

Life Montserrat Project.- Silvopastoral management for habitat conservation and prevention of large forest fires ^[1]

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Autor: Proyecto LIFE Montserrat/Fototeca CENEAM

The project was designed to prevent fires and improve the biodiversity of a typical Mediterranean mountain environment such as Montserrat, through silvopastoral management practices.

Characterized by a long tradition of settlement and human use, Mediterranean forests have shaped and evolved in terms of ecosystems and landscapes through the combination of traditional agricultural practices, extensive

livestock and forest management. The result is a characteristic landscape known as the Mediterranean agro-silvopastoral mosaic with a high level of biodiversity but also significant social and economic value.

The decline, down to the practical disappearance of traditional agricultural, forestry and livestock activities, has caused a marked abandonment of land management practices in the area, which has led to the continued and growing onset of unmanaged forest scenarios, to the detriment of fields and pastures. This scenario has little interest from a biodiversity standpoint and is prone to large forest fires, particularly in the current climate change context.

Case Study Description

Challenges:

The LIFE Montserrat project is located in the Montserrat Mountain and its surroundings, in the province of Barcelona. The area included in the project occupies just over 32,000 ha in 14 different municipalities, with a predominance of forests (64%), constituting an emblematic area in Catalonia for various reasons:

- its great natural wealth, since a significant part of the project area is included in the Natura 2000 Network
- it is host to an important religious, spiritual and cultural pilgrimage center, the Montserrat Monastery, very popular both locally and for tourism
- it is a singular and unique landscape

The area has suffered some large forest fires but a good portion thereof has regenerated its forest area with scrub and Aleppo pine communities with a high density of trees and a high biomass fuel load, making it very vulnerable to fire and with a high risk of new forest fires. This is aggravated by the increase in forest area and the lack of economic profitability of its exploitation combined with the abandonment of the agricultural and livestock activity, which results in the absence of forest management initiatives of any kind and abandonment, further contributing to biomass fuel accumulation and the risk of fire in the current climate change context.

As a result, the project addresses two challenges:

- designing strategic protection areas against possible new forest fires, with the creation of low-fuel strips or firebreaks that help hinder the spread of fire and facilitate its extinction, if it occurs.
- establishing an agro-silvopastoral mosaic territory model through joint forest restoration and public-private management to reclaim open habitats and implement grazing systems.

This seeks to create a break in the continuity of the forest in the area, generating an agro-silvopastoral mosaic that improves resilience against fires and favors biodiversity, and creating a landscape of greater natural value that is more diverse and less vulnerable.

Implementation of this project will enable the active, economic and efficient management of forests as well as the creation of open spaces and extensive grazing zones in an area such as Montserrat. This constitutes a formula for success when facing some of the main challenges posed by climate change in Catalonia, which include the reduction of river flows and available water for ecosystems, the vulnerability of forests to stress, pests and diseases, or the increased risk of fire associated with a greater number of days with extreme weather conditions

Objectives:

The area included in the project presents a significant fire risk due to the accumulation of a biomass fuel load, climate change and the disappearance of crops and other traditional forest uses. As mentioned, the area has suffered from major forest fires in the past.

For this reason, the project promotes, among others, different undertakings in the field of fire prevention in the area that include forest restoration work and management of the forest stands, in order to adapt them for extensive grazing with local herds that can contribute to the maintenance and conservation of habitats and

species of high ecosystemic interest.

In this sense, the main objectives of the project are the following:

1. Development of different management measures for affected ecosystems, through the implementation of a silvopastoral exploitation plan aimed at increasing the resilience and stability of forests against fires.

This will improve prevention of the Montserrat Mountain and its environment against possible large fires, through the creation of strategic areas that limit their spread, facilitate extinction and decrease their intensity and extent.

2. Contribution to the conservation of some species and habitats of great ecological value included in different Birds and Habitat Directives. In particular, the project aims to contribute to:

- the conservation of various species of interest such as the Bonelli's eagle present in the intervention area, by maintaining and restoring some of their priority habitats
- the improvement of habitats host to more than a hundred species protected by regional, national or international legislation through the reclamation of open spaces

3. Maintaining and increasing biodiversity in the intervened area, by increasing the zonal connectivity through the creation of a mosaic of grasslands, bushes and forests.

