



Prescribed Range Burning in the Pyrenees: From a Traditional Practice to a Modern Management Tool

Introduction

Fire is one of the oldest and most efficient tools in the land-use history of human beings. In the Pyrenees, the use of fire has contributed to shape landscapes of high ecological and cultural diversity, e.g. heathlands and open grasslands. While burning for clearing disappeared progressively, rangeland management by periodically setting fire during the relatively dry winter season remained an indispensable technique to control shrub progression. In spite of the opposition of some foresters, burning was generally considered a necessary and useful technique until the 18th century (Ribet, 2008).

Historical evolution of burning

The situation changed only during the 19th century, with the forestry law (1827) and the laws for re-forestation and restoration of mountain areas (1860 and 1882). Faced with severe problems of erosion and flood, restrictive regulations of burning appeared and the authorities tried to eradicate this "archaic practice"¹.

Legal burning became difficult or impossible, but in the Pyrenees the use of fire never stopped. If the stockbreeders could not meet the new regulations, uncontrolled illegal burning took place because there was no alternative to this efficient management tool. For decades, illegal rangeland burning was more or less "tolerated" if no damages occurred. As a result, reliable data is often unavailable in the Pyrenees. Very often, no written proof exists of burnings without damages, especially if they occur in higher mountains. A study carried out in the Central Pyrenees (Picot, 2008) showed that only a few percent of the range burnings are recorded in the official fire statistics.

During the 20th century, the decline of mountain agriculture and stockbreeding led to an accumulation of biomass and fuel load, with a subsequent increase of the burnt areas. In Ariège (central Pyrenees), the mean surface of a fire was about 10 ha between 1925 and 1940, but increased to 40 ha between 1980 and 1995 (Faerber, 2000). Uncontrolled burning brought a large range of problems in terms of security, economy and ecology. The potential danger was accentuated by the fact that fire was more and more used in lower mountain areas. Covered partly by agricultural terraces and partly by common rangelands, this area was traditionally less concerned with the burnings. Grazing management with high stocking rates and mechanical clearing had often been sufficient to control the vegetation dynamics. If burning was necessary, the low intensity fires were easy to control (Figure 1a).

The overall decline of breeding in mountain areas, and the abandonment of agriculture deeply modified the situation: the rangeland area in the lower mountains increased (traditional common pastures and abandoned agricultural terraces) while the number of cattle and sheep decreased. As a result, the stocking rate was insufficient, and the progression of shrub dramatically reduced the pastoral value of these areas. Shrub progression was particularly quick on the agricultural terraces with their deep, rich soils. Fire was the only way to clear the shrub and to save the low-mountain pastures, indispensable for stockbreeding in the Pyrenees. However, because of the high fuel load, the lacking fire-breaks and the impossibility to practice legal burning, illegal fires were set without any controls. As a result, the damages linked to the burnings increased significantly, especially in the mountain forests situated above (Figure 1b). Additionally, the growing frequency of week-day tourist who were not informed and not used to the traditional practice of rangeland burning induced a serious security problem. The potential risk of uncontrolled fire was dramatically underlined by the accident of

¹ Until today, the French forestry law (art L322-10) prohibits for a period of 10 years breeding activities in burnt forests and, in several French regions, in burnt heathland and shrub, to facilitate the regeneration of the vegetation and to discourage the practice of rangeland burning.

Estérencuby (Bask Country) in February 2000 when 6 mountain tourists were burnt to death by a traditional rangeland burning.

