Working Woodlands: Public Demand, Owner Management, and Government Intervention in Conserving Mediterranean Ranches and Dehesas[1]

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Abstract

The contributions of California and Spanish oak woodlands to owners, neighbors, and society are undervalued. Recent Spanish studies have begun to identify the components of value provided by traditional oak woodland agro-sylvo-pastoral systems, including environmental and self-consumption values. Work in California has revealed that self-consumption by owners, benefits to neighboring properties, and benefits to the larger society are important components of the total valuation of traditional low-intensity oak woodland ranching. In Spain, this type of bioeconomic analysis, known as "Total Economic Value," engages an institutional framework at pan-European, national, and regional levels as the full economic values of low-intensity agriculture are increasingly recognized and supported by subsidies and public policy initiatives. In California oak woodlands this accounting helps provide a means for assessing conservation investments by third party non-governmental organizations, and sheds light on oak woodland landowner behaviors crucial to efforts to conserve these mostly private lands. We embark on a course of research to conduct comparative bioeconomic analysis in Spain and California, including evaluation of the ecological outcomes of various scenarios, and the institutional leverage points for such information. This paper introduces ecological, economic, and institutional similarities and differences in the woodlands, with particular attention to the possibilities of comparative bioeconomic analyses.

Introduction

The undervaluing of traditional oak woodland agro-sylvo-pastoral systems in California and Spain has resulted in misguided government policies and interventions, and misunderstandings of landowner goals and behaviors. We are embarking on a collaborative, multi-disciplinary project of comparative bioeconomic analysis on privately managed oak woodlands, with the goal of developing strategies

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that will increase the contribution of oak woodland ranches in California and Spain to conservation and quality of life locally, regionally, and at larger scales. In Spain, "Total Economic Valuation" of oak woodland ranches has engaged policy initiatives at regional, national, and pan-European levels. In California, the fit of this type of bioeconomic information with current institutional structures is less clear. We argue that a "total valuation" analysis in California will help elaborate the value of non-governmental organization investment in oak woodland conservation, an increasingly important factor. It will also lend fuller explanation to landowner behavior and stewardship incentives, and help locate and explain opportunities and weaknesses in oak woodland conservation policy and practice.

However similar the flora and the climate, and the way they look, Spanish and Californian woodlands have quite different ecological dynamics and institutional settings. This affects the environmental consequences of shifts in economic valuation and land use, and means there are different institutional leverage points for bioeconomic information. First we describe the settings: the characteristics, ecology, and management of the two oak woodlands. Then we discuss valuation methods as applied in each setting. We conclude with a few words about institutional capacity to respond to problems, and future work.

The Woodlands

When the Spanish settled California late in the eighteenth century they found a familiar countryside of grassland and open oak woodland and savanna. Annual rainfall ranges from about 200 mm to more than 1,000 mm, but is most notable for its high variability and summer absence. The Mediterranean climate of both areas means winters are cool but freezes are rare.

In some ways the oak woodlands and savannas of Spain and California were more different in 1769 then they are today. Prior to Spanish colonization perennial bunchgrasses were a major component of California grasslands. Today these are scattered amid a matrix of hundreds of species of annual grasses from all over the world, including Spain. Wild oats (*Avena* spp.) and numerous other annual species are widespread in both woodlands. In the eighteenth century, California was home to an indigenous population of several hundred thousand. Native Californians have a history of thousands of years of oak woodland management that was undermined and ignored by California's post-Columbian society. Spain over the last several hundred years has been a land of conquest and reconquest, with successive kingdoms and influxes of peoples from the north and south. Yet the evolution of rural practices for oak woodland management progressed until the extent of oak savanna peaked early in the twentieth century (Campos-Palacín 1997).

