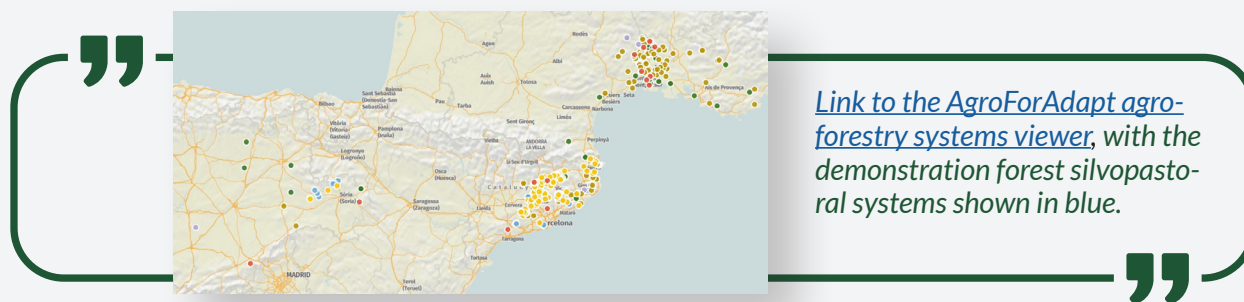


LIFE AgroForAdapt (2021-2026)

Monitoring and results of the AgroForAdapt demonstration silvopastoral systems

LIFE20 CCA/ES/001682

The LIFE AgroForAdapt project has established a network of 26 demonstration silvopastoral systems across 477 hectares of forest in the Spanish provinces of Barcelona, Girona, Tarragona and Soria. These forests encompass a wide range of forest formations, dominated by Aleppo and Scots pines, holm and other Mediterranean oaks, and mixed conifer - broadleaved forests.



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The silvopastoral systems were established in two phases:

- a) Application of silvicultural treatments: reducing tree and shrub density to create a forest structure that is less vulnerable to wildfire and more suitable for grazing.
- b) Introduction of livestock (cattle, sheep, goats, horses, donkeys or alpacas) to use and improve the forage resources and help maintain the forest structure achieved through the silvicultural treatments.

To assess these systems, their development was monitored through field measurements taken before the silvicultural treatments, immediately afterwards, and two or three years later (final monitoring), as well as through surveys of forest and livestock managers. In addition, the effects of three treatments, adapted to each forest, were studied in detail in 13 demonstration forests:



Low-intensity thinning and scrub clearance: selective reduction of tree and understorey density, retaining a forest environment while facilitating livestock access.



High-intensity thinning and shrub clearance: a substantial reduction in tree density, creating a semi-open ("Dehesa-type") landscape to increase herbaceous pasture production.



Control: an untreated area allowing to compare its development with that of the other treatments.



EFFECT OF SILVOPASTORALISM ON FOREST DYNAMICS

By the end of the study, two or three years after silvicultural treatments application depending on the forest, the interventions and subsequent introduction of livestock had altered forest dynamics. Overall, satellite remote-sensing techniques recorded a sharp decline in total forest vegetative activity (photosynthesis) in treated areas compared with control ones. This decline was particularly pronounced in high-intensity thinning areas and in pine forests. However, these forests showed a rapid recovery in vegetative activity and, in every case, levels similar to those in control areas were restored by the end of the study. The effects on the different forest layers are presented below:

Effects on trees: the silvicultural treatments reduced the number of trees and the basal area, an indicator of the total area occupied by tree stems. With low-intensity thinning, the reduction was 20% in pine forests and 35% in oak forests, while with high-intensity thinning it was 30% and 50%, respectively. By the end of the study, trees in the treated areas showed a favourable response: basal area increased by 25% in pine forests, while in oak forests the increase ranged from 20% under low-intensity thinning to 35% under high-intensity thinning. By contrast, the increase in control areas over the same period was 3%. The retained trees therefore responded very favourably to reduced competition.

Effects on the understorey (shrubs under 7.5 cm in diameter and herbaceous vegetation, both of interest as livestock feed): the silvicultural treatments caused a sharp reduction in the cover of these species, amounting to 80% under low-intensity thinning and 95% under high-intensity thinning. Recovery of both layers depended on subsequent livestock management, the type of intervention and the forest type:

Shrubs: in forests where livestock were introduced shortly after silvicultural treatment and at a sufficient stocking density, final shrub cover was approximately half the initial level. However, when livestock introduction was delayed or stocking density was insufficient, especially in oak forests whose species resprout after cutting, shrub cover reacted so strongly that it exceeded the initial level, although shrub height remained much lower. No significant change in shrub cover was observed in control areas over the monitoring period.

Herbaceous vegetation: these species generally have greater pastoral value than shrubs and showed strong recovery in treated areas, exceeding initial levels particularly in high-intensity thinning forests. Production between May and October 2025 in these stands ranged from 500 to 3,000 kg of dry matter per hectare, with the highest values in oak forests. In pine forests, herbaceous production was three times higher in the newly created gaps than beneath pine crowns. In addition to productivity, a marked increase was recorded in the number of herbaceous species of particular pastoral interest, from an average of 2.4 to 6.2 species per monitoring plot. By contrast, control areas showed a slight decline in herbaceous cover and richness during the study period.