As these are the fundamental objectives of the project, two other secondary objectives can also be mentioned, such as the long-term durability of the actions carried out beyond the four years of the project's own implementation, and their replicability in other similar environments in the Mediterranean basin

Adaptation measures implemented in the case study:

[Structural/physical: Technology options](#) [3]

[Structural/physical: Ecosystemic options](#) [4]

[Institutional: National and governmental policies and programs](#) [5]

[Social: Education options](#) [6]

[Social: Information options](#) [7]

[Social: Behavior options](#) [8]

Solutions:

The actions carried out in the project aim to transform the current and homogeneous continuous extensions of unexploited and/or abandoned forest and scrubland into an agro-silvopastoral mosaic that improves resilience against possible forest fires and in which the variation in environmental conditions favors the recovery of significant species whilst fostering biodiversity, constituting also a landscape of greater natural value.

The following can be identified among the solutions implemented:

- previous undertakings:
 - forestry inventory of priority grazing areas
 - determination of grazing patterns and regimes
 - creation of the livestock farmers association of the Montserrat area
 - increase in the number of members of the Associació de Propietaris Forestals Entorns de Montserrat (APFEM)
- conservation initiatives:
 - forest restoration ? basically, thinning has been carried out to decrease tree density in the regenerated areas of high-density Aleppo pine. This type of intervention accelerates the maturation of the pines and gives rise to a structure more similar to that of an adult pine forest, notably improving the habitat for various plant species of the shrub and herbaceous strata and increasing wildlife diversity.

The increase in the production of pinecones after thinning facilitates the regeneration of the forest mass in the

event of any new disturbance, such as a fire.

- Reclamation of open spaces ? these spaces play a key role in the project since:
 - they are decisive for biodiversity, resulting in fundamental habitats for a large number of species
 - they contribute to fire prevention, breaking forest continuity and hindering the spread of fire
 - are essential for cattle feeding, facilitating development of grasslands and the viability of livestock farms.

Reclamation of these open spaces has been carried out through brush clearing, controlled burning and mechanical work, in order to recover abandoned cultivation fields.

Burning is carried out with low intensity fire by specialized professionals and reduces the fuel load in the area, thus protecting the forest space and the adjacent agricultural and urban environments against uncontrolled fires. The effects of this type of burning on the organic fraction of the soil and the edaphic fauna are minimal, and do not cause soil loss, degradation or erosion problems.

- Implementation of forest grazing ? in addition to promoting the signing of agreements between cattle ranchers and forest owners to allow livestock to access pasture areas, up to ten livestock management units (five of them newly created) have been organized, structured around the different strategic areas established for purposes of fire prevention.

These farms have different species and infrastructures (pens, fences, water, ...), and each one has specific management plans in order to balance their economic viability with the project's management objectives.

- dissemination, communication and social involvement actions:
 - dissemination and communication ? the main elements developed or used were the following:
 - development of a web page and visual identity of the project, with publication of bulletins and presence on social networks
 - development of information brochures, panels and videos, local awareness campaigns, technical workshops and conferences
 - distribution of diverse promotional material at local fairs and events and presence in different media
 - publication of articles in informative publications and specialized magazines
 - participation ? being a technical project, LIFE Montserrat also integrates an important social aspect. The ultimate goal has been to involve the entire local population and the general public to generate a sense of responsibility toward the conservation and orderly use of their natural environment, whilst taking part in a management model developed for its conservation.

In turn, the project also requires:

- follow-up measures, which evaluate the efficiency and degree of compliance with the management plan
- profitability studies on fire prevention/extinction and the socioeconomic impact on local populations
- management, control and audit measures
- post-project communication plan

Importance and relevance of the adaptation:

The management model promoted by LIFE Montserrat is well aligned with the need to adapt to current and foreseeable future climate scenarios for Catalonia and the Mediterranean as a whole. In such conditions, managing the use and custody of both forest and territory is an essential tool to mitigate the observed and projected impacts of climate change scenarios.

The LIFE Montserrat project has created a green protection infrastructure to prevent large forest fires and promote the conservation of the natural heritage in an area of 14 municipalities around Montserrat Mountain.

In this sense, the activity of the project has focused on different strategic areas for the prevention of such

possible fires, as determined by firefighters from the Catalanian Government. In these areas, forestry work has been carried out to decrease tree density, reduce the accumulated fuel load and improve the structure of the forest.

