Agroforestry systems as a technique for sustainable land management
Silvopastoral systems for forest fire prevention in Andalusia

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Introduction

Forest fires are one of the main problems faced by forestlands in Europe. Development has produced a series of socio-economic changes leading to the devaluation and abandonment of the forestlands; that has been particularly intense in the less productive areas of the Mediterranean, which have become highly vulnerable to fire. The frequency, intensity, and impact of this perturbation are such that forest fires have become the first environmental concern for the Andalusian society (IESA/CSIC 2006). In accordance with this fact, it is the issue that receives the most attention and investment among forest management activities.

As a consequence of the increased budget provided during these last twenty (20) years, the tasks of detection, control, and extinction have achieved a spectacular improvement in Spain and, except for some particularly difficult years, the results have consistently improved. The average annual percentage of burnt forest area in Spain is close to 0.54%, a
successful figure in Europe, but still far from the objective of 0.3% marked by the current Spanish National Forest Plan. When these figures are compared with those of the countries on the south coast of the Mediterranean sea, which are below 0.2%, though they hardly have any means for detection and extinction. These figures represent large differences in the status of Mediterranean forests despite the dissimilar socio-economic contexts. On the one hand, in less developed countries, rural activities that reduce fire incidence are still practised: gathering of wood and firewood, intense domestic livestock use, agroforestry mosaics, etc. On the other hand, in the countries of the European Union, rural abandonment enhances shrub encroachment and the loss of heterogeneity in forestlands.

High vulnerability of forestlands areas in combination with long dry periods and strong winds, create the conditions for the occurrence of wild forest fires that generate extensive and costly damage, for which the abundance and efficacy of detection and extinction methods may prove insufficient. For this reason, and with the objective of reducing the impact of forest fires, the reinforcement of preventive measures to reduce the vulnerability of the forestlands is put forward.

The silvopastoral system for fire prevention

Among many other available techniques, controlled grazing has been proposed in various national and international fora as a tool for fire prevention (González-Rebollar et al. 1999; Rigueiro et al. 2005). The establishment of “pastures on fuelbreaks”, defined as fuelbreaks with scattered trees and pasture maintained by grazing, may be an effective and efficient way to put this idea into practice. This is a silvopastoral system whose more immediate objective is to create an adequate zone to facilitate the control and extinction of fire that may occur in forestlands (Ruiz-Mirazo et al. 2005).
Logically, livestock use reduces the fuel load and lessens the maintenance costs of the fuelbreaks. Furthermore, this system is a way of making the local cattle ranchers co-responsible for the management of their own environment. Many managers, having to face the consequences of the rural abandonment and the abandonment of the forestlands, demand collaboration in the development of sustainable and efficient alternatives for area management. In the context of the insecurity generated by the Common Agricultural Policy (PAC), the cattle owners need to join the programmes that recognize the environmental role of their activity; that is, they must participate in activities that will allow them to have access to new subsidies and means of assistance. In this context, the pasture-fuelbreak areas constitute a response of understanding and collaboration attractive to both agents. In this way they share responsibility for the management of the forest resources.

In addition, extensive livestock use is a key to achieving the multi-functionality of the forestlands. There is no doubt as to the relation between the abandonment and the proliferation of forest fires. Therefore, the promotion of activities like livestock grazing are important in that they renew that value of a declining activity and provide new agriculture and rural jobs.

From the ecological point of view, intense pasture is considered in itself an element of the Mediterranean ecosystems (Perevolotsky and Seligman 1998). The impact of big herbivores has been present in the evolution of this environment since time immemorial, provoking a multitude of adaptations in the plant species, and generating mutual relationships between the plants and animals (Ramos et al. 2006). For this, the livestock fulfill a very relevant ecological function. The pasture-fuelbreak areas constitute open spaces within the forests, forming part of a mosaic of vegetation that maximizes biodiversity values (Fernández 1995).
For all of these reasons, the pasture-fuelbreak areas are seen as a silvopastoral system useful in fire prevention and a valuable system of forest land management that provides, at the same time, socio-economic and environmental functions.

**Current situation in Andalusia**

Since 2003, the “Junta de Andalusia”, the administration responsible for the management and protection of the forestlands of the region, has financed scientific studies to understand the potential and the limitations of cattle grazing in pasture-fuelbreak areas. In 2005, the working group “Pastores por el monte mediterráneo” (“Shepherds in support of Mediterranean forests”) was formed with the goal of promoting this management system in Andalusia based on the experience gained.

