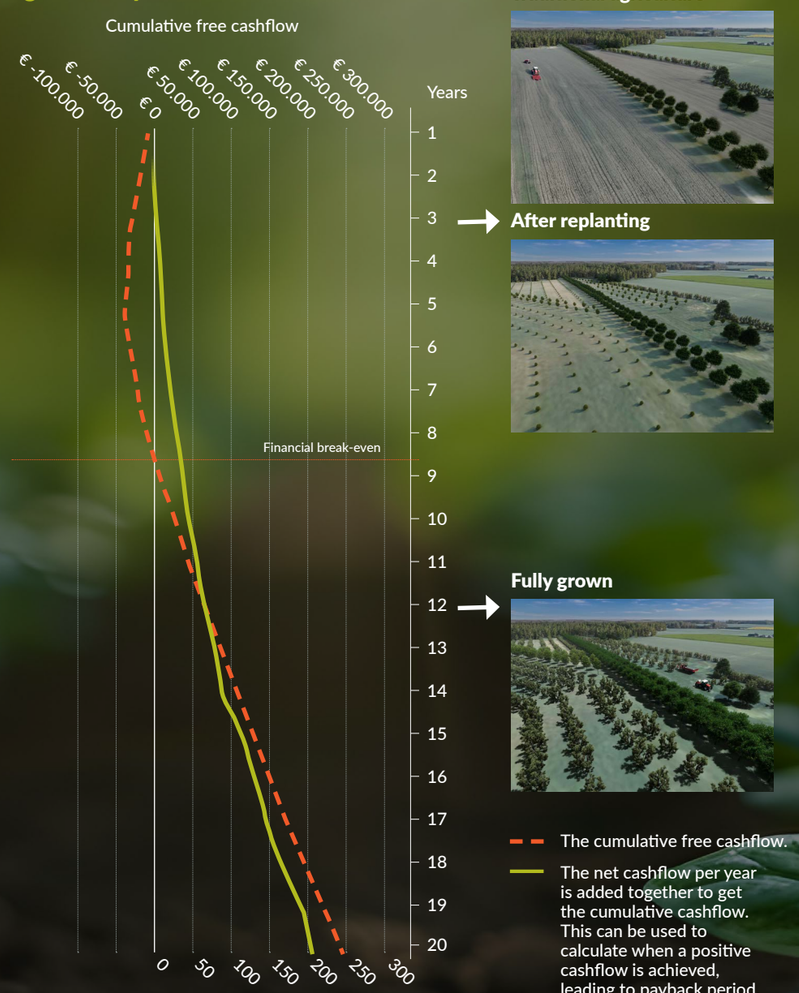
The project projected **long-term income increases for farmers, with an average increase of 17% over 20 years**. By diversifying income streams and reducing dependency on single crops, agroforestry practices have proven to be economically beneficial.

Cost savings and revenue projections

Agroforestry systems achieved significant cost savings and higher revenue:

- **Profitability**
  The project surpassed its initial goal, achieving **a profit of 540 Euros/ha/year** compared to the target of 100 Euros/ha/year.
- **Cost efficiency**
  Reduced inputs of water, fossil fuels and fertilisers contributed to cost savings. For instance, **water usage decreased by 20%**, and **fossil fuel inputs were reduced by 15%**.

Agroforestry cost-benefit



Traditional agriculture

After replanting

Fully grown

The cumulative free cashflow.

The net cashflow per year is added together to get the cumulative cashflow. This can be used to calculate when a positive cashflow is achieved, leading to payback period.

Testimonials

> "I want my company to blend into the natural transition between forest and polder of the existing landscape, with a variety of harvest products, improved living conditions for livestock, and contributing to the capture of greenhouse gases."
> **Pipie Smits van Oyen, De Koekoek**

> "Agroforestry for us, it is a combination of goals that we can achieve. We can add an extra crop to our farm through the nuts. The nut trees give shade to the cattle that walk underneath and, at the same time, the grass can still be used, and it makes the landscape more beautiful. For us, it's a win in all areas."
> **Pipie Smits van Oyen, De Koekoek**

> "We see the transition to agroforestry as an answer to the problems we face on our farm, especially with drought, poor soil and the absence of landscape elements."
> **Jan van der Horst, Kwaalburgse Hoeve**

Additional results

Environmental impact

Agroforestry systems reduced greenhouse gas emissions and increased carbon sequestration compared to conventional methods. Producing plant-based cheese from walnuts showed lower emissions due to higher carbon capture, despite higher energy use.