These actions have also promoted the creation of open spaces and the recovery of crops, with the intention of creating a mosaic structure of high fire resistance and with greater diversity of habitats and species. Based on this context, the balance of the newly generated landscape is maintained through cattle grazing, coupled with the progressive deployment of extensive stockfarming activity involving diverse herds.

All of them are priority actions falling under the adaptation strategies of a territory like that of Montserrat, faced by the effects of climate change in this area (water scarcity, stress, risk of fires, pests and diseases). The most obvious example is the thinning actions of the regenerated Aleppo pine populations. This pine species is the one that best tolerates the demands of the Mediterranean climate, capable of withstanding severe summer droughts, thriving on very poor soils and maintaining high reproduction rates.

Taking into account climatic projections, restored low-density Aleppo pine forests such as those left by the project are likely to become, in the medium term, the only viable tree formations in large areas of the Montserrat environment and, consequently, the only real opportunity to maintain the environmental and social functions of the forest and the landscape, with all its associated biodiversity.

Additional Details

Stakeholder engagement:

In the approach and development of LIFE Montserrat, the following institutions take part and collaborate:

- Barcelona Provincial Council
- Board of the Montserrat Mountain
- Firefighters of the Generalitat de Catalunya
- Dpto. of Agriculture, Livestock, Fisheries and Food (DAAM) of the Generalitat de Catalunya
- Montserrat Forest Owners Association (APFEM)
- Catalunya La Pedrera Foundation

In any case, the true stakeholders and keys to the success of the project are effectively the shepherds and cattle ranchers, since the objectives of the project cannot be achieved without the consolidation of viable farms that maintain their long-term extensive grazing activity. And this requires individuals committed to a livestock management model that puts the quality of the natural heritage, landscape and the food that is produced first, versus obtaining greater economic benefits or short-term income.

For this reason, the men and women who are in charge of the farms linked to LIFE Montserrat, now incorporated into the Montserrat Livestock Farmers Association, are the most valuable and perhaps the most vulnerable asset left by the project.

Project interest:

The proposed undertakings and adaptive measures together with the agro-silvopastoral management brought about by the LIFE Montserrat project break the dynamics of an eminently forest landscape, which translates into greater uniformity of habitats and a loss of opportunities for numerous species that depend on open spaces, therefore favoring the creation of a mosaic of environments that allows hosting a much wider diversity of habitats and species.

In addition, within the scope of the project, the existing affected areas of high natural value, within and outside the Natura 2000 Network, maintain a favorable status in terms of biodiversity and landscape, with the application of this low-intensity management model consisting of forest thinning activities and extensive livestock farming, since forest management and the recovery of open spaces directly generate biodiversity in the project areas subject to action. Simultaneously and away from these areas and in an indirect manner, they favor the conservation of numerous species and habitats that could be affected by large forest fires.

As regards extensive livestock farming activity, this does not cause any impoverishment of the biodiversity within the scope of the project; rather on the contrary, grazing is the only viable means in this geographical environment to maintain Mediterranean meadows and open spaces in general and avoid closing of the vegetation.

Therefore, in this geoenvironmental framework, a model like the one proposed by LIFE Montserrat can be an excellent opportunity to evolve toward:

- a territory that is better adapted and defended against fires
- better management of biodiversity in the Mediterranean shrubs, favoring habitats and species of high interest that are in many cases protected by current regulations
- a boost to the socio-economic dynamism of rural environments, with new job opportunities in traditionally disadvantaged sectors and investments that boost the local economy

Thus, the desirable scenario is a management model that rescues fundamental ecological functions for the health of agroforestry ecosystems, such as herbivores, and that allows us to return to a forest fire regime similar to the one that has existed in this type of Mediterranean environment during the last few centuries, characterized by a succession of small and medium recurring fires every tens of years that are considered acceptable from a social point of view. These create irregular spots of plant type successions, thus contributing to the heterogeneity of the landscape, greater diversity of habitats and discontinuities in the accumulation and distribution of biomass fuel.

It is not possible (or desirable) to prevent all fires, but it is possible to minimize the risk of those that occur to evolve into large uncontrolled fires. The objective is to preserve the territory in adequate conditions so that, in the event of a fire, sufficient capacity exists to ensure its impact on the ecosystem, goods and services and people can be controlled with guarantees.