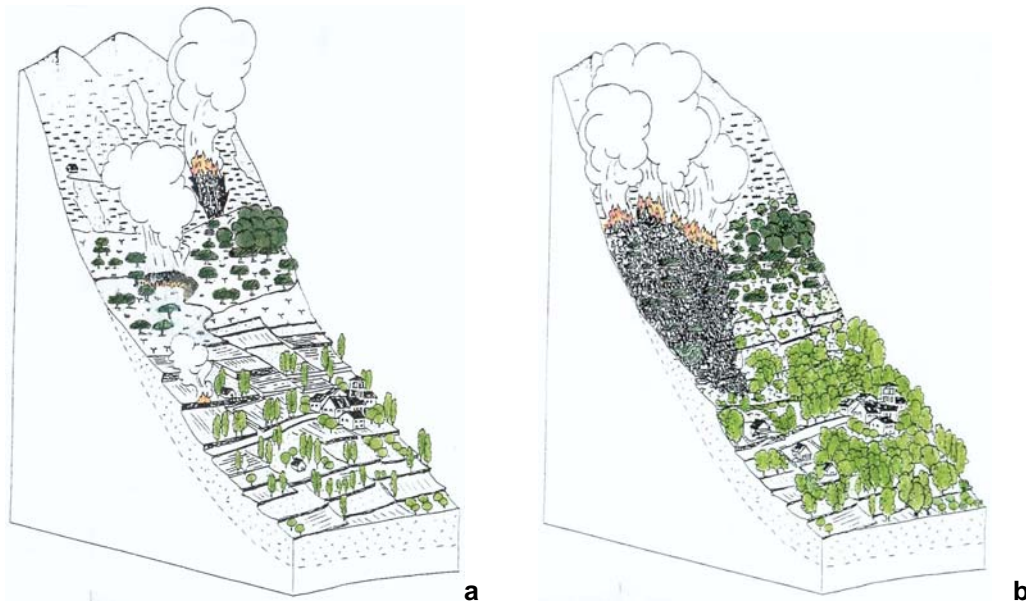


Figure 1. Land-use and burning in the Pyrenees.

a) The traditional use of fire in the Pyrenees in the 19th century: low fuel load, small fires, fire control easy.

b) The use of fire in the 1980s: high fuel load, legal burning difficult or impossible. Illegal burning causes serious damages in mountain forest.

The implementation of new fire policies

The increasing damages linked to uncontrolled burning and the proven inefficiency of fire prohibition made it necessary to reconsider the official fire policy.

In the 1980s, favoured by a change of the scientific perception of fire², the idea emerged that only the legal use of controlled fire would cause an end to uncontrolled burning. This solution of the problem was particularly interesting, as there was an urgent need for a low-cost management tool: shrub control had become a priority because of a revival of stockbreeding in mountains. Prescribed burning seemed the most efficient method, as this traditional management technique can be used in large, difficult areas and induces low costs.

However, the economic and social situation had changed. The common knowledge of controlled burning had disappeared during the past decades in some parts of the Pyrenees. A new conception of prescribed burning was necessary, taking into account the very different situation in the Pyrenees, from one end of the mountain range to the other. As a matter of fact, a strong gradient exists in terms of climate, economic evolution of stockbreeding and -still existing- traditional use of fire. In the eastern part of the Pyrenees, in a Mediterranean, highly fire-sensitive environment, stockbreeding had declined since the 19th century, and traditional burning had almost disappeared. In the western Pyrenees, in a highly oceanic climate, stockbreeding is still intensive, and rangeland management by fire remains a common practice (Figure 2).

² Many scientists shared the negative perception of fire until the middle of the 20th century, e.g. G. Kunholtz-Lordat, a well known French agronomist and botanist, in his famous book *la terre incendiée* (burnt earth) published in 1938. In spite of more differentiated judgements issued from observations in the Pyrenees and in Mediterranean environment (Jovet, 1957; Baudière, 1970; Trabaud, 1980), a scientific reconsideration of fire occurred in France only in the early 1980's, as a result of a detailed field work (Métailié, 1978 and 1981) and taking inspiration from the American prescribed burning policy (Alexandrian et al., 1980).

