Forest planning and traditional knowledge in collective woodlands of Spain: the dehesa system

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Abstract

Since the middle of the 19th century, the German Forestry School's doctrines gained acceptance in Spain, spreading the idea that it was necessary to maintain some collective property forests under State control. The official recognition of this measure marked the beginning of a technical and economic planning process in the country, with the purpose of replacing the traditional management in communal and municipal woodlands. The main aim of the present work is to show the results of this process in Extremadura, a vast region situated in the South-west of Spain, which has been historically characterized by the preponderance of a type of open oak parkland, known as 'dehesa'. The natural peculiarities and the traditional multiple-use management of this woodland variety created special conditions which planning had to face in the region. In this process, the central forest administration tried to implement German technical management principles, based on the Central European high forest and a focus on timber and firewood production. Given the particular features of the dehesa, this task had to be reviewed and updated by the foresters to adapt to the local economic and ecological surroundings. This paper explores the process by which the knowledge gradually accumulated by the forest engineers who were in contact not only with Extremadura but also with other regions of Spanish triggered the development of a new forest economy in the country, based on the recognition of the traditional resources of the Mediterranean woodland.

Key words: forest history, dehesa system, forest planning, collective woodlands

1. Introduction

Since the middle of the 19th century, the Spanish State developed a double crusade against collective rustic property, as part of the liberal agrarian reform (García-Sanz, 1985)[1]. On the one hand, according to the General Disentitlement Act of 1855, the central administration put up for sale most of the estates administered by local corporations. The act exempted from privatization only commons in a strict sense (free lands for restricted neighborhood's use), grazing areas allocated to cattle in each village, as well as some communal and municipal forests with a specific environmental purpose. All these exempt estates continued to be collective property assets, but in administrative terms they began to be considered 'public woodlands'.

On the other hand, following the German Forestry School's guidelines, the Spanish State undertook the management of all non-privatized holdings, posting foresters in each province and putting them in charge of regularizing forestry activities in the new public woodlands. The German School's philosophy held that the logic of the highest profit led individuals to abuse wood lands without taking into account the beneficial influence of the forests on climate, soil and water management. The public sector appeared to be the only body capable of combining the quest for economic profit with concerns for ecological preservation. The State should, therefore, maintain high forests in public hands and, at the same time, exert close control over those other woodlands which continued under local administration.

[1] In this paper, 'collective property' includes both communal and municipal lands. In Spain, the historical difference between them was mainly the greater or lesser control that local corporations exercised over them. In practice, as Nieto (1964) remarks, collective patrimony, with all its diversity, remained as one: "what today was exploited in common and freely, tomorrow was leased to residents or to strangers according to the situation of the municipal finances".

This theory was rapidly adopted by the first forestry academy in Spain, founded in 1848 in Villaviciosa de Odón, and prevented an important part of the collective rustic patrimony from becoming privatized (Bauer, 1980; Casals-Costa, 1988). But the German influence also marked the beginning of a planning process in the country which, taking the high forest in Central Europe as its model, tried to reduce the traditional rights of use in the new public woodlands. In accordance with this policy, since the middle of the 1860s, both the non-privatized estates due to their environmental value and those other holdings exempted because of their social function (i.e., commons and pastures for cattle) began to be managed by the foresters posted in each province.

In a first phase, the main tool used by foresters to carry out their duties was the drawing up of 'forest supervision plans' (Fsp): provincial programs of annual land-uses based on the local corporations' proposals and adapted by the forest services to be put into practice along with technical principles (Manuel & Sáez-Pombo, 1989). This system, reinforced in 1876 through the deployment of a billeted police force as part of the army, was implemented on all non-privatized woodlands between 1875 and 1925 as an initial step towards the comprehensive scientific planning.

The last phase of the intervention, supported by the drawing up of 'forest management plans' in a strict sense (Gómez-Mendoza, 1992), did not start in Spain until the 1890s. In this second phase, the planning was a very slow process and only had an effect on the best forests of the collective patrimony. The historical study of such process at national or regional scale is not easy in the country because the sources available on this matter only contain data for individual woodlands (González *et al.* 1996; Iriarte, 2005).

The present work tries to show the results of the first phase of the intervention by comparing forest supervision plans and forest production statistics. The objective of this initial planning process had a double face. On the one hand, the Spanish State, making use of the German School's political suggestions, tried to convert the communal and free practices into restricted and taxable ones by implementing public auctions as the main procedure to assign the different land-uses. Likewise, through intervention, the Spanish State endeavored to impose, for the first time, tax collection on forest production in order to pay the costs of the new forest administration (Jiménez-Blanco, 1991).

