

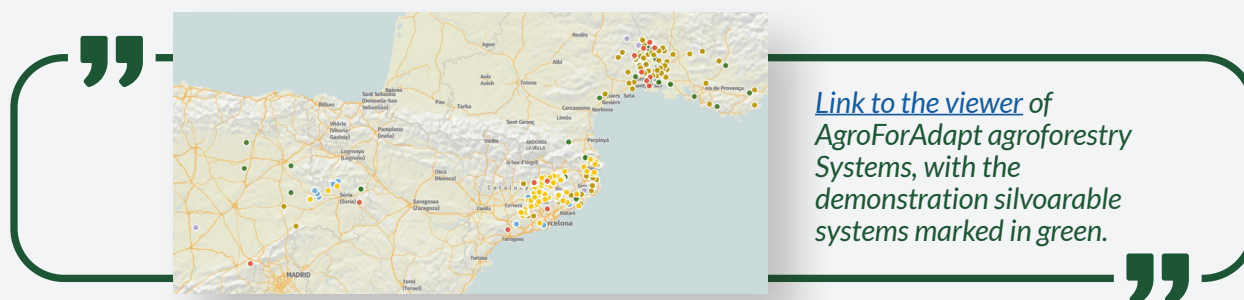
LIFE AgroForAdapt (2021-2026)

## Overall results of the Agroforadapt network of demonstration silvoarable systems

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### AGROFORADAPT DEMONSTRATION SILVOARABLE SYSTEMS

Monitoring was carried out in 38 demonstration silvoarable agroforestry systems located in Catalonia, Castile and León (Spain), Occitanie and PACA (France). This network encompasses a wide diversity of crops (cereals, aromatic plants, forage crops, grapevines, vegetables, etc.), tree species (fruit, timber, fodder and mycorrhized trees, and trees providing support functions for the crop, such as wind protection, habitat for beneficial fauna and soil retention) and production and climatic contexts. Of these systems, 15 pre-dated the project, which broadened the range of system ages and development stages represented, although most of the silvoarable systems are still young.



Monitoring focused on comparing the combined performance of crops and trees in silvoarable agroforestry systems with that of monoculture systems used as controls under the same production conditions. The effect of trees on crops at different distances was also examined in detail. The main results are presented below.

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## INTERACTIONS BETWEEN TREES AND CROPS

- During the first years of tree development, no positive or negative interactions between the trees and the crop are detected.
- Interactions start to become detectable in crop areas located at distances inferior to 0.8-1.2 times the tree height.
- These interactions are complex: many of the affected variables do not follow a fixed pattern over time. They depend heavily on system design and the trees' stage of development. In addition, weather conditions in a given year have a decisive influence on which variables are affected and how. Consequently, markedly different interactions may be observed in the same system in two consecutive years when temperature and rainfall patterns differ substantially.
- Despite this variability, the measured interactions show a general trend whereby trees induce:
  - i) a reduction in available light during periods when they are in leaf, particularly to the north of tree rows;
  - ii) buffering of extreme air and soil temperatures, especially maximum summer temperatures; and
  - iii) an increase in soil organic carbon content.However, effects on air and soil moisture, as well as on physiological variables such as vegetative activity or NDVI and nutritional status, do not show a clear trend attributable to the trees; instead, they depend on weather conditions and the time of year.
- On clay-textured soils, silvoarable systems show a lower tendency to waterlogging than agricultural monocultures.
- No significant effect of the crop on the trees was observed in the monitored systems.



## PRODUCTION AND ECONOMIC RESULTS

- The total productivity of a given silvoarable area, combining the agricultural crop and tree production, is higher than the productivity obtained from the same area when the two productions are grown separately.
- Total productivity is more stable from year to year, with less pronounced production peaks, both high and low. This result suggests lower vulnerability to increasingly irregular weather and extreme events.
- Producing two or more products also reduces financial risks: the farm becomes less vulnerable to fluctuations in market prices of a given product, both for inputs and for the outcomes sold.
- The asset value of the plot increases as the trees develop.
- In areas where detectable interactions occur between trees and crops, the following trends in crop productivity are observed, compared to monoculture areas or to areas without interaction:
  - Yield (kg/ha) is not affected in areas with light or moderate shade, particularly in hot years with low or irregular rainfall. However, yield declines are observed in heavily shaded areas and in moderately shaded areas in years with favourable weather conditions.
  - Appropriate shade management, maintaining shade at a moderate level, improves the commercial quality of horticultural crops (fewer defects and a higher proportion of extra-grade produce), cereals (higher protein content) and grapes (lower alcohol content). In aromatic plants, excessive shade may reduce the concentration of essential oils or rosmarinic acid.



## EFFECTS ON AGRONOMIC MANAGEMENT

- Establishing a silvoarable system on agricultural land makes management more complex: tree maintenance is added to agricultural operations and, as the trees develop, the management of each component must be adapted. For example, pruning may need to be brought forward or intensified to regulate shade, or the pruning period may need to be adjusted to avoid interfering with crop management.
- This greater management complexity is offset by the positive interactions generated by the trees: in agroforestry systems, irrigation rates for horticultural crops can be reduced by 50% without loss of yield. A lower incidence of pests and diseases is also observed in silvoarable systems, reducing dependence on agrochemicals.
- A key design decision is to set an appropriate distance between woody rows so that agricultural mechanisation is not constrained.
- When selecting woody species, priority should be given to hardy species adapted to increasingly dry and hot weather conditions.
- Shade extends the crop growing period. In some cases, this is beneficial, for example by providing more months of vegetable production; in others, it is detrimental, for example because it leads to uneven crop ripening.
- Interactions with wildlife: an increase in the presence of roe deer and wild boar has been observed in some silvoarable systems. However, planting lavandin in combination with holm oaks mycorrhized with truffle appears to reduce the presence of wild boar.



## ENVIRONMENTAL RESULTS

- Soil improvement: silvoarable systems show an increase in soil organic matter and carbon. This increase is particularly marked within the tree row, where the soil is not tilled, but it is also detectable in the crop associated with the trees. The rate of increase depends on climate and soil conditions, as well as on the agronomic management applied.
- Biodiversity and beneficial fauna: silvoarable systems showed an increase in bird species associated with mosaic landscapes, particularly passerines such as warblers, shrikes and buntings. Growth in pollinator populations, including honeybees, wild bees, bumblebees and hoverflies, depends more on the total availability of flowers than on whether the flowering vegetation is woody or herbaceous.

## CONCLUSION:

Silvoarable systems are dynamic systems whose functioning changes as a function of tree size and weather conditions. Nevertheless, when **properly designed and managed, with moderate and regulated shade**, they offer production and financial advantages through higher, more stable and diversified productivity; they are better adapted to climate change, with lower vulnerability to droughts and heatwaves; and they deliver environmental improvements, particularly in soil protection and biodiversity.

### For further information:

- [Full description](#) of the 38 demonstration silvoarable systems (in Spanish).
- Monitoring protocols (in Spanish):
  - [productivity and interactions](#)
  - [biodiversity](#)

- Coello J, Santana JC, de Torre B, Liagre F. 2026. [Manual for the design and management of silvoarable agroforestry systems under Mediterranean conditions](#). LIFE AgroForAdapt. Generalitat de Catalunya. Departament d'Agricultura, Ramaderia, Pesca i Alimentació 124 p.
- [AgroForAdapt publications](#)