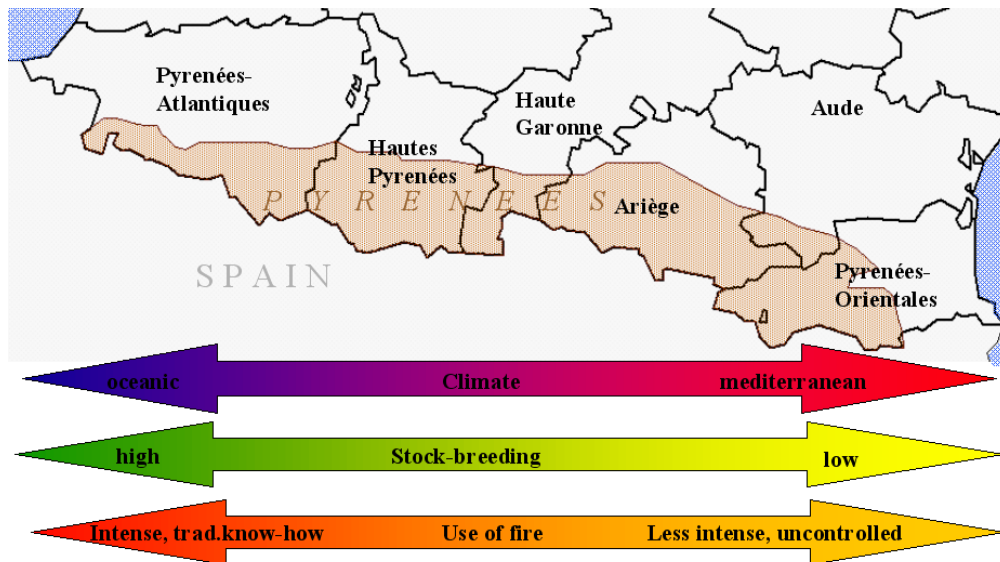


Figure 2. Climate, breeding activities and use of fire in the French Pyrenees in the 1980s.

The new fire policies had to be adapted to the socio-economic and the bio-geographical context. In France, National laws (such as the code forestier) give the framework, but there is a regional decision making for matters related to a specific local or regional context. For instance, the use of fire is regulated by a decree (arrêté préfectoral) passed at the level of départements³. Consequently, the new fire policies were implemented at the level of these regional administrative entities. As a result, the specific local situation could be taken into account, and the four main pyrenean départements Pyrénées-Orientales, Ariège, Hautes-Pyrénées and Pyrénées-Atlantiques have chosen quite different responses to the overall problem of uncontrolled burning.

Regional strategies of prescribed burning

The département of Pyrénées-Orientales corresponds to the Mediterranean part of the Pyrenees. Periods of several weeks of dry weather are rather frequent even during the winter season. The high frequency of a strong regional wind (called *tramontane*) increases the fire problem. During the past 30 years, the fire statistics count an average of 110 fires per year, burning almost 1500 ha. However, the annual surface burnt can go up to 11,000 ha (in 1978). Consequently, fire regulations are rather restrictive. On the other hand, stockbreeding has dramatically decreased, reaching its lowest level in the 1980's. Breeding activities stopped in many villages, and rangelands turned to shrub with increasing fuel load. The traditional know-how of controlled burning almost disappeared, and the use of fire had become dangerous.

In the middle of the 1980s, the situation was characterised by two main problems:

- High damages in forests linked to uncontrolled fire, inducing a very high regional concern.
- An increasing need for an efficient management tool to restore and maintain rangelands, linked to a certain revival of extensive stockbreeding (National and EU subsidies for agriculture in mountain regions).

In response to these problems, the département of Pyrénées-Orientales was the first in developing a new fire strategy based on prescribed burning. Faced with the technical difficulties of burning (high fuel load, flammable vegetation and dangerous climatic conditions) and the lack of stockbreeders with local know-how, the solution couldn't be based on a revival of traditional burning. Consequently, in 1986, the Ranging Offices⁴ in co-operation with the Forest Office⁵ set up a group of specialists to organise and to conduct prescribed burnings. The principal objective (about 2/3 of the burnings) is rangeland management, with its side-effect, the reduction of uncontrolled fires. 1/3 of the fires are set for forest

³ Regional administrative entity. For the localisation, see fig.2

⁴ Société d'Elevage des Pyrénées-Orientales and SIME (now SUAMME)

⁵ Office National des Forêts (ONF)

protection (reduction of fuel load, creation of fire breaks) or for environmental objectives: habitat management, landscape management. Additionally, the burnings are used for training, for the technical staff of forestry and agricultural offices from other French regions in the framework of the French diploma of prescribed burning, and for the Army. Most burnings are carried out by a Civil Protection Brigade of the French Army, in order to train the soldiers to fight forest fires in the most sensitive Mediterranean regions in summer. The solution makes sense not only from a technical point of view, it helps also to reduce the costs of the burnings (partly taken into charge by the Army).