On the other hand, the forest administration itself, following the German School's scientific experience, tried to technically rationalize the management of the non-privatized woodlands. Consistent with the forest literature of the second half of the 19th century (Gómez-Mendoza, 1992; Casals-Costa, 1996), this objective was originally supported by three basic principles. The first and most important one was to give priority to timber and firewood over any other product and, consequently, to high forest over any other woodland type. The second precept, directly related to the first one, was to consider livestock rearing as an activity incompatible with a sustainable forest management. Accordingly, the central forest administration attempted to reduce the livestock density in the estates under supervision. In the same way, the third technical guideline was to prohibit cultivation as a practice intended for improving the quality of grasses and acorns. All of these principles, based on a conservationist vision, marked the route to follow by the forest engineers stationed in each province, at least during the first decades of the State intervention.

The main aim of my work is to show the ambiguous results of this intervention by studying the case of Extremadura, an extensive region located in southwestern Spain. This region has historically been recognized for the importance of its communal and municipal woodlands in supporting villages' livelihood (Linares, 2002). The difference between the Spanish Forestry School's principles, directly imported from Germany (Groome, 1990; Gómez-Mendoza, 1992), and the ecological and economic peculiarities of this kind of woodlands justifies the choice of Extremadura to evaluate the workability of technical forestry knowledge and practices in relation to traditional forest management.

2. The study material: the dehesa system in Extremadura

Similar in size to Switzerland (40,000 km^2), Extremadura has been administratively divided into two provinces since the 1830s: Cáceres and Badajoz. Surrounded by mountains in the north, south and east, the regional plateau gradually descends into Portugal on its western frontier. High summer temperatures and irregular winter rainfall contribute to a hostile climate which makes this area among the driest in Spain. The barrenness of the soil, added to aridity of the climate, strongly conditions the agricultural activity in the region. Only xerophilous species, able to survive the summer droughts, can prosper in high forest and scrubland. The herbaceous substratum of these woodlands is largely limited to those species which germinate in winter (cereals and some pulses). Vines and olive trees are adapted to the waterless summers with the mild temperatures of winter, but the risk of frost in autumn and the irregular rainfall of spring can deter their germination.

The concentration of rain in March and October and the different oak species found in the wooded areas favor, however, grazing during most of the year. This potentiality underpins animal husbandry, an activity which has dominated the agrarian history of Extremadura and which played a decisive role in the liberal redefinition of collective patrimony. In fact, livestock production represented the main use of the communal and municipal woodlands in the region before the General Disentitlement Act of 1855 (Linares, 2006).

Although it is difficult to know exactly the area covered by the collective estates, some local and regional forest surveys from the middle of the 19th century allow us to estimate a total surface of over one million hectares, divided among nearly 2,000 holdings. These properties were mostly large farms (between 300 and 600 hectares) in which trees and shrubs had been partially or totally eliminated in favor of extensive grazing areas. In other words, as the forest surveys themselves suggest, the communal and municipal woodlands in Extremadura were in fact 'dehesas' (Linares, 2001).

The dehesa is a savannah-like landscape characterized by scattered holm oak (*Quercus rotundifolia*) and cork oak (*Quercus suber*) stands with an understorey of grasses, cereals and Mediterranean scrub (Díaz *et al.*, 1997). It is also an 'agrosilvopastoral' land-use system where livestock rearing is the activity that determines all other uses (Campos-Palacín, 1984). The initial state of dehesa is the so-called 'monte pardo': transitional scrubland and woodland in which oaks are accompanied by woody species such as *Arbutus unedo*, *Pistacia lentiscus* and *Cistus* (Martín-Bolaños, 1943). Human intervention basically consists of expanding pastures and, in due time, arable land in densely populated areas to prevent shrub encroachment (Parsons, 1962).

The conversion of the Mediterranean forest into dehesa involves not only a decrease in the extent of the original high forest (Blanco *et al*., 1997), but also the diminution of tree variety. In this sense, the most significant historical changes have been the decrease of some oak species in favor of holm oaks (Manuel & Gil, 1996) and the diminution of some holm oak sub-species in favor of those holm oaks that produce more and sweeter acorns (González-Bernáldez, 1992).