In Spain two evergreen oak species are common in the open woodland-savanna formation characteristic of the west and southwestern Iberian peninsula *(fig. 1)*. Holm oak or encina (*Quercus ilex* and/or *rotundifolia* or ssp. *rotundifolia* or *ballota*) is most widespread and grows throughout Spain. Cork oak or alcornoque (*Q. suber*), is found intermixed with holm oak when soil conditions and location permit, preferring siliceous soils and moister conditions. There are several deciduous species that are also common in some areas, one is quejigo, *Q. faginea,* found at elevations of 600 to 1,200 m. including on calcareous soils, and another is mellojo, *Q. pyrenaica*, similar to California's black oak found at elevations ranging from 400 to 1,600 m, though sometimes as high as 2,100 m, growing best on siliceous soils (Real Jardín Botánico

de Alcalá de Henares 2001). In about 45 percecnt of wooded dehesa, Holm oak is found alone, cork oak is found alone in 5 percecnt, and 50 percecnt is a mix of any of the major four and sometimes other oaks (Joffre and others 1988). About half of the wooded dehesa is found in the region of Extremadura, where 65 percent of cork oaks are found growing together with holm oak, 31 percent are in pure stands, 2.4 percent grow with mellojo, and 0.2 percent with quejigo. Nearly half has a grassland understory, almost a third a shrub (mattoral) understory, 14 percent is cultivated, and the remaining area is patchy (Cardillo 2000). Savanna formations are most common at 400 to 800 m above sea level on poor, acidic soils.

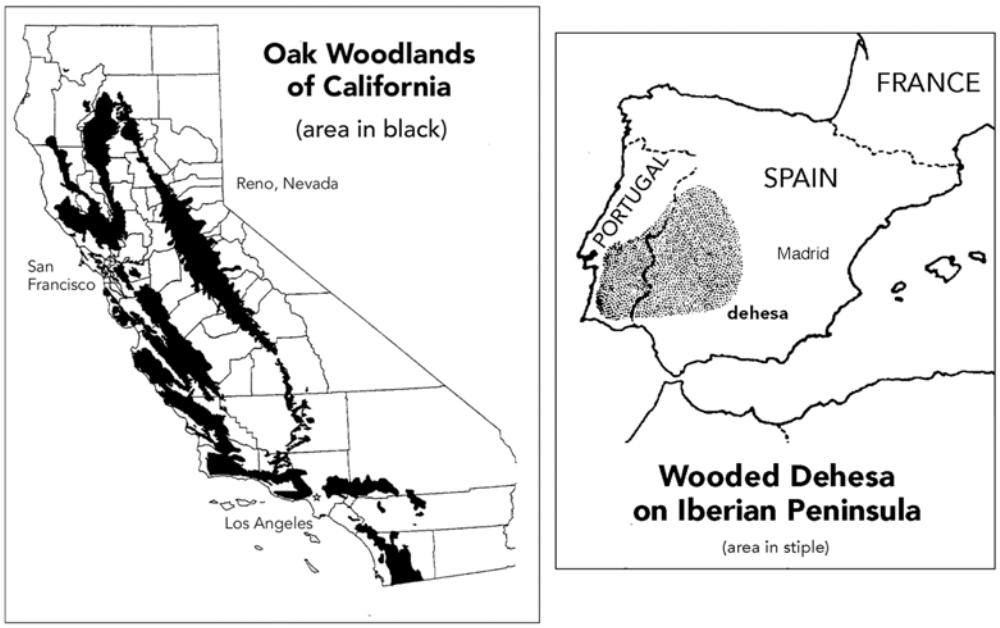

Figure 1—Californian oak woodlands and Spanish dehesa.

Californian oak savanna has four oaks that are considered particularly widespread and characteristic: the deciduous blue (*Q. douglasii*), and valley oaks (*Q. lobata*), and the evergreen coast live (*Q. agrifolia*), and interior live oaks (*Q. wislizenii*). Savanna generally occurs at elevations ranging from 60 to 700 m on a wide variety of soils, and includes communities dominated by each of the four species, as well as mixtures of these species. More than 85 percent of understories are dominated by annual grasses, with the remainder having shrub understories. By far the most common savanna types are those that include blue oak (Allen-Diaz and others 1999). Englemann oak, *Q. engelmannii*, is common in parts of southern California, and Oregon white oak, *Q. garryana*, in the north, but distributions are relatively small.

More than 300 vertebrate species inhabit California's oak woodlands and savannas (Jensen and others 1990), and it is perhaps the most significant wildlife habitat in the state on a regional scale. In Spain, dehesas support a number of Spain's endangered species and Europe's migratory birds (Diaz and others 1999). Dehesas have qualified as habitats to be preserved within the European Union Habitats Directive because of their high biological diversity. Unique breeds of Spanish cattle

are also found only in the dehesa. Public interest in open space, recreation, and purchasing large recreational or "amenity" properties has increased steadily over the last 25 years, adding considerable value to Spanish and Californian oak savanna. In each country, there is widespread concern about the stewardship, regeneration, and extent of oak woodlands. The importance of each as a priority for conservation efforts varies locally and regionally.