Figure 3. Prescribed burning of a *Cystisus purgans* heath in the Pyrénées-Orientales (Sournia, February 2008). The burning is implemented by the Civil Protection Brigade of the French Army (UIISC 1).

From 1987 to 2007, the official burning group carried out about 1000 burnings; a surface of 17,593 ha has been burnt, a high level compared to the 1,751 forest fires burning 12,306 ha in the same period⁶ (Figure 4). In relation to the total rangeland area, the surface burnt by prescribed burning during the last 20 years represents about 15 %.

Prescribed burning is nowadays a well working “service”. Stockbreeders, associations or municipalities can ask for the intervention of the burning group. The burning group does a preliminary study of the area: pertinence of the project, necessary preparation, difficulty of the burning. Burning is implemented by two kinds of intervention groups. In higher mountains, areas with low biomass and in non fire-sensitive environment, burning is done by small groups using basic equipment (drip torch and hand tools). This kind of burning is quite near to the traditional practice, using if possible natural fire breaks (snow, humid areas, etc.). More difficult burnings, with higher fuel-load, lacking natural fire-breaks and the proximity of forests are carried out by the civil protection brigades of the French army using heavy equipment (fire engines).

Prescribed burning is considered an operation of common interest in order to uphold the local breeding economy, to maintain open “touristic” landscapes and to decrease fire hazard. Public funding⁷ reduces the costs of the burnings (in most cases between 60 and 200 €/ha) to a reasonable level for the stockbreeders.

⁶ In to the official French data base Promethee (promethee.com), a fire is called “forest fire” if the surface burnt is above 1 ha, even if only shrub, heath or sparse Mediterranean vegetation is burnt.

⁷ Mostly from the French Conservatory of the Mediterranean forest and EU or National subsidies for mountain agriculture