In the traditional dehesa, holm oak stands are regularly cleared and thinned to promote herb growth as well as to ensure a maximum yield of acorns for animal forage (Fuentes-Sánchez, 1994). The cut wood is used as firewood and for charcoal production, and the smaller branches and leaves are used as livestock fodder (San-Miguel, 1994). The plowing, traditionally developed in long rotation cycles, is a frequently applied practice for the cultivation of cereals and pulses, as well as for the control of shrub advance (Montero *et al.*, 1998). The motive for keeping the trees is that, in relatively poor soils, the profitability of acorn, grass and rotational crop is higher than intensive cultivation alone (Plieninger, 2003). In this way, the dehesa, despite the ecological simplification of the original forest, can simultaneously support livestock, forestry and agricultural production without irreversibly endangering the Mediterranean ecosystem (Campos-Palacín, 1984; Dawson & Fry, 1998; Plieninger & Wilbrand, 2001).

Available information indicates that this form of multiple-use management was practiced in the collective woodlands of Extremadura by the middle of the 19th century (Linares, 2001). Grasses and pastures were consumed by both beasts of burden and breeding livestock. From October to January, municipal authorities reserved the holdings populated by holm oaks for pigs to feed on acorns shaken from the trees with

rods. Subsequently, villagers pruned trees and bushes in order to assure the production of acorn for the next season and to stock up on firewood for the next winter. In scarce rainfall years, sheep and goats supplemented their diets with the tender branches of the trees.

In woodlands with cork oaks, every nine or ten years, the bark was stripped from the trees. The inner part of the bark served the local leather industry as a tanning agent. The outer part served for both domestic use and the construction of beehives and, since the 1830s, for the bottle cork industry. In the areas most suited to cultivation, residents alternated sowing cereals with fallow periods of between 4 and 50 years. Once the crop was harvested, the fields were cleaned by local livestock, which could also graze the arable lands in fallow periods. Moreover, the collective woodlands in Extremadura, as in other parts of the country, represented an irreplaceable reserve of resources for the rural community's livelihood: game, fishing, mushrooms, medicinal plants, stone, sand, and other useful products (Linares, 2002).

The forms of access and the duration of these uses were generally regulated by municipal ordinances and, thanks to the strength of custom, were perfectly understood by the local population. The existence of more or less formalized codes and the persistence of customs did not guarantee the absence of abuses, but, at least, legitimized residents' complaints against self-interested conduct. This 'moral economy' (Thompson, 1975) did not assure the equitable distribution of the production, but it did guarantee, to some extent, the survival of those practices which contributed most strongly to the peasantry's income.

The forms of possession of the collective woodlands in Extremadura by the middle of the 19th century (Table 1) reflect the relative balance among the different

interests involved in the use of the village patrimony. Certainly, an important part of this kind of property (64.8%) had been converted into limited and taxable estates (municipal woodlands), thus fulfilling the growing financial needs of the local corporations and the claims for restricted use by the wealthiest social group. Nonetheless, within these holdings, only the most market-demanded products (pastures, cork and, sometimes, acorns for pigs) had been permanently commercialized by the municipalities of Extremadura (Linares, 2006). The remaining uses and the rest of the collective surfaces (35.2%) continued to be free for all the members of each neighborhood (communal woodlands).

The General Disentitlement Act broke the pre-existent balance in terms of social sharing. Despite protests against privatization (Linares, 2001), from 1855 to 1925 almost a million of hectares of collective surface in Extremadura were transferred to private hands (Table 2). As we will point out below, these transactions had important consequences for the management of the non-privatized woodlands. However, the present work does not intend to study the privatization process, but the effects of the first forest planning implemented around 1875 in the holdings which were not sold. In this sense, the available sources reveal that, rather than breaking the traditional flexibility of the dehesa, the intervention in the region gave technical legitimacy to the customary multiple-use management system.

3. Sources: forest supervision plans and forest production statistics

Most of the documentation generated in Spain by the provincial forest services used in this study is kept in the Agriculture Ministry Archive (AMA). This information,

whose features and problems have been well studied by GEHR, 1991, concerns the public woodlands managed by engineers of the Development Ministry and covers the period between 1873 and 1914. Documents produced since 1914 by the Development Ministry's foresters are currently kept in the Spanish Administration General Archive (AGA).