Management

Management practices and ecological dynamics characteristic of Spanish and Californian oak savanna differ. A decline in landowner investment in Californian oak woodland may result in gradual or no vegetation change, depending on site characteristics. In Spain, substantial investment is required to prevent rapid change that results in the disappearance of open woodland within twenty years.

Spanish savanna is a human-engineered agroecosystem developed over hundreds of years known as "wooded dehesa." Without management, dehesas become a tangle of brush and oaks. The shrub layer in a dehesa is suppressed to produce a grazable understory. Oaks are spaced as close as 8-10 meters apart in all directions *(fig. 2)*. It has been suggested that at the southern, drier extent of the dehesas, tree spacing is strongly influenced by annual rainfall and fewer than 10 oaks/ha may be found. At the north end, the limit to tree density seems to be maintaining understory productivity (Joffre and others 1999). The ideal is between 30 and 60 oaks per ha, with an average of 45. Commonly, tree canopy cover is 40-60 percent.

Figure 2—Oaks are evenly spaced in southwestern Spain's wooded dehesa.

Trees are pruned to produce acorns and open the canopy. With a 40 percent oak canopy cover, 96 percent of the soil surface is still grass covered (Hernandez 2001). To maintain the open understory, many dehesas must be disked every 3-10 years, otherwise the understory is invaded by unpalatable shrubs, such as rockrose species (*Cystis* spp.), referred to as "jara." The dehesa is typically grazed to a golf course-like appearance by late summer. Paleoecological study suggests origins for the modern oak dehesa as early as around 500 B.C., and an earlier prehistoric dehesa with origins as far back as 4000 B.C. (Joffre and others 1999).

In California, savanna oaks are bunched in the swales, or rocky areas, or are irregularly scattered. Controls are seed and seedling predation, shade, drought, fire, and microclimate. Over much of its extent, the savanna is stable for decades, with irregular, limited regeneration and little shrub invasion. Research has shown great variability in overstory effects, both within and between years. In higher rainfall areas, canopy cover suppresses understory forage production, but in low rainfall areas, may enhance it (Allen-Diaz and others 1999). Oak woodland landowners with oak canopy covers of less than 50 percent were significantly less likely to cut oaks to increase forage production in a 1985 statewide survey (Huntsinger and others 1997). The widely recommended grazing management practice in California is to leave several hundred kilograms per ha of ungrazed grass behind at the end of the season.

The savannas in each realm are mainly used for dryland grazing *(table 1)*. Livestock producers own 56 percent of Californian oak woodlands, but livestock graze more than 70 percent (Huntsinger and others 1997), using land in public, utility, speculative, or amenity ownership. In a recent study of ranchers in the fast growing Central Sierra, almost all the ranchers studied leased land to augment private holdings (Sulak and Huntsinger 2002). The California ewe herd has decreased from 620,000 to 330,000 head in the last 10 years, while beef cows declined from 955,000 to 800,000 (California Agricultural Statistics 1990-2001). Calves are the major source of income, trailed by firewood, game, and lamb.

Wooded dehesas are most common in the regions of Extremadura, western Andalucia, and Castilla y Leon. Each type of dehesa, comprised of one or more oak species, has peculiarities of management and use. The traditional, diversified dehesa system is capable of producing a sizable assortment of commercial products *(table 1)*. It is not unusual to see cattle, horses, goats, and sheep grazing together or sequentially on the dehesa. In the fall months, pigs are grazed in many woodlands, producing a particularly costly acorn-fed ham known as jamon serrano (Parsons 1962). Income from the renting out of land for organized hunts is also common, for which there is new-found ardor in the post-Franco era as a kind of conspicuous consumption.

Transhumance, a summer migration to higher-elevation range, was once common practice in California and Spain, but has declined as stock migration routes are closed off by development and land use change, and higher elevation lands are set aside as parks and preserves. The shift to cattle, and the failure to take them elsewhere in the summer, has changed grazing patterns.

Regeneration of oaks is of concern in both Spain and California. Recruitment has been characterized as sparse to absent in California's coast live oak, blue oak, and valley oak woodlands and savanna (Bolsinger 1988), but there is considerable site to site and study to study variation (McCreary 2001). There is growing concern that for a number of reasons, including changes in grazing, fire frequencies, grassland

species, shrub distribution, hydrology, and wildlife population dynamics, the natural regeneration that once sustained the woodlands is inadequate.