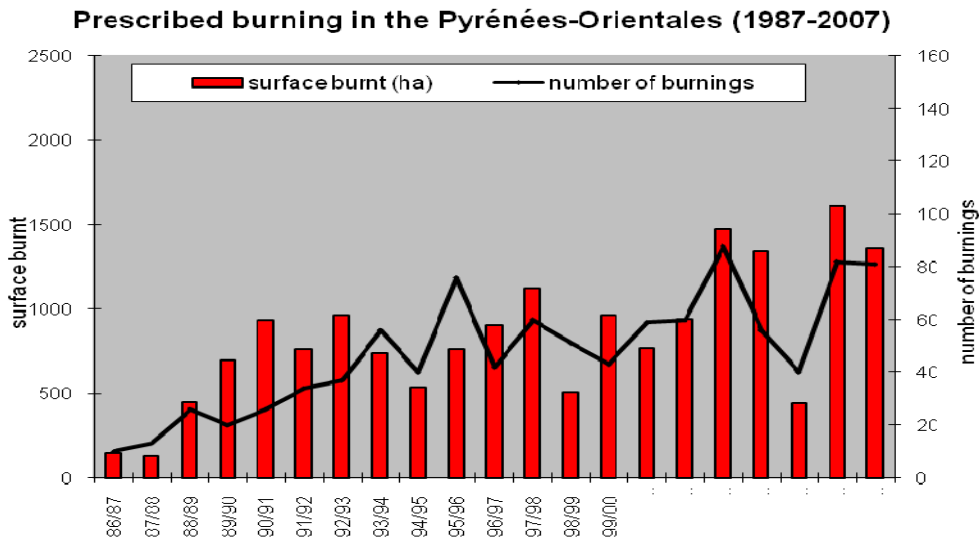
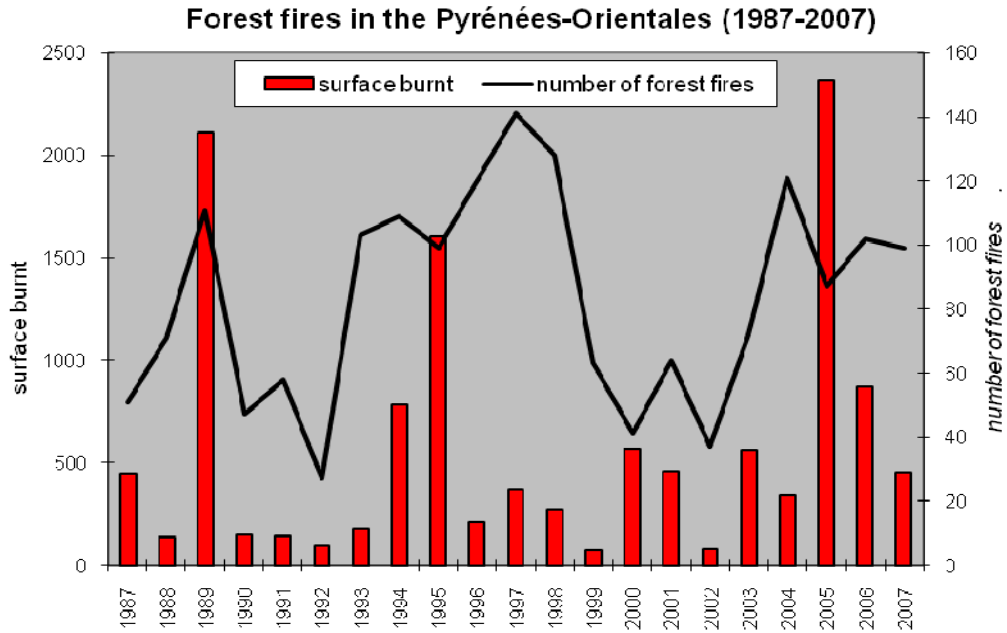


Figure 4. Number of fires and surface burnt by forest fires and by the prescribed burning team from 1987 to 2007.

In addition to the professional burning, the few local stockbreeders still knowing to practice traditional burning are allowed to burn rangelands situated in non-sensitive areas. However, only very few stockbreeders are concerned, and the surface burnt is rather low compared to official burning.

The results of this policy are quite encouraging. In the Pyrénées-Orientales, prescribed burning is nowadays considered as an appropriate management technique. The service is well accepted by the local stakeholders, because of its low costs and high efficiency.

At the level of the département, the establishment of the burning group coincides with advances in fire-fighting and better fire prevention. Therefore, the decrease of forest fires⁸ may not be related only to the prescribed burning policy. However, if we focus on the mountain area where prescribed burning is

⁸ An average of 135 fires per year and 950 ha burned after 1987, compared to 152 fires and 2900 ha burned per year between 1974 and 1986.

mostly used, the impact of the new policy seems clear. For example, in the Madres-Coronat Mountain range, a significant decrease of uncontrolled burnings has been observed, since prescribed burning is implemented in the framework of an official management plan. As a result, the damages in mountain forests decreased.

In Ariège, agriculture and stockbreeding in mountains have declined since the end of the 19th century. Shrub progression is a general problem and in many valleys only a few stockbreeders remained. In spite of the more humid, sub Atlantic climate, fire is a common phenomenon. In the region Midi-Pyrenees, Ariège has the biggest surface and the most forests burnt per year. As all over the Pyrenees, fire occurs mostly during winter. The statistics do not allow a clear idea about the origins. Frequently the fire origin is indicated as “unknown”. About 40 % is “certainly” or “probably” linked to illegal rangeland burning, but there are various other reasons to set fire: to clear for hunting, bee-keeping, landscape management, and criminal burning.... Fire is considered as a very common and natural phenomenon. “Fire set itself on the slope” explains a local stockbreeder, suggesting that nobody is responsible for it.