Between 1900 and 1922, the management of an important part of the public woodlands (commons, pastures for cattle and still non-privatized alienable estates) was assigned to a new corps of forest engineers, employed by the Finance Ministry. For these holdings, the unique sources existing today, at least for Extremadura, are the yearly tables published in Provincial Official Bulletins. These records only involve the physical and monetary estimates of the uses forecasted for each season, but not their qualitative evolution or the final valuation of actual production.

In the plans of the Development Ministry, these data are collected in two kinds of documents: justification reports and execution reports. The first contain explanations by the chief engineer of each province for the uses forecasted in the annual supervision plan. It is complemented with an evaluation of the Spanish forest authorities to approve or disapprove the forecasted uses. This information allows us to discern the level of accomplishment of central orders by the provincial services. For such purpose, the execution report is also of a great utility. Unfortunately, this type of documentation is highly irregular not only in Extremadura, but also in the few other places which have already been investigated (Moreno-Fernández, 1994; Manuel, 1996; Sáez-Pombo, 2000).

The lack of execution reports could be only partially compensated for by using the forest production statistics were published by the Development Ministry between

1861 and 1880, and from 1901 to 1933. These statistics not always include the same estates (GEHR, 1991). While data available between 1861 and 1880 corresponded to all non-privatized public woodlands, the statistics published from 1901 to 1933 only included figures about the holdings which were exempt from privatization because of their environmental qualities. Only during a short interval (1923-1925), coinciding with the termination of the Finance Ministry's forest services and the reincorporation of the lands under their control to the Development Ministry, all non-privatized woodlands reappear in the forest statistics.

On the other hand, the production data collected in these statistics are not always consistent (GEHR, 1991). The figures which were published between 1861 and 1880 gathered the annual monetary value according to the adjudication forms. The criteria for classification are as follows: ordinary uses (auctioned to the highest bidder), neighborhood uses (free or carried out with fixed prices) and extraordinary uses (non-forecasted or non-licensed by the provincial forest services but appraised for statistical purposes). At no time, did the statistics of the period 1861-1880 contain specific figures about the different products obtained from the woodlands under control. This type of information is only available in the data which were published between 1901 and 1933. During these years, the categories of the previous stage are the same, but the publication of the physical and monetary values for each use allows us to analyze the internal composition of the public woodlands' production.

In short, the sources currently available about Spain in general and Extremadura in particular hinder the consistent comparison of the uses forecasted by the provincial forest engineers with the real production throughout the period under study. Nonetheless, the contrast of the forest supervision plans with the production statistics,

never carried out in the country to date, allows us to check at least the level of equivalence between forecasting and production both at the beginning and at the end of the period under study. More importantly, the systematic analysis of the handwritten documentation drawn up by the foresters stationed in Badajoz and Cáceres from 1875 to 1925 makes it possible to develop a sufficiently accurate picture of the qualitative results of the forest planning process in the region.

4. Results: the forest planning process in Extremadura (1875-1925)

Almost all the previously published works devoted to the study of Spanish forest history have highlighted the success that the forest administration finally achieved in regularizing production of the non-privatized public woodlands (Zapata, 1986; Jiménez-Blanco, 1991; GEHR, 2002). Moreover, the statistically confirmed increase of the auctioned uses, to the detriment of the neighborhood practices, has been considered to be a good indicator of the market's progress in forestry activities of the Spanish collective woodlands and, to some extent, as a sign of the liberal State's success in its goal of weakening common rights (Sanz-Fernández, 1985 and 1986).

The Extremadura case is not especially different from the rest of Spain. In fact, the great importance attached to the privatization process in this region (Table 2) overshadows any other consideration. A thorough assessment of the sources available about Extremadura reveals, however, the difficulty to complete the substitution of traditional management systems. The forest production statistics show, for example, that the aim of reducing the communal practices in the non-privatized surfaces was far from being a totally achieved (Table 3). Despite an increase in the auctions in Extremadura

between 1875 and 1925, neighborhood uses continued to be relatively important at the end of the period (44%). This figure is especially significant if we take into account that, in contrast with the uses adjudicated to the highest bidder, the communal practices' monetary value mostly corresponded to free rights which were only appraised for statistical purpose.

The persistence of these rights in the region is probably related to the increase in the products obtained from the non-privatized woodlands to counteract the powerful advantage of the privatization process. The Spanish forest administration implies such possibility when, in the forest production statistics of 1871-1875, it shows that over the last few years the lands for beasts of burden, "particularly in the provinces of Extremadura, are the object of different uses, in addition to pastures, that considerably increase their productivity" (Dirección General de Agricultura, 1866-1887).