Success and limiting factors:

LIFE Montserrat constitutes a successful model of application for the entire Mediterranean arc, supported by the proper functioning of the initiatives implemented and the results obtained. In this case we must highlight:

- the increasing the resilience and stability of forests against possible large forest fires, through a set of ecosystem management measures:
 - promotion of forest stability (structuring, regeneration, threatened forest species,...), the Mediterranean pine being the predominant habitat
 - reduction of the biomass volume in strategic areas through extensive grazing; reducing the fire load by 80%.
 - minimization of the risk of forest fires and maintenance of a mosaic landscape, which contributes to reducing the recurrence period of large fires
 - reduction of fire fighting costs
 - increased knowledge and involvement of stakeholders, and promotion among forest owners of the protection and improvement of forest biodiversity
 - long-term economic sustainability of the spaces belonging to the Natura 2000 Network
- contribution to the conservation and improvement of biodiversity in the Montserrat area
 - reclamation of open, wet and dry Mediterranean meadows habitats, among others

- reclamation and/or maintenance of abandoned agricultural habitats
- increased level of survival and reproductive success of Bonelli's eagle (*Aquila fasciata*)
- increase in the number of other species of conservation interest such as the Egyptian vulture (*Neophron percnopterus*), the black wheatear (*Oenanthe leucura*), various species of bats, and prey species such as the red-legged partridge (*Alectoris rufa*) or the European rabbit (*Oryctolagus cuniculus*)
- the creation of a mosaic of grasslands, bushes and forests that improves connectivity between spaces of the Natura 2000 Network
 - Conservation and improvement of the quality of the landscape and the connecting functionality of ecosystems (decrease of fragmentation and improvement of permeability and migration)
 - increase in area and improvement of the state of mosaic ecosystems

In addition to the above, and in general, silvopastoral management leads to savings in terms of the amount of mechanical means used in forest maintenance (brigades) and allows maintaining a local economy based on the production of quality meat.

On the other hand, other new initiatives – some already underway such as the Montserrat Rural Park – can take over and ensure the continuity and viability of the project's success, for the benefit of the territory and the whole citizenry.

In terms of the possible problems or limiting factors that could alter the execution of the project, in addition to the environmental problems typical of the Mediterranean basin, we highlight in particular:

- the high density of the regenerated pine forests after the great fires in the area at the end of the 20th century, which required intense thinning in order to eliminate combustible biomass; slowdown of tree growth and delayed reproduction. We must point out in this sense that, once forest work has been completed (clearing, thinning, ...) in a Mediterranean area like this, the development of forest stands presents some typical constraints, apart from the terrain itself, such as meteorological conditions, since the amount of light and the availability of water affect the type of vegetation and its growth.
- the approach and launch of extensive grazing livestock that had practically fallen into disuse, profitable and sustainable in the long term, as a viable and competitive alternative to intensive farms, with higher productivity and shorter fattening times.

The essential idea was to take advantage of the compatibility of an extensive grazing system as an instrument for fire prevention and biodiversity conservation through habitat management, obtaining a product of high quality and high commercial value.

The creation of the Cattle Farmer's Association was a key piece in this sense, allowing the development of up to ten grazing livestock farms in the strategic areas for fire prevention, as well as a market that is willing to pay an adequate price for a quality product, therefore contributing to an adequate management of the territory and promoting its natural and landscape values.

This Association, together with the Association of Forest Owners of Montserrat (APFEM), formed the basis on which the management of the territory was articulated, as part of the undertakings promoted by the project. The set of agreements and the relationship dynamics between the two associations constituted in this sense a fundamental challenge, since the fulfillment of the project's objectives rely to a great extent on their proper functioning.

Budget, funding and additional benefits:

The total budget of the project was € 3,561,825, of which € 1,763,000 (49.5%) was financed by the European Union. The rest, € 1,798,825 (50.5%) is borne by the group of partners involved:

- Barcelona Provincial Council
- Board of the Montserrat Mountain

- Department of Agriculture, Livestock, Fishing and Food of the Generalitat de Catalunya
- Fire Department of the Generalitat de Catalunya
- Catalunya-La Pedrera Foundation
- Association of Forest Owners of Montserrat

Overall coordination was carried out by the Territory and Sustainability Department of the Barcelona Provincial Council.

