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Competing for Meadows

A Case Study on Tourism and Livestock Farming in the Spanish Pyrenees

The consequences of tourist growth on extensive livestock farming were studied in a valley in the Spanish Central Pyrenees (Upper Esera), characterized by important growth in tourist activity during the last 3 decades. The municipalities with the greatest tourist development experienced the biggest drop in livestock farming (abandonment of cultivated land, decrease in livestock population and farms) because of the competition of tourism for labor and fertile land, which are essential to the maintenance of extensive livestock farming. Low use of pasture resources leads to their progressive loss, owing to the advance of plant succession (substitution of pastures by shrubs), decreasing landscape diversity, and increased fire hazard and soil erosion. We conclude that the current model of tourist development in the Spanish Pyrenees represents serious problems in terms of sustainable development.

Keywords: *Mountain tourism; livestock farming; sustainable development; Pyrenees; Spain.*

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Introduction

Livestock farming has traditionally been the main economic activity in the Spanish Pyrenees (García-Ruiz and Lasanta 1990). Nevertheless, tourism has reached a significant level of development in some valleys since the 1970s, because of the establishment of several alpine ski resorts and a growing interest in nature and the rural world. The tourist sector has become the main source of livelihood in several valleys: Upper Esera, Tena, Canfranc, Arán (Loscertales 1993; Lardiés 1995).

Tourism development in mountain regions has remarkably positive effects, such as maintaining or even increasing the number of inhabitants, balancing the demographic structure, diversifying economic activities, and improving the service network and infrastructure (Kariel 1984; Barbier 1993; Snowdon et al 1999). But it also has negative impacts such as competition between the primary and the tertiary sectors (Messerli 1987), heavy economic, social, and managerial dependence on external influences that increase socioeconomic vulnerability and instability hazards (Dorfmann 1983), and environmental and landscape impacts on the areas that are the most visited (Oberacher 1995; Buckley et al 1999).

In the Spanish Pyrenees, it has also been observed that tourism develops in fertile areas with meadows that are essential for the management of cattle in the region. Nowadays, meadows are the key factor providing stability in the socioeconomic system in the Pyrenees. García-Ruiz and Lasanta (1993) estimated that between 66% and 75% of the feed for Pyrenean cattle is obtained from meadows, although this varies from one valley to another. Thus, a decrease in forage production (decrease in cultivated land or extensification in management) implies a decrease in the cattle population and less cattle pressure on natural pastures (García-González et al 1990; Molinillo et al 1997). The change in cattle pressure on the land is vital for the global exploitation of Pyrenean grazing resources—which are quite abundant and cheap—and it indirectly affects landscape diversity, watershed supply, and soil conservation (González Bernáldez 1991; García-Ruiz and Lasanta 1998; Vicente 2001).

In this context, one should ask whether this new model of tourist development in the Spanish Pyrenees based on ski resorts contributes to the sustainable development of the area or, on the contrary, whether it competes with the traditional management model. We explore the competitiveness of the traditional model, based mainly on cattle management, in terms of labor force and cultivated land—both vital resources in socioeconomic management—landscape balance, and resource conservation. Finally, an evaluation is made of how the sudden establishment of tourist activities affects sustainable development in a mountain area.

Study area

The study area corresponds to the Upper Esera River Basin, located in the Central Spanish Pyrenees or Aragonese Pyrenees. It has a surface area of 502.4 km^2 and includes 8 municipalities (Figure 1). In 1996, there was a population of 2823 inhabitants (43% of them in the municipality of Benasque).

The Upper Esera was chosen because of its suitability for the objective of this study, as it includes municipalities with different degrees of tourist development. It is also a valley that has been little affected by external interventions (reservoirs, roads, social and administrative services), compared with other Pyrenean valleys. These characteristics allow an evaluation of the influence of tourism on the evolution of the primary sector and on recent socioeconomic changes.