Setting a fire remains quite a common practice, and most of the burnings are carried out without control: legal burning seems too risky, and the respect of restrictive regulations impossible. Consequently, the damages of mountain forests increased (Figure 5), and fire hazard became a public concern, especially after two dry winters in 1988 and 1989.



Figure 5. Damage of mountain beech and oak forests linked to uncontrolled burnings. a) Melles, July 1992, b) Axiat, February 1993.

Since 1990, the Ranging office with the help of the University of Toulouse tried to change the situation by the promotion of prescribed burning. More appropriated regulations should facilitate legal (thus controlled) burning and reduce the number of illegal uncontrolled fires. At the same time, a large information campaign and the implementation of “demonstrative” fires (Figure 6) are aimed to modify the negative image of burning.



Figure 6. “Demonstrative” prescribed burnings are aimed to promote the technique. Broom and Bracken heath, Goulier, March 1992.

As a result, the number of declared burnings increased very significantly from about 25 per year in the 1980s to 118 in 1992. However, the situation did not change definitively, and the number of declared burnings decreased as quick as it had increased. Uncontrolled burning continued (nearly) in the same way as before. Possibly because the know-how of controlled burning had disappeared, due to the “individualism” of the local stockbreeders, or because of the still too restrictive regulation.

In 1996, new regulations should resolve the problem. Controlled burning was facilitated for groups of stockbreeders with existing know-how and a management plan for their rangelands, but became more difficult for individual stockbreeders. However, no such group of stockbreeders has been established yet, and the new regulations brought in fact only more restrictions.

The creation of a professional burning team did not bring a solution. First set up by the provincial office for Ranging Activities⁹ in 1995, this team was taken under the wing of the fire- brigades¹⁰ since 1999. Unfortunately, only a few burnings¹¹ could be carried out each year, because of insufficient means (human and material) and too few good burning days due to the subatlantic climate. A wet winter would need simultaneous burning on several sites during the few good burning days, but this is impossible with one provincial group and limited staff.

As a result, stockbreeders often had to wait several years for the fire while their rangelands overgrew with shrub. Finally, they did not ask any more for the professional team but set fire by themselves. Additionally, if the management of the burning group by the fire brigades proved to be a good idea from a technical point of view, the solution was less appropriated in terms of rangeland management. A better involvement of the Ranging office would have been necessary to co-ordinate burning of pastures and other range improvement practices. Nowadays, the professional team is still working, but the rare burnings are done for forest protection or landscape management.

In Ariège, after more than 15 years of efforts, the results are not completely satisfying. The new policy did not resolve, up to now, the problem of uncontrolled burnings. However, each prescribed burning and each additional burning declaration may have avoided damage resulting from illegal fire.

In the Hautes-Pyrénées, the decline of stock-breeding is less pronounced than in Ariège. The knowledge of controlled burning survived in many places, but damages linked to rangeland burning occurred frequently, especially during the dry winters at the end of the 1980s. New regulations tried to prohibit the use of fire, but the local population continued burning in an illegal way.

The failure of the ban of fire led to the implementation of a very offensive policy based on a fire management at a local level. “Committees for prescribed burning” have been set up since 1991, in order to favour the discussion about burning and future land planning between all stakeholders involved. Stockbreeders, hunters, forest-managers, fire-brigades... discussed together where and when to burn. The new fire regulations are easy to meet, a burning declaration in the beginning of the season and the respect of some basic rules is enough. Adequate equipment (e.g. drip torch) is proposed to the local stockbreeders to facilitate burning and to make it safer. In districts without committees, burning continues to be allowed, but the regulations are a little bit more restrictive.