EFFECT OF SILVOPASTORALISM ON WILDFIRE VULNERABILITY

The vulnerability of the demonstration forests to wildfire was assessed using the TVFoC methodology, which determines how prone their structure, in terms of the quantity and continuity of the different vegetation layers, is to generating crown fires, the most intense type. In the final inventory, low-intensity thinning reduced wildfire vulnerability in 62% of the forests, rising to 82% under high-intensity thinning. The improvement was particularly notable in pine forests. Control forests showed no significant change.

Another factor studied, using computer simulators, was the intensity and rate of fire spread in the event of ignition. The study showed a drastic reduction in both variables in treated forests compared with control forests.

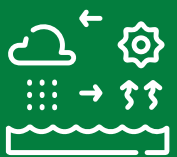


EFFECT OF SILVOPASTORALISM ON THE FOREST MICROCLIMATE

Conversion to silvopastoralism alters the internal forest microclimatic conditions in proportion to the intensity of the silvicultural treatment:

- **Light availability:** a sharp increase was observed in treated areas, averaging +114% in low-intensity thinning areas and +236% in high-intensity thinning ones.
- **Air and soil temperature:** compared with control areas, silvicultural treatments produced wider daily temperature ranges, averaging +1.3 °C under low-intensity thinning and +2.4 °C under high-intensity thinning, and higher maximum summer temperatures rose by +2.4 °C and +4.1 °C, respectively.
- **Air humidity:** average ambient humidity fell by 3.0% in low-intensity thinning areas and by 3.4% in high-intensity thinning areas, compared with the control area.

Overall, the conditions created with silvopastoralism are brighter, which is beneficial for pasture resources, but are also hotter with lower ambient humidity, which is disadvantageous.



EFFECT OF SILVOPASTORALISM ON WATER DYNAMICS

Soil moisture sensors and simulations using the Medfate model were used to study the effects of conversion to silvopastoralism on two variables:

- **Soil moisture:** it increased following silvicultural treatments, by +14% in low-intensity thinning areas, and by +18% and +32%, respectively, in the gaps and under tree crowns within high-intensity thinning areas.
- **Blue water:** it is the water that flows over the surface or infiltrates the soil towards groundwater courses, thereby helping to recharge aquifers and rivers. Silvicultural interventions produced an average increase in blue-water availability of +207% under high-intensity thinning and 113% under low-intensity thinning, compared with initial conditions. This effect diminished over time, to +47% and +42%, respectively, by the end of the study, particularly in oak forests.



EFFECT OF SILVOPASTORALISM ON BIODIVERSITY

Birds: high-intensity thinning led to a slight decrease in the presence of birds associated with mixed habitats combining open and closed areas, while birds typical of forest environments were unaffected. Low-intensity thinning had no effect on bird populations.

Butterflies: low-intensity, and high-intensity thinning to a lesser extent, increased butterfly presence compared with the control area.

Flora: no meaningful positive or negative effect of silvicultural treatments on plant diversity was observed.

Structural habitat quality: this was measured using the Potential Biodiversity Index, an indicator of a forest's capacity to host biodiversity. This variable showed no significant changes associated with conversion to silvopastoralism over the course of the study.



SOCIO-ECONOMIC ASPECTS OF SILVOPASTORALISM

In 2025, managers of the demonstration forests and the livestock were interviewed. Overall, perceptions of conversion to silvopastoralism were clearly favourable, particularly because of increased pasture availability and improved accessibility.

Consumption observed during August and October 2025 represented savings of between €9 and €146/ha in the need for purchased supplementary forage, depending on the forest. This level of use was modest because the herbaceous species were still becoming established and consumption accounted for only 6% to 58% of production. However, the estimated medium-term potential is €450-747/ha/year, with an indicative return on investment of 2-5 years for silvicultural treatments costing €1,500-2,000/ha.

CONCLUSIONS

Converting a forest into a silvopastoral system increases and diversifies forage resources of value to livestock. This results from greater light availability in the understorey and increased water availability in the soil.

Conversion to silvopastoralism also improves the forest's capacity to adapt to climate change: tree growth and vigour increase, wildfire vulnerability is reduced and more blue water is generated.

However, these effects are dynamic over time and are influenced by:

- livestock management and forest type: livestock must be introduced shortly after silvicultural interventions and at a sufficient stocking density, especially in oak forests, where understorey recovery is fastest.
- silvicultural treatment: high-intensity thinning brings about a drastic change in forest conditions, with a very marked increase in forage resources and a sharp reduction in wildfire vulnerability, but it also largely removes the humid, mild-temperature microclimate typical of forest conditions.

Overall, silvopastoralism can increase the socio-economic value of forests by enabling livestock farming and strengthen their capacity to adapt to climate change, without significant adverse effects on biodiversity.



Further information:

• Full description (in Spanish) of the demonstration silvopastoral forests with [low-intensity](#) and [high-intensity](#) thinning.

• Monitoring protocols (in Spanish):
- [forest dynamics](#)
- [biodiversity](#)

• Taüll, M., Baiges, T., Gallego, M., Coello, J., Casals P. (2026). [Design and management of silvopastoral systems for adaptation to climate change](#). LIFE AgroForAdapt. Generalitat de Catalunya. Departament d'Agricultura, Ramaderia, Pesca i Alimentació 112 p.

• [Other AgroForAdapt publications](#)