The Upper Esera belongs to the Axial Pyrenees, the central sector of the mountain range. The prevailing lithology is granite and slate, although in some sectors limestone and quartzites are dominant. Glacial and periglacial modeling are significant, and the valley contains some of the residual glaciers of the Iberian Penin-

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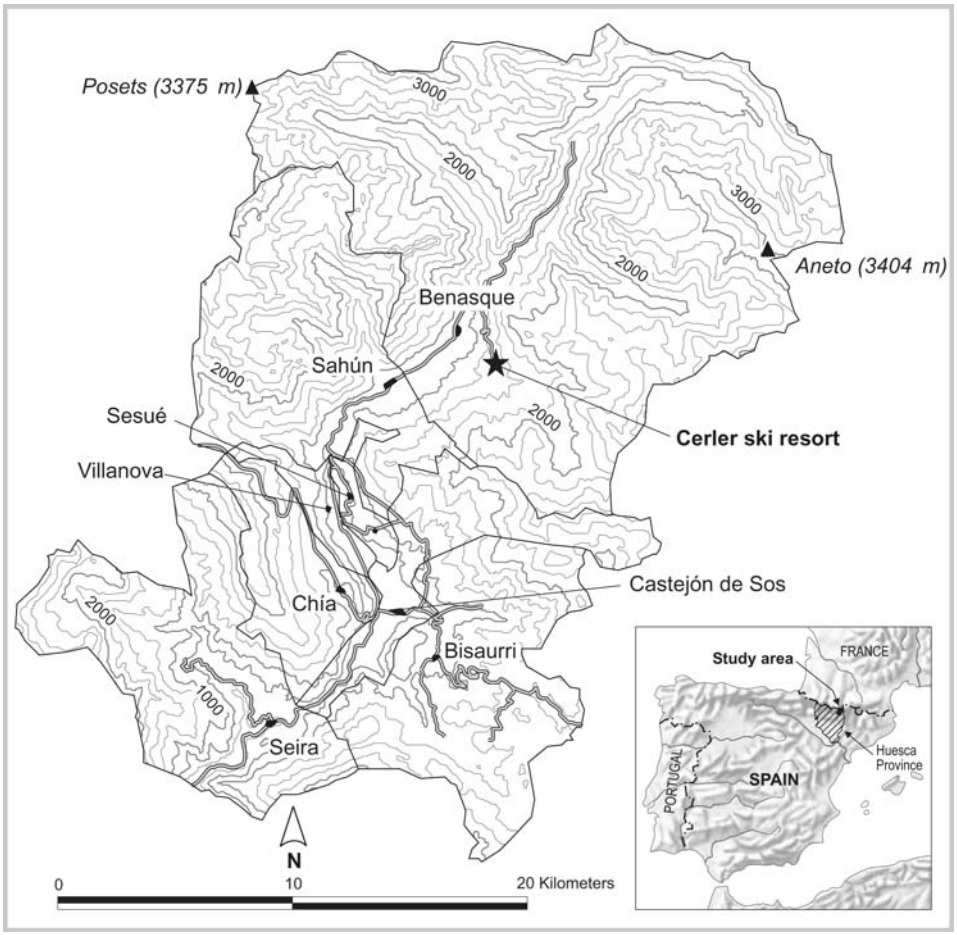

FIGURE 1 Location of the study area. (Map by authors and Andreas Brodbeck)

sula (García-Ruiz et al 1992). Precipitation ranges from 1000 mm at an altitude of 940 m to 2600 mm above 2900 m (Chueca and Julián 1994). Average temperatures range from 9°C to 11°C in villages located at lower altitudes. The 0°C isotherm is located at 1700 m in wintertime. As a result of this climate, snow plays an important hydrologic, geomorphologic, and socioeconomic role (García-Ruiz 1997).

The altitudes in the area range from 3404 m on the Aneto summit to 950 m at the lowest point. Because of this altitude gradient, complex relief, and topoclimatic conditions, a diverse landscape has developed, with great environmental value and immense attractiveness for tourism (Laguna 2001).

The study area belongs to a zone known as Pyrenean valleys. All these valleys have a N–S orientation, following the river channels that cut transversely through the tectonic and lithologic structure (Solé Sabaris 1951; Sala and García-Ruiz 1984). The different land uses are set in terraces. The bottom of these valleys and the slopes adjacent to them are used for agriculture, traditionally cultivated with cereals for human consumption and now occupied by meadows for cattle grazing. Above this is a wide strip of forest (*Pinus sylvestris, Quercus faginea,* and *Fagus sylvatica,* among the representative species), and on the upper level are pastures known as *puertos* used by cattle in summer (Puigdefábregas and Fillat 1986; García-Ruiz and Lasanta 1990). Ski resorts have been constructed at this height since the 1960s (López Palomeque 1982; Chapeau 1985). There is extensive scientific literature on the physical characteristics and management of these Pyrenean valleys (eg, *Mountain Research and Development* 10(3) devoted an entire issue to the Spanish Pyrenees).