Seventeen years later, the results of the new fire policy are very encouraging. Burning Committees have been established in the most sensitive mountain districts. The local discussion inside the committees often permitted a better mutual understanding and helped to avoid conflicts. The number of legal burnings increased considerably. Today, about 80% of the burnings are declared. In February 2008, an exceptional burning period (about 20 days with excellent conditions and numerous burnings) proved the high level of fire control by the local population. An inventory of the burnings showed that 6100 ha had been burnt in only one month, a very large surface compared to the 700 ha for the total 2006/07 burning season, and the 2050 ha in 2005/06 (Picot, 2008). In spite of the high surface burnt, only 10 ha of damages in forests have been recorded (0.2% of the burnt area).

Additionally, during the last years, the provincial office for civil protection experienced a Pyrenean version of a “let burn” policy: during dry periods, when burning is done simultaneously on almost all slopes, a systematic “reconnaissance” of the burning places is carried out. Additional teams are in charge of a specific inquiry and information campaign during the weekends. Fire-brigades are called

⁹ Fédération Pastorale de l'Ariège

¹⁰ SDIS: Service Départemental d'Incendie et de Secours

¹¹ About 10 burnings per year for a total of 100-300 ha burnt

only in case of potential risk (insufficient control of fire, proximity of forest...). All other fires are allowed to burn, even if no declaration had been done. The creation of reconnaissance teams has permitted not only to reduce the costs of fire-fighting, but also to better inform the local population about the necessity to control fire and to respect the regulations.



Figure 7. In the Hautes-Pyrenees, the traditional practice of prescribed burning is still alive, and a local knowledge exists. The pictures show a rangeland burning implemented in the framework of the first local committee (Soum det Mont, district of Argèlès-Gazost, January 1993).

In the Pyrenees-Atlantiques, finally, where stockbreeding is still very alive (numerous stockbreeders, intensive production and large common rangelands), burning is mainly organised by the local population without any help from an official side. The incineration of 15,000 ha approximately is authorized¹² every year, which would correspond to 10% of the total rangeland area. The surface burnt is more than 10 times larger than in the other départements, a consequence of the much more intensive breeding-activities, but also of the Atlantic vegetation (bracken heath and *Brachypodium* meadows which can be burnt each year).



Figure 9. Rangeland burning is still a very common practice in the Western Pyrenees. On good burning days, dozens of fires are set in each valley. The satellite picture (MODIS on Aqua, 16 February 2008) shows only the very large burnings. Source: NASA.

¹² In the Pyrénées-Atlantiques, a burning authorization is delivered by the local administration (mayor or National Park), while in other départements only a declaration of the burning project is necessary. In both cases, the data indicate an intention to burn, but do not correspond necessarily to the real burnt surface which can be much lower (burning impossible because of the atmospheric conditions) or higher (larger surfaces burnt than allowed / declared).

Most of the burnings are well controlled and the know-how of the technique seems still alive. However, uncontrolled burning with the subsequent damages in mountain forest exist also in the Pyrenees-Atlantiques. The accident of 2000, when six tourists were burnt to death, made obvious an urgent need for a better organisation of traditional burning. It was interesting to observe that the accident did not lead to a general incrimination of the practice. This may be linked to the strong practice of stockbreeding in this département inducing a large public understanding of the necessity of periodical burning. Only a few voices asked for a general prohibition of burning.

In the contrary, after 2000, the official objective was to increase the number of authorized burnings. Local burning committees have been established, a large information campaign has been implemented and regulations of burning modified. In several valleys (Aspe, Soule), semi-professional teams have been set up, in order to implement difficult burnings and to help the local population.

The results were quite positive: in a few years only, the number of burning authorisations increased from about 200 to 1100 per year. Simultaneously, the damages in forests have decreased.

Conclusions

20 years after the implementation of the first prescribed burning strategies in the Pyrenees, the results of the new policies are encouraging: In most cases, the uncontrolled setting up of fire was considerably reduced, and forest degradation and the risk of accidents decreased.