From this point of view, privatization could be considered as a factor upsetting the customary but tense equilibrium between rural community and their natural resources. Indeed, contrary to those authors who consider common systems as incompatible with sustainability (Hardin, 1968), some critics maintain that it is precisely the redefinition of collective property rights which causes the main problems in the sustainable management and conservation of many ecosystems. This idea, related to the thesis of the 'tragedy of enclosures' (Thompson, 1991), considers that privatization, rather than guaranteeing the conservation of assets, can lead indirectly to the 'tragedy of the commons' from the moment it induces forcible violation of traditional norms of management and natural resources renewal.

Beyond underlying the ecological rift, the persistence of communal practices in the new public woodlands was insufficient to resist the interference of the liberal State.

In spite of the underdevelopment with regard to other places in the country, the traditional land uses in Extremadura lost ground relative to the auctioned uses. In this sense, it seems clear that the aim of reducing the models of traditional management in the old communal and municipal woodlands was a difficult task but not a completely failed objective during the forest planning process.

In terms of productive guidance, the intent of regularizing forestry along through the application of technical principles was a much more complicated task. According to the supervision plans (Table 4), between 1875 and 1925, the only noteworthy change in the 'day-book' of the engineers posted in Extremadura was the growing role acquired by pastures and crops to the detriment of corks and acorns. This change was not, however, the result of indiscriminate uprooting in collective woodlands. Consistent with provincial forest services, the most important causes for the lower production of corks and acorns were, on the one hand, the privatization of cork and holm oak stands in the last decades of the 19th century and, on the other hand, the damage caused on holm oaks by a plague of Bombix dispar (*Malacasoma nestrium*). In the light of such contingencies, what the supervision plans seem to show in Extremadura is the growing acceptance of the regional forestry framework.

This acceptance was of course related to the transformation experienced by the Spanish forestry science since the beginning of the 20th century. From then on, a new forest economy, based on the recognition of the traditional resources of the Mediterranean landscape and supported by a more productive vision of the woodland, was developed in the country (Gómez-Mendoza, 1992; Manuel, 1996). Nonetheless, the progressive abandonment of the previously acquired German doctrines was not the outcome of a mere intellectual evolution. Behind the change, is the remarkable role

played by the different social and economic interests which confronted the forestry experts stationed in each province during the planning process. These interests and the impediments they generated at local and provincial scale gradually undermined the original spirit of the forest engineers and triggered the advance of Spanish forestry science.

In Extremadura, as in other parts of the country (Balboa, 1990; Araque, 1997; Iriarte, 1997; Sabio, 1997), one of the most important obstacles to the provincial forest services' work was the concealment of woodlands which officially might be subjected to forest control. Until the first years of the 20th century, together with the privatized holdings and, consequently, removed ones from the forest planning, the supervision plans of the region continued to register increases in the number of estates under control. Most of these, deliberately hidden by the municipalities, were safe from any statistical entry as 'classified but not investigated woodlands'. If it was difficult to control the use of the estates already identified, planning in those not investigated ones was practically non-existent.

In the known holdings, the main tactic employed by local corporations to avoid the forestry experts' supervision was not submitting their annual proposals of uses as required by legislation. This practice was the major reason offered by the engineers posted in Extremadura to explain the difference between forecasted and real production, a difference which was significant until the beginning of the 1920s (Table 5). It is necessary to bear in mind that the lack of personnel in a region as extensive as Extremadura compelled the engineers to put into the hands of municipalities the daily development of planning. In these circumstances, the refusal to send proposals left the provincial forest services without the information needed to monitor this process.

Another form of resistance against intervention was the refusal of villagers to pay the taxes imposed by the central administration on the use of non-privatized woodlands. The policing organs had the job of impeding the exercise of any use without official recognition and of punishing infractions. The supervision plans, however, confirm that not only were taxes rarely paid, but also that very few penalties were ever levied. Moreover, as in other parts of Spain (Balboa, 1990; Manuel, 1996; Araque, 1997; Sabio, 1997), many local corporations refused to impose these fines in Extremadura. Only in the last years of the 19th century the payment of annual taxes became more regular in the region, although it is not clear whether this greater regularity was due to improved enforcement methods or because residents began to view the payment as a guarantee to exclude unauthorized users.