Sources and methodology

Data on livestock census, tourist accommodation, urban planning, and evolution of urbanized areas in recent decades were obtained from local and regional government agencies.

Detailed land-use maps were based on aerial photographs and fieldwork, with a special focus on agricultural areas. This information was linked to a geographic information system (Arc Info v.7.0) to determine land-use evolution. We used this methodology to identify abandoned agricultural areas and establish their relationships with tourism growth (direct occupation by infrastructure and marginalization of other fields because of their abandonment).

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Using interviews with residents (municipal council, cattle and tourism associations, the environmental agency in the valley, and 35 direct interviews with farm owners) and tax information (regional government), we compared employment at the beginning (1965) and end (2000) of the study period.

Results

Crisis of the farming system and tourism development

From medieval times, the management system in the Spanish Pyrenees has been based on sheep grazing and cereal farming. During summer, pastures above the timberline (*puertos*) were grazed by sheep, which used to migrate during the rest of the year to the Ebro Basin. Cereal crops on low slopes fed the population (Puigdefábregas and Fillat 1986; García-Ruiz and Lasanta 1990).

After the 1950s, the farming system underwent a very deep crisis: the migrating system tended to disappear because of the cultivation of untilled land in the Ebro Basin and the integration of mountain areas into the market economy. In this new economy, mountain areas were unable to compete with products from lowland areas, where irrigation and mechanized agriculture were easily established. The population in the valleys of the Central Pyrenees was reduced almost by half in 3 decades (from 24,735 inhabitants in 1950 to 13,009 inhabitants in 1981). The process of depopulation in the Pyrenean valleys began in the 1930s (in 1900 there were 26,445 inhabitants, and in 1930 there were 26,228 inhabitants), although it was slow at the beginning; in 1950 there were still 24,735 inhabitants, 94.3% of the 1930 population. The amount of cultivated land dropped from 16% to 4.7% of the total area, whereas the sheep population showed a steep decline, from 450,000 at the beginning of the century to 89,000 in 2000.

Under these circumstances, a boom in tourism began in the 1960s, mostly related to alpine skiing. In the Aragonese Pyrenees, 5 ski resorts were established: Candanchu in 1962, Formigal in 1965, Panticosa in 1970, Astún in 1971, and Cerler in 1971. The last is located in the municipality of Benasque (Upper Esera). The study area has been a major tourist attraction since the ski resort opened in Cerler (Figure 2).

Table 1 shows the evolution of accommodation facilities for visitors since 1960. At that time there were just 2 hotels and 50 second homes. Ten years later, almost the same accommodation facilities were still available. Accommodation has increased and diversified since the 1970s. Today more than 17,000 beds are available, a figure that is 6 times greater than the number of inhabitants registered in the study area. The evolution of the Defert Tf (tourist function: this concept was developed by Defert [1967] and has since often been used in tourism studies—see, for example, Barbier 1984, Callizo 1991, and Smith 1995) clearly shows the great increase of tourism in the study area: it was 6.9 in 1960, 33.5 in 1970, 217.6 in 1981, 483.2 in 1990, and 650.7 in 1999. Thus, the Upper Esera can be classified as a valley with a functional specialization in tourism (Callizo 1991).

The distribution of tourist accommodations in the study area is quite heterogeneous. Benasque accounts for 60% of all accommodations. Castejón de Sos ranks a

TABLE 1 Trends in accommodation (number of beds) in the Upper Esera, 1960–2000. (Source: national government statistics for 1960 and 1970; regional government statistics for 1981, 1990, and 2000)

	1960	1970	1981	1990	2000
Hotels	119	119	678	1530	1677
Apartments	—	—	—	—	218
Second homes	225	215	2760	6035	13030
Hostels	—	—	—	175	242
Mountain lodges	—	—	—	188	147
Rural gites (VTR)[a]	—	—	—	132	378
Rural gites (VTV)[a]	—	—	—	—	381
Camping sites	—	—	—	1000	1000
Total	344	334	3438	9060	17073

[a] VTR and VTV are Spanish abbreviations for rural gites, depending on the source (regional or local government statistics).

FIGURE 2 Permanent settlement in Cerler (Benasque) resulting from tourism, located in a very fertile side-valley. (Photo by María Laguna)

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distant second, with 11.2%, because of its location at a crossroads. Sahún is third owing to its proximity to Benasque. The remaining municipalities have only a few beds and a less diverse offering, totally concentrated in second homes. The Defert Tf also establishes clear contrasts: Benasque has the highest value (Tf = 878), whereas Chía (Tf = 243) and Bisaurri (Tf = 316) have the lowest.