In terms of the results obtained, we provide only a quantitative snapshot of some of those most representative:

- Forest restoration in more than 1,300 ha, equating to about 350 ha per year, an area 3 times greater than the area covered before the project started in the area
- recovery of approximately 200 ha of open spaces by means of prescribed burning and mechanical means
- implementation of a grazing system in about 1,400 ha
- establishment of 8 livestock farms directly linked to the project (5 goats farms, 2 cow farms and 1 donkey farm)
- construction and adaptation of fences and 4 accommodations for livestock (corrals and sheepfolds)
- cattle acquisition (499 goats and 32 cows)
- water supply for livestock
- Establishment of 10 management plans for grazing areas and consolidation of 25 agreements.

In terms of diversity and conservation of singular species (Bonelli's eagle, eagle owl or Egyptian vulture), more time is required to rigorously evaluate the effects and the real extent of the actions carried out, although the first follow-up data point to a positive response with respect to insects and plant species.

In this sense, with regard to threatened species of high conservation interest, trends pointing to a recovery have been detected in places where open spaces have been reclaimed, which provide evidence of an already-known fact: that fire is part of the natural dynamic of Mediterranean forest ecosystems and essential for maintaining their biodiversity. For this reason, LIFE Montserrat does not intend to avoid all forest fires, but to minimize the risk of large uncontrolled fires, which are the ones that cause truly severe and harmful economic, social and environmental damage.

As regards forests, an increase in diversity is found in all habitats, except the maquis shrubland, being especially significant in large shrubs dominated by the grass *Brachypodium phoenicoides* and in Aleppo pine forests, where forest management initiatives have been more intense

Legal aspects:

Broadly speaking, the legal circumstances that have been highlighted during the execution of the project can be classified as follows:

- Local Regulations.- The project has contributed to highlight and raise awareness among local actors on the importance of livestock in habitat management and in the prevention of forest fires.

One of the major problems of the municipalities in Catalonia, and more intensely in the municipalities of the metropolitan area of Barcelona, is the management of emergencies in residential developments, especially the management of measures aimed at avoiding the effects of forest fires. For this reason, in 2003 the Generalitat de Catalunya approved Law 5/2003 on the prevention of forest fires in residential developments.

Mayors and mayoresses are ultimately responsible for law enforcement and, one of the problems they face is finding economically viable solutions for maintaining the fire prevention strips and firebreaks in these residential developments.

Meetings have been held as part of the LIFE Montserrat project, and all necessary information has been provided to carry out these maintenance tasks via the livestock farms linked to the project. This facilitates both the economic viability of the farms and addresses the municipal problem of forest strip/firebreak maintenance.

- Regional Regulation (Department of Agriculture, Livestock, Fishing and Food (DARP) - Generalitat de Catalunya GENCAT).- In order to guarantee the continuity of the management model promoted by the project and the viability of livestock farms in particular, we have worked together with the different areas of DARP to facilitate the accessibility of the fire prevention and extensive livestock farming aid programs to livestock farms in the territory.

To this end, project technicians agreed on the need to define the Montserrat Priority Protection Perimeter (PPP) as a technical instrument defined by GENCAT, based on which, fire prevention activities are prioritized in the different areas of Catalonia.

With the completion of LIFE Montserrat, the PPP allows opening the door to economic compensation to livestock farmers whose cattle graze in strategic areas. On the other hand, work has also been done with the DARP to revise the grazing coefficients of the SIGPAC plots (Geographic Information System of Agricultural Plots) that host cattle grazing after the end of the project, since aid from the first pillar of the CAP (Common Agricultural Policy) is another essential factor for the sustainability of farms.

- European Regulation.- LIFE Montserrat is a strategic silvopastoral project for preventing fires and promoting biodiversity that must be economically viable in the long term. In this sense, the territorial policies must find the legal framework to allocate projects to the territory, by means of the aids available to them (such as CAP or Rural Development Programs).

Since the project began, the technical team has worked to find solutions to ensure the long-term economic sustainability of livestock units; but all these efforts are at risk due to the limitations established by rural development policies stemming from the European legislation, and have been brought to the attention of the Commission in an effort to find effective solutions. In this sense, on May 2019, a contribution was made to the NAT Commission (Natural Resources Commission) of June 17, 2019 of the CDR Regions Committee regarding the Consultation to Agents on Agro-silvo-pastoralism.

Implementation time:

The Life Montserrat project lasted 48 months, starting on July 1, 2014 and ending on June 30, 2018.

Reference Information

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