This latter factor may explain the relative regularization of the public auctions for the use of the pastures and acorns since the first decades of the 20th century. Until then, the previously agreed absence of bidders at the annual auctions was another method to elude the planning process. While the engineers lowered the reserve prices in order to find bidders, the residents agreed among themselves not to bid at all so that they could continue to use the non-privatized woodlands according to their own rules. Only when the forestry experts combined the rights of pastures and acorns and proceeded to award them for longer periods (3 or 4 years), the public auctions began to gain certain level of acceptance with the local population.

Still, the system rarely guaranteed adherence to the technical conditions established by the provincial forest services. The forest engineers' attempts to limit the number of cattle entering communal and municipal woodlands were futile: villagers consistently introduced more than had been agreed at the time of the auction. This

practice was, however, progressively accepted by the technicians stationed in Extremadura. So much was this the case that the annual plans drawn up in the first quarter of the past century, instead of reducing the livestock density, held it constant in the woodlands submitted to planning. In spite of scientific principles, "grazing is now and will continue to be for many years the use that will provide the major income to municipalities and to the State" (AGA, Fsp, Cáceres 1916-1917).

The recognition of local reality was especially controversial in the case of goats. From the first years of the planning process, these animals were considered enemies of a sustainable forest management. In fact, the presence of goats in the supervision plans of Extremadura was continuously reported by the country's forest authorities. The engineers placed in the region justified the decision claiming that it was a way to avoid "the numerous denounces received in provincial services because of abusive grazing of goats in forests adjacent to particular ones" (AMA, Fsp, Cáceres 1894-1895). In other words, once the fraudulent presence of this kind of livestock in the woodlands under planning was confirmed, it was convenient to yield to the pressures of the villages rather than causing, via prohibition, the complete devastation of populated areas. The poverty of the region and the need of guarantying the subsistence of many peasants could be also decisive on this matter.

Something similar happened with cultivation practices. As was pointed out above, the cultivation of cereals and pulses always played a significant role in the traditional use of the dehesa. Furthermore, in spite of the initial rejection of the foresters placed in Extremadura, the planning process not only failed to restrict this practice, but also acted as an official guarantor against the forest authorities' disapproval. In the first contacts with regional reality, the engineers, before technically justifying the crops,

recognized “the power of custom” (AMA, Fsp, Badajoz 1873-1874). As time went on, the technicians stationed in the region ended up accepting cultivation as “a practice intended for improving the grass and acorn production in the public woodlands” (AMA, Fsp, Badajoz 1880-1881). It was, in essence, another form to recognition of the persistence of customary land use practices and, at the same time, another way for forest technicians to achieve some slight acceptance among rural communities.

A similar attitude could be observed regarding timber and firewood, the most important forest products according to the German School. After the first contacts with Extremadura’s collective woodlands, the forestry experts recognized that, “being pastures and acorns as the main uses of these estates, precepts and rules that support a scientific and rational use of the high forest have no application in this region” (AMA, Fsp, Badajoz, 1878-1879). Subsequently, the engineers’ concern was centered on the limited remuneration from timber and firewood in the market. In this sense, the technicians soon realized that the practices traditionally carried out in private lands were an important obstacle not easily surmounted. On the one hand, the woodcutters in Extremadura were accustomed to extracting timber in particular forests without taking into account any legal principle. On the other hand, the landowners would give for free the firewood from their woodlands with the aim favoring the production of acorns. In view of these practices, the forest engineers finally admitted the impossibility of regularizing timber and firewood production.

With reference to other uses, the planning process also had to face reality. In the case of tender branches, charcoal, stone, clay, brushwood or beehives, the personnel in charge of the technical supervision proceeded as simple agents fulfilling those requests made by the villages in the few management projects that local corporations sent to the

provincial forest services. The main aim of these requests was to increase the municipal income by selling at auction products revalued in the market. In the particular case of game, the forestry experts intended to implement a regular system of public auction but they ended up accepting the local custom: game had always been freely available to residents and continued to be so after the arrival of the forestry experts.