The competition for labor force between the tourist and the primary sectors

Figure 3 shows trends in the number of farms in the study area. Although 662 farms were counted in 1962, only 127 remained in 2000. There was a great decrease in all the municipalities, in line with a similar trend in the Spanish Pyrenees in the 20th century (García-Ruiz and Lasanta 1996). Nevertheless, the drop was slightly higher in the municipalities with greater tourist activity, especially in Benasque, where just 11.5% of the farms remained in 2000. In contrast, municipalities with less tourism maintained a higher percentage of farms.

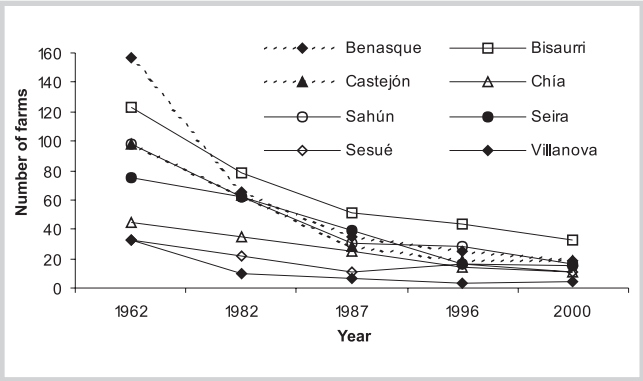

FIGURE 3 Number of farms in the study area, 1962–2000.

In 5 municipalities, we studied the occupations in the year 2000 of individuals who were farm owners (or were the direct descendants of farm owners) in 1965 (Table 2). Whereas in 1965 there were 284 farm owners, only 44 remained in 2000 (15.5%). On the other hand, 52 farm owners moved from the primary sector to the tourism sector and 11 to the construction sector (closely related to tourism), whereas only 8 divided their time between farm work and tourism.

The most tourist-oriented municipalities (Benasque and Sahún) lost the most farms and showed a significant transfer of active population to the tertiary sector, whereas those that focused less on tourism (especially Chía) still have a great proportion of their population active in the primary sector.

Decrease of cultivated land and cattle census as a result of tourist growth

Figure 4 represents the increase of built-up land between 1960 and 2000. The differences between municipalities are quite relevant: Benasque expanded the most, from 11 hectares in 1960 to 235 hectares in 2000. In Sahún and Castejón de Sos also, the space occupied by buildings and tourist infrastructure increased substantially. In the other municipalities, growth was significant but more moderate.

The increase of tourist infrastructure and accommodations implies the occupation of plots, mainly fodder-crop fields (García-Ruiz and Lasanta 1993). Logically, much infrastructure and many buildings tend to be located close to villages and communication routes, to take advantage of access and the use of services (water, electricity, and drainage). These areas correspond with the fields traditionally used for agriculture.

The loss of fodder resources is a determining factor in the evolution of some farms because their capacity to feed cattle during winter has been greatly reduced. This has been a major cause of farm disappearance and, indirectly, abandonment or extensification of the remaining cultivated land. As a consequence, competition for employment between tourism and the primary sector also increases. Figure 5 shows the decreasing trend in livestock farming since 1982, when the highest census was recorded. Between 1982 and 2000, the cattle census was reduced by 40.2%, with a sharp drop in the 1990s. The biggest losses were in the municipalities most focused on tourism (Benasque and Sahún maintain roughly a third of the census they had in 1970), whereas the less tourist-oriented ones registered minor losses. The matrix regression given in Table 3 confirms that the evolution of livestock farming has an indirect relation to the development of tourism. The application of the same statistical analysis, including all the municipalities of the valleys in the Central Pyrenees,

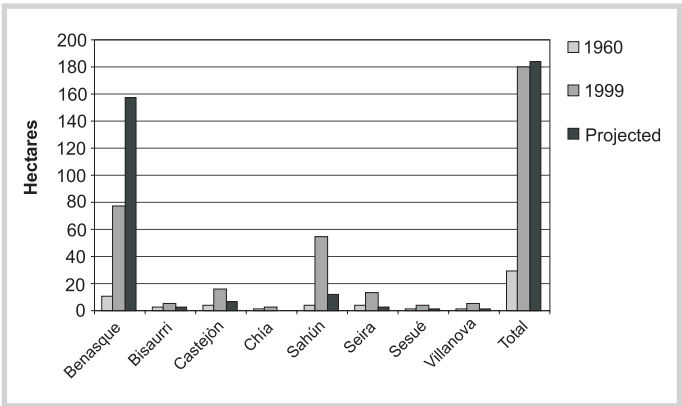

FIGURE 4 Built-up land in the study area, 1960–1999, and projected increase.