Biodiversity

Agroforestry promoted significant biodiversity insect species increases by integrating various crops and trees, supporting insert species.

Soil health

Agroforestry improved soil fertility and structure. The integration of trees and shrubs increased soil organic matter, enhancing fertility and structure.

Lasting impact

The Farm LIFE project has established a foundation for long-term environmental and economic benefits through sustainable agroforestry practices. The initiatives and innovations developed during the project will continue to have a positive impact on agriculture and biodiversity in the future.

Agro farm forestry label

The establishment of the Agro Farm Forestry (AFF) label will continue to promote and recognise agroforestry practices. This certification system helps farmers market their products and demonstrates their commitment to sustainable agriculture. Annual inspections ensure that certified farms adhere to the nine golden rules of agroforestry. See: http://www.agrofarmforestry.eu/

Network organisations

The regional agroforestry networks established during the project will persist, supported by provincial governments, companies, NGOs and farmers. These networks provide a platform for ongoing knowledge exchange, collaboration and support for agroforestry initiatives.

Transition toolkit

The online knowledge hub, known as the Transition Toolkit, will continue to grow and offer step-by-step guidance for farmers who wish to transition to agroforestry. This resource will remain accessible to farmers, consultants, and educators, providing valuable information on technical, business and regulatory aspects of agroforestry.

Documentation and manuals

Guides and manuals developed during the project, such as the network manual, will be available for ongoing and new agroforestry initiatives. These documents offer practical advice and best practices for implementing and managing agroforestry systems.

INTACT tool

The INTACT tool will continue to be a valuable resource for assessing the resilience and adaptability of farming systems. It provides insights into the

effectiveness of agroforestry practices, helping farmers make informed decisions and adapt their practices to changing environmental conditions. See: https://bdbnet.bdb.be/pls/apex/f?p=147:14.

Monitoring and evaluation

Continued monitoring and annual inspections will ensure adherence to the established agroforestry practices. This ongoing evaluation helps maintain high standards and allows for the collection of data to measure long-term impacts.

Training and education of practitioners

Ongoing partnerships with educational and research institutions will sustain knowledge transfer and innovation. The agroforestry specialisation offered in a Master's degree programme will continue to prepare future agricultural managers.

Long-term environmental and biodiversity benefits

The long-term environmental benefits of agroforestry include more climate-resilient agricultural systems, healthier soils and increased biodiversity. By integrating trees and shrubs into farming systems, agroforestry helps create habitats for diverse species, improves soil structure and enhances carbon sequestration.

Conclusion

Farm LIFE successfully demonstrated the potential of agroforestry to transform agricultural practices and deliver substantial environmental and economic benefits. By integrating trees, shrubs, crops and animals, the project has shown that sustainable farming practices can enhance biodiversity, improve soil health, manage climate risks and increase farmer income.

The establishment of the Agro Farm Forestry label, the creation of regional networks, and the development of the Transition Toolkit and educational resources have laid a strong foundation for the continued growth and adoption of agroforestry. These initiatives ensure that the knowledge and practices developed during the project will continue to benefit farmers, policymakers and the environment.

As the project concludes, the lasting impacts of Farm LIFE will be seen in more resilient agricultural systems, healthier ecosystems and a stronger, more sustainable agricultural sector. For those interested in learning more about agroforestry and continuing the journey towards sustainable farming, visit the project website.

Acknowledgment

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Farmlife
Farming the future

PROJECT SUMMARY

Farm LIFE aimed to develop and implement sustainable farming practices through innovative agroforestry approaches. By integrating trees, shrubs, crops and animals, we improved soil health, manage drought, and enhance biodiversity, while increasing farmers' income. The establishment of the Agro Farm Forestry label, creation of regional networks, development of the Transition Toolkit and educational resources have laid a strong foundation for the continued growth and adoption of agroforestry.

PROJECT PARTNERS

Instituut voor Landbouw-, Visserij- en Voedingsonderzoek, (ILVO), Belgium
Horst Beheer B.V., The Netherlands.
Bosboom B.V., The Netherlands.
Stichting De Koekoek, The Netherlands.
Boefkik B.V., The Netherlands.
Forestry Service Grou, The Netherlands.

PROJECT LEAD PROFILE

Prof. Dr Euridice Leyequien Abarca has been working as a researcher and advisor in the field of global change in forested landscapes and agroecological systems for more than 20 years. Currently, professor at VHL, external agroforestry advisor for the FAO and co-founder of Rewilding Academy.

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