This recognition shows the need for adaptation. Faced with the difficulty of abolishing certain local practices, the foresters had no option but to accept them in order to avoid indiscriminate attacks as revenge for prohibitions. In this respect, it must be taken into account that fraudulent practices were common in the planning process (GEHR, 1999). In Extremadura, references to non-forecasted cutting, abusive grazing, unlawful land cultivation or massive thefts of acorns filled the annual reports. Only since the first decade of the 20th century did these infractions start to decrease. In fact, the progressive reduction of fraudulent uses itself made possible to reconcile data on the actual woodland production with their value registered in the statistics. And this was due to the official acceptance of uses initially considered as criminal, such as cultivation or goat trespassing on non-privatized estates.

During the process of acceptance of local experience and customary practices, only the technical principles initially defended by central forest administration were questioned. The Spanish State, sponsor of the planning, benefited from it. The adjustment between the real production and the statistical one was eventually achieved, accompanied by the consolidation of the tax payment and the decrease of communal uses. In both cases, the result was an increase of State income. However, to achieve this, forest engineers had to abandon certain principles previously adopted from the German Forestry School and accept the realities of the regional surroundings. In the end, despite

ignoring the orders of the country's forest authorities, the technicians placed in the region managed to regularize, if not the forestry of the collective woodlands, at least the statistical control of traditional uses of these lands.

On this matter, the contrast between the forest supervision plans and the production statistics in the first years of the 1920s is quite enlightening (Table 5). If 'agropastoral' is the woodland forecasted by the provincial forest services, agropastoral is also the forest collected in the production statistics. From this perspective, it is possible to conclude that the fact of granting statistical legitimacy to the physical and economic potential of the local environment was the greatest success of the State intervention in Extremadura. More precisely, the planning process in the region technically supported the multiple-use management of the dehesa system.

5. Conclusions

This study shows the results of the first forest planning process which was applied to communal and municipal woodlands in Extremadura between 1875 and 1925. Both the theoretical basis of this process and the academic background of the engineers who carried it out were influenced by the German Forestry School's doctrines. The Spanish State made use of these doctrines not only to assure the preservation of the woodlands under control, but also to establish public auctions as the means to assign rights to harvest products and, for the first time, to collect taxes on the production of these estates.

The study, based on an assessment of the forest supervision plans and production statistics, reveals that the aim of reducing the local customary uses together with regularizing the collection of taxes was a difficult task but one that was accomplished to

a certain extent. Until the beginning of the 20th century, agreements among villagers not to place bids at the annual auctions was the most common practice to avoid the weakening of traditional adjudication practices. Likewise, the refusal of the villagers to pay duties imposed by the State, many times with the consent of the local corporations, prevented the normalization of tax collection. Nevertheless, during the first years of the 20th century the public auctions and the payment of taxes became more regular, although it is not clear whether was due to improved enforcement methods or because the residents began to abide by the legal framework as a guarantee to exclude unauthorized users.

From a technical perspective, the results of the planning process in Extremadura were much less evident. The analysis of the land-use systems before and after the arrival of the forest engineers shows that attempt to apply forest techniques in a strict sense was soon abandoned. The realization of the regional socioeconomic framework and the ecological differences between the dehesa landscape and that of the high forest led to a rapid review of previously acquired knowledge. At first, this reconsideration was marked by a conscious abandonment of attempts to regularize timber and firewood production, limited by nature and by historical evolution in this type of Mediterranean ecosystem. However, the adjustment did not stop here.

The persistence of traditional land-use systems in the collective woodlands led the forest engineers stationed in Extremadura to allow practices not accepted by the central forest administration. Thus, for instance, they eventually justified plowing in woodland areas and the presence of goats on sites submitted to technical supervision. Likewise, the forest services of the region finally accepted the trespass of more animals

than stipulated at the time of auctions, despite the Spanish forest authorities' persistent disapproval.

To sum up, this study reveals that the planning process in Extremadura gave technical legitimacy to the traditional multiple-use management of the dehesa system. Moreover, the development of a new forest economy in Spain since the beginning of the 20th century was not the result of a simple intellectual evolution. The knowledge that the forest engineers posted in each province were accumulating through contact with the different regional realities of the country undermined the original influence of the German Forestry School. In this sense, it is possible to conclude that the planning process was the one that resulted in major changes in Spanish forestry science.

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Table 1. Extent and ownership patterns of collective woodlands in Extremadura by the middle of the 19th century

	Total area			Forms of ownership	
	Geographical Surface	Collective Woodland	Collective W. over Geographical S.	Communal W. over Collective W.	Municipal W. over Collective W.
	ha	ha	%	%	%
Badajoz Province	2,177,229	495,767	22.8	32.6	67.4
Cáceres Province	1,979,995	678,544	34.3	38.1	61.9
EXTREMADURA	4,157,244	1,174,311	28.5	35.2	64.8

SOURCE: Linares, 2002.