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TABLE 2 Status (in 2000) of individuals who were farm owners in 1965. (Source: regional government and interviews of farm owners and local entities)

	Benasque	Sahún	Chía	Sesué	Villanova	Total
Primary sector	13	12	9	6	4	44
Tourism	25	21	1	4	1	52
Pluriactivity	3	1	0	3	1	8
Construction	5	4	1	0	1	11
Hydroelectric power plant	—	1	0	1	0	2
Retired	9	5	6	2	3	25
Migrants	21	32	16	22	5	96
No descendants	6	—	2	2	3	13
Deceased	7	17	4	4	1	33
Total (farm owners in 1965)	89	93	39	44	19	284

gives very similar results, with R^2 values of –0.48 for hotel beds, –0.65 for total tourist accommodation, and –0.61 for Defert Tf (Laguna 2001).

Table 4 shows that the municipalities with major tourism activity lose more cultivated land. Between 1957 and 1994, 41.6% of the cultivated land was left untilled, an amount much larger than that left untilled in the whole Central Pyrenees (26.9% according to Lasanta [1989]). The widest patches of abandoned fields appear in Benasque and Sahún, and significant patches also appear in Castejón de Sos. The loss of agricultural land has been small in Sesué and relatively moderate in Bisaurri and Chía. The great losses in Seira are explained by the establishment of a hydroelectric power plant, occupying productive meadows, at the bottom of the main valley.

The decrease in cultivated land and cattle census implies a direct loss of fodder (fields that become built-up plots and others that are abandoned) as well as an indirect loss (plots that are extensified because of a low stocking rate). A recent study (Laguna 2001) showed that only 48% of the potential production of meadows and 61.4% of the potential production of pastures above the timberline are used in the study area. The lack of balance between production and consumption is higher in the municipalities focusing most on tourism than in those with the least focus on tourism.

Discussion and conclusions

Since the 1970s, the economy in many Pyrenean valleys has exhibited a progressive trend toward tourism, exploiting the potential of the area for the development of winter sports.

The present article is concerned with the relations between the primary sector—the basis of the traditional economy—and tourist activity in the Upper Esera. We focused on the use of labor and the use of the most fertile spaces because these are the key factors in livestock production. In relation to the former, the results show a shift in activity from the primary sector to the tourist sector. Only 15.5% of the 1965 farms remain active; 18.3% have become involved in the tourist sector, and others are engaged in activities related to tourism, such as construction. Besides the shift in economic activity among the local population, we found that in-migrants moved to the most touristic municipalities to work in jobs related to tourism. As a consequence, the distribution of the employed population changed in the most touristic municipalities, with the

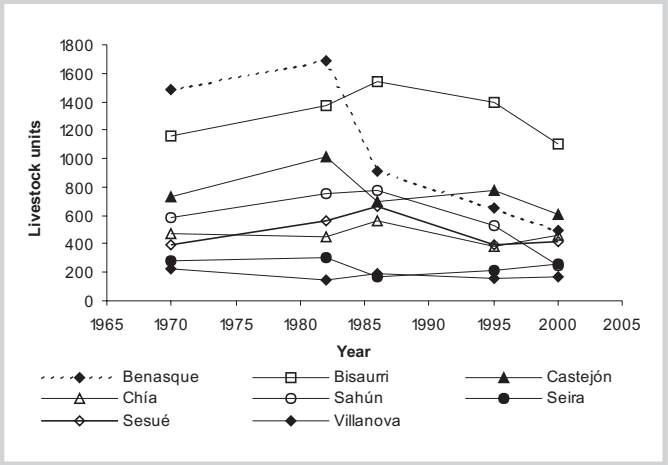

FIGURE 5 Trends in livestock farming in the study area, 1970–2000.

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TABLE 3 Matrix showing regression and correlation between some tourist indicators and livestock trends (*, P < 0.01; **, P < 0.05).