This group is formed by diverse professionals that will develop this proposal. Among them, there are shepherds and livestock owners, forest managers and forest rangers, technicians specialized in fire prevention and scientists from the Spanish Council for Scientific Research (CSIC). The group has pursued the creation of the network of Pasture-Fuelbreak areas of Andalusia (RAPCA), which is described next.

The RAPCA is composed of the group of fuelbreaks and fuelbreak areas that are maintained with the controlled use of livestock and whose results are subject to scientific and technical monitoring. This network extends to the provinces of Cádiz, Málaga, Granada, and Almería, located preferably in protected areas. The programme includes a total of 12 municipalities and 16 forestlands owned by the municipalities or by the regional government. The area covered by the RAPCA is around 791.4 ha and there are 16 shepherds with their herds, grazing in these areas and participating in the programme. There are livestock other than cattle, with a total of approximately 3,260 sheep and 1,940 goats distributed among 15
forestlands, while cows are practically nonexistent, with only 6 individuals grazing in one of the forestlands.

After a detailed assessment of the current forest status, grazing areas are delineated for each shepherd and cattle owner. These grazing areas are only a fraction of the total fuelbreak areas existing in the forest. Grazing in these areas is intensive, since these are strategic zones in which the reduction of the fuel load is the priority. However, the grazing activities are not limited to these spaces. In order to make the integration of livestock grazing in fire prevention activities feasible and viable, it is necessary to have additional, supplementary grazing areas. These additional areas are grazed less intensively, with stocking rates adjusted to the sustaining capacity of the forestlands, and considering the protection of natural tree regeneration. The use of forestlands by livestock creates a gradient in grazing intensity that configures the following mosaic: i) Areas under regeneration or protected due to the presence of endangered plant species with restricted or zero-grazing; ii) Areas with intermediate grazing rate (Supporting Zones); and iii) Strategic Zones, with high grazing rates, necessary to reduce the fuel load. This way of managing livestock in the preventive and integrated management of the forestlands, makes the presence of a shepherd or the use of fencing necessary in order to concentrate the animals in strategic zones. The RAPCA has specifically opted for the first option, due to the advantage of having vocational shepherds in the area committed to the mission of preventing forest fires.

In any case, the maintenance of the fuelbreaks with livestock does not mean that the mechanical shrub clearing on them will be stopped. The increased stocking rate limits, though does not completely prevent, the growth of vegetation and thus the accumulation of wood fuels. This does allow for less mechanical shrub clearing interventions however, and therefore a great savings in cost. For improved performance of the system, it is
advisable to provide incentives, such as the placement of water points and pasture improvement, to graze in the fuelbreak areas. Also, payments to shepherds have been considered necessary in order to obtain an adequate control of the vegetation. This economic compensation was designed like an award/prize for those fuelbreak areas maintained free of vegetation, and not as a subsidy a priori. Thus, the work done by each shepherd is under technical monitoring, focused on measuring the effect of grazing on the vegetation at the start of summer which coincides with the start of the fire season. A negative evaluation will result in the cancellation of the payment for the grazing services, while a positive evaluation, demonstrating an effective control of vegetation, results in a payment. The amount of this remuneration will be determined according to the level of vegetation control in the pasture-fuelbreak areas as a result of grazing, considering the slope, the remoteness, and the existing vegetation.

Aside from this technical monitoring, various scientific investigations are being done to rigorously study some of the key factors that influence the functioning of the system. Current on-going research includes:

- The use of less flammable forage shrubs in pasture-fuelbreaks
- The effects of fuelbreak creation and its maintenance on biodiversity
- A detailed measurement of the accumulation of the fuels in distinct scenarios with livestock pressure and type of vegetation.
- The efficacy of using SALT or improved pasture to stimulate the presence of herbivores (wild and domestic) in the fuelbreaks.
- The economic evaluation of this management system, including all its externalities, and the alternatives.

The monitoring and assessment of pasture-fuelbreaks in Andalusia is a pioneering line of research of great importance and relevance. The results that will be generated in the next two years will allow the adjustment of the
development possibilities of this preventive system within the Andalusian context.

References