Table 2. Trends in privatization of collective woodlands in Extremadura (1855-1925)

	Privatized Surfaces (1855-1925)			Percentages over Total	
	1855-1875	1875-1925	1855-1925	1855-75	1875-1925
	ha	ha	ha	%	%
Badajoz Province	310,559	80,987	391,546	79.3	20.7
Cáceres Province	482,760	47,494	530,244	91.0	9,0
EXTREMADURA	793,319	128,471	921,790	86,0	13.0

SOURCE: Linares, 2002.

Table 3. Uses and monetary values realized in collective woodlands of Extremadura (1875-1925)
(in thousands of Pesetas of 1913 and percentages)

Adjudication Forms	Badajoz Province		Cáceres Province		Extremadura	
	1875-1877	1923-1925	1875-1877	1923-1925	1875-1877	1923-1925
Annual Average Value						
Ordinary Uses	25	103	286	497	311	600
Neighborhood Uses	652	80	320	393	972	473
(*) Extraordinary Uses	11	0	7	5	18	5
Total Uses	687	183	613	895	1,301	1,078
Percentages						
Ordinary Uses	4	56	47	55	24	56
Neighborhood Uses	95	44	52	44	75	44
(*) Extraordinary Uses	1	0	1	1	1	0
Total Uses	100	100	100	100	100	100

(*) These include illegal uses and destroyed products which were appraised for statistical purpose.

SOURCES: Dirección General de Agricultura, 1866-1887; Dirección General de Agricultura, 1925-1927.

Table 4. Monetary value of forecasted production in collective woodlands of Extremadura (1875-1925)
(in thousands of Pesetas of 1913 and percentages)

Three Years	Pastures	Acorns	Crops	Woods	Corks	Others	Total
Annual Average Value							
1875-1877	655	342	65	14	44	0	1,120
1881-1883	1,148	382	175	41	38	0	1,785
1887-1889	1,313	145	77	27	62	1	1,625
1893-1895	1,214	88	85	36	53	1	1,478
1899-1901	885	54	103	27	11	1	1,081
1905-1907	858	50	95	30	7	2	1,042
1911-1913	976	53	98	38	17	4	1,187
1917-1919	584	28	39	28	5	6	691
1923-1925	885	33	95	19	4	4	1,040
Percentages							
1875-1877	58	31	6	1	4	0	100
1881-1883	64	21	10	2	2	0	100
1887-1889	81	9	5	2	4	0	100
1893-1895	82	6	6	2	4	0	100
1899-1901	82	5	10	3	1	0	100
1905-1907	82	5	9	3	1	0	100
1911-1913	82	4	8	3	1	0	100
1917-1919	85	4	6	4	1	1	100
1923-1925	85	3	9	2	0	0	100

SOURCES: AMA, Fsp, Badajoz-Cáceres, 1875-1913; AGA, Fsp, Badajoz-Cáceres, 1914-1925; Provincial Official Bulletins, Badajoz-Cáceres, 1900-1921.

Table 5. Forecasted and real production values of Extremadura's collective woodlands (1875-1925)
(in thousands of Pesetas of 1913 and percentages)

Three Years	Pastures	Acorns	Crops	Woods	Corks	Others	Total
1875-1877							
Forecasted Production							
Annual Average Value	655	342	65	14	44	0	1,120
%	58	31	6	1	4	0	100
(*) Real Production							
Annual Average Value							1,283
1894-1896							
Forecasted Production							
Annual Average Value	1,226	73	79	41	39	1	1,459
%	84	5	5	3	3	0	100
Real Production							
Annual Average Value	1,167	39	40	9	1	0	1,256
%	93	3	3	1	0	0	100
1923-1925							
Forecasted Production							
Annual Average Value	885	33	95	19	4	4	1,040
%	85	3	9	2	0	0	100
Real Production							
Annual Average Value	884	21	124	39	2	3	1,073
%	82	2	12	4	0	0	100

(*) Statistics do not include specific data about each use.

SOURCES: AMA, Fsp, Badajoz-Cáceres, 1875-1878 and 1894-1896; Dirección General de Agricultura, 1866-1887; Dirección General de Agricultura, 1925-1927.