	Defert Tf	Total tourist beds	Hotel beds	Livestock evolution
Defert Tf	1	0.70**	0.66**	–0.67**
Total tourist beds	—	1	0.99*	–0.72**
Hotel beds	—	—	1	–0.71**
Livestock trend	—	—	—	1
Significance Defert Tf	—	0.027	0.037	0.034
Total tourist beds	0.027	—	0.000	0.022
Hotel beds	0.037	0.000	—	0.025
Livestock trend	0.034	0.022	0.025	—

TABLE 4 Trends in cultivated land in the Upper Esera, 1957–1994. (Source: aerial photographs [1957 and 1994] and geographic information system Arc Info v.7.0)

		Cultivated land (hectares)		Abandoned land (1957–1994)	
	Defert Tf	1957	1994	Area (hectares)	Percentage of 1957
Benasque	878.3	1042	363	679	65.2
Bisaurri	316.6	1671	1311	360	21.5
Castejón de Sos	378.8	821	529	292	35.5
Chía	242.9	359	244	115	32
Sahún	451.3	733	230	503	68.6
Seira	525.7	323	108	215	66.5
Sesué	373.5	315	297	18	5.7
Villanova	795.5	211	118	93	44.1
Total	650.7	5475	3200	2275	41.6

tertiary sector becoming the most important. This trend was not observed in the least touristic municipalities. This competition between sectors is also evident in the greater decrease of farms in the most touristic municipalities, such as Benasque, Sahún, and Castejón de Sos. Only one third of the farms from 1982 remain, whereas in the rest of the municipalities more than half are still active.

The shift from farming to tourism is a trend often noted in the literature (Majoral and López Palomeque 1983). It is even pointed out that the young are more likely to leave the primary sector for jobs in tourism because of the advantages offered by this sector: a shorter working day, paid holidays, and better social insurance coverage (Messerli 1983, 1987). The final result is a significant shift in the active population structure, with a decrease of young farmers and corresponding aging of farmers. This reduces continuity in the primary sector as well as the possibilities of modernization on farms and improvement in cattle infrastructure (buildings, fences, use of abandoned fields for grazing). Thus, farms become less stable and less competitive.

We also studied the relations between the primary and tertiary sectors in the use of the most fertile areas

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(cultivated land). Because cultivated fields are located close to roads and built-up areas in villages, they are quite attractive for tourist facilities and buildings. They are occupied by urban developments, sports facilities, hotels, camping sites, and roads. The land suitable for urban development in the Upper Esera multiplied 12-fold (from 29 to 335 hectares) between 1965 and 2000. The most touristic municipalities show the greatest growth, although in the last decade urban expansion has reached other municipalities that have seen a significant increase in second homes.

The occupation of cultivated fields by tourist infrastructure implies a decrease in fodder production. This seems to be a key factor in the disappearance of some farms and also contributes to extensification or abandonment of the rest of the fields. Thus, in the study area the municipalities with greater tourist development have recorded a larger area of abandoned fields and the greatest losses in cattle census.

Because cattle census and grazing decrease, the underuse of cultivated land directly implies the progressive loss of fertility and of capacity to produce fodder. Indirectly, it implies less exploitation of other pasture resources (*puertos,* abandoned fields, uncultivated low slopes, and clearings in the forest). Definitively, the occupation of cultivated land for nonagricultural uses not only implies a loss of land but also keeps large farming areas from being grazed.

Less grazing pressure favors the advance of shrubs that occupy most of the slopes, which diminishes grazing resources (Molinillo et al 1997), reduces run-off in the watersheds (García-Ruiz et al 1995), increases fire hazards and soil erosion (Vicente et al 2000a), and results in loss of landscape diversity (Vicente et al 2000b). Finally, the current model of tourist development has negative effects on cattle production, an essential activity for exploiting one of the most important resources of the Pyrenees—pastures—which are cheap (roughly US$ 1 per cow per year), and allow for great numbers of flocks tended by few shepherds. On the other hand, grassland degradation (evolution toward shrubs) not only has socioeconomic consequences but environmental and landscape impacts as well (as noted above). Nevertheless, the coexistence of touristic and grazing activities is desirable for maximum exploitation of Pyrenean resources, as well as for balancing biodiversity conservation and socioeconomic status. Future research should focus on development models that make development of tourism compatible with cattle production. That is, it would be desirable for tourist infrastructure to occupy marginal lands instead of the most fertile land, as happens nowadays. That would allow the stabilization of cattle census, greater exploitation of pastures, and, as a consequence, greater diversification, and a landscape more attractive to tourists. Currently, however, tourist patterns in the Pyrenees cannot be considered a sustainable development model.

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