In the same time, controlled burning proved to be an appropriate management tool for rangelands. The data recorded on permanent transect lines since 1990 confirmed the efficiency of burning (Faerber, 1995, 2000). In all cases studied, a significant increase of the pastoral value has been observed after burning. The degree and the duration of this positive impact depend mostly on the vegetation composition (regeneration capacity of the ligneous species) and on the age of the stands, but also on the conditions of burning and on subsequent grazing. The Pyrenean heathlands (except Juniper stands) proved to be of high resiliency and often even depend on fire: burning is the only disturbance factor able to prevent the natural succession to shrub and wood. Controlled burning maintains open rangelands and set up a mosaic of meadows, heath and forests thus increasing landscape and habitat diversity at the scale of slopes.

However, the implementation of prescribed burning as a viable improvement practice for rangelands needs to take into account the local situation. The example of the 4 Pyrenean départements shows that different strategies may allow to set up an efficient policy of land management, and to resolve the problem of uncontrolled burning.

Professional burning by a group of specialists can be the only appropriate solution in a fire sensitive environment. However, in most cases, the professional solution works only if there is a clear political will to support financially prescribed burning: extensive stockbreeders would be unable in most cases to pay the real costs, and the temptation to save money by setting illegally fire would be too high. On the other hand, as the example of Ariège shows, a professional group can work efficiently only if the climatic conditions allow a long burning season. Humid climates would need simultaneous burning on many slopes during the few burning days and thus require decentralized solutions.

To give back the control of fire to the stakeholders principally interested in the burnings seems to be the only practicable solution in these cases. The success of this approach in the Hautes-Pyrenees and in the Pyrénées-Atlantiques was based on three principles:

- an information campaign in order to make all actors involved sensitive to the problem of uncontrolled burning,
- regulations facilitating legal burning,
- fire management at a local level, including if possible a discussion between all stakeholders with a view to a common decision on future land-planning.

The experience of the Pyrenees emphasizes the sensibility of the local population in particular to the second point. The French administration tried several times to "secure" traditional burning by more

restrictive regulations (limitations of surface or of burning time, necessary security measures...). The result was either a shifting into illegality of burning (thus uncontrolled fire and high damages), either a local abandon of the traditional practice and consequently a growing up of shrub (thus pasture degradation and increasing fire hazards).

If some of these regulations make sense from an ecological point of view (e.g. limitation of the burning area), the negative impact of too restrictive regulations has been systematically higher than the expected beneficial effects.

Additionally, many of these regulations may seem unnecessary. As a matter of fact, the person igniting the fire has a strong interest to avoid dangerous situations (e.g. setting of fire in too dry vegetation), as he declared the burning and would consequently be responsible for all eventual damages. On the other hand, most burnings are done for rangeland management. Stockbreeders will naturally try to reduce the impact of fire on the vegetation, to favour a quick regeneration of the pastures. Generally, stockbreeders know quite well when and how to burn. Inappropriate burning under hazardous conditions may occur in some cases. But, the stockbreeder responsible for such a burning will be affected immediately by the consequences: destruction of the vegetation cover and subsequent erosion, thus pasture degradation. He will learn quickly his lesson. The negative ecological impact of such rare "wrong" burnings will be much lower than the impact of the many illegal and uncontrolled burnings resulting from restrictive regulations.

Finally, the experience of the Pyrenees shows also that the administrative procedure must be easy and quick. Both systems, a simple declaration of burning as well as a local demand of authorisation work if the paper work is reduced to a necessary minimum. The number of stockbreeders accepting the procedure is directly related to its complexity and to the necessary effort. For instance, the limitation of validity of burning declarations to a short period often made necessary to proceed to a new declaration, if the atmospheric conditions did not allow burning. As a result, during wet winters, stockbreeders had to fill out the papers 5 or 6 times before the fire could be carried out. A less time intensive procedure certainly would increase the number of burning declarations and contribute to reduce illegal burning. The recent efforts, e.g. a project of the Hautes-Pyrenees to make possible an online registration of fire declarations, are a step in the right direction.

IFFN contribution by

Ms. Johanna Faerber
MEDI-TERRA-University of Perpignan
Perpignan
France

e-mail: faerber@univ-perp.fr

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