Table 1—*Spanish wooded dehesa and Californian savanna.*

	Californian savanna	**Spanish wooded dehesa**
Extent	3.8 m ha savanna out of 7.4 m ha total oak woodlands and grasslands (Allen-Diaz and others 2000).	2.2 oak woodland dehesa out of 6 m ha dehesa woodlands, shrublands, and grasslands (Díaz, Campos-Palacín, and Pullido 1997).
Most common oak	Blue oak (*Q. douglasii*)	Holm oak (*Q. ilex*)
Ownership	80 pct + private (Ewing and others 1988) 56 pct owned by livestock producers (Huntsinger and others 1996), much is leased (Sulak and Huntsinger 2002).	75-80 pct+ private based on study of a representative area in Extremadura (Campos-Palacín 1996) 100 pct are livestock producers.
Average ranch size	800-960 ha (Huntsinger, Buttolph, and Hopkinson 1997; Sulak and Huntsinger 2002).	670 ha (Campos-Palacín 1996)
Amenity & investment ownership	Increasing owner self-consumption of environmental services	Increasing owner self-consumption of environmental services
Land use	70 pct of woodlands are grazed (Huntsinger, Buttolph, and Hopkinson 1997).	Agro-sylvo-pastoral complex, "Dehesa"
Stocking rate of livestock (does not include wild herbivores, nor does it meet total animal demand)	5-10 ha/A.U./year (Ewing and others 1988).	4 ha/A.U./year in Extremadura (Campos-Palacín 1997)
Small stock	Declining	Declining
Large stock	Declining; 92 pct of animal demand is cattle (California Agricultural Statistics 1990-2001)	Increasing; 42 pct of animal demand is cattle (Campos-Palacín 1997).
Commodity products in use	Beef, lamb, wool, firewood, game, grazing resources.	Beef, Iberian pig, lamb, acorns, firewood, hay, cereal grain, grazing resources, wool, cabrito, goat milk, game, trufa, charcoal, cheese, fodder, honey, cork.

Spanish researchers have found that without direct efforts at oak regeneration, predictive models based on assessment of existing stand structures indicate that nearly eighty percent of the dehesa will eventually become treeless (Martin 2001). This is generally attributed to changes in grazing patterns and high stocking rates, coupled with a lack of landowner attention to regeneration.

In the last 3 years, concern has grown about oak mortality in California from a phytophthora fungus known as "sudden oak death" syndrome. A reduction of tree densities due to the death of Spanish holm and cork oaks from a similar ailment, referred to as "seca," has also been noted. Seca is not fully understood, but has been attributed to incorrect pruning, old age, plowing too close to trees and other factors related to soils and site characteristics (Diaz and others 1997).

Declining Woodland Extent

At the close of the 1950s rural Spain was in financial crisis. Prices for dehesa goods like ham and charcoal fell, pig diseases increased, much of the rural population emigrated to urban areas, and changes in cropping practices led to the collapse of the existing transhumance. The Spanish government tried to increase the value of rural production by subsidizing a shift to improved cattle cross-bred with foreign breeds, and to cereal production. The newer livestock breeds required more feed, raising demand for pasture and crop fodder. Increased dependency on concentrate and outside forage resulted in artificially high stocking rates that halted oak recruitment in many areas. The quality of grazing land decreased, trees and regeneration were neglected, and shrubs were allowed to invade from the surrounding brushlands or matorrales. Government-sponsored afforestation plantings with eucalyptus and pines covered vast acreages, many of which have deteriorated since from pathogens, wildfire, and arson. Subsidies were provided for pulling up holm oak, cork oak, and wild olive until the early 1970s. Changes in ownership laws and high prices for game hunting caused many farms to convert to hunting enterprises. Game fences are put up and the shrub layer is allowed to return. Encouraging intensification of agriculture was justified by high crop prices, including a protected cereal market, minimum levels of public recreation at the time, and inattention to the long term depletion of natural capital in trees and soil. A resulting decrease in the dehesa area has been noted by researchers (Diaz and others 1997). Fortunately this push has been countered in recent years.

Livestock grazing in California's oak woodlands began along the coast in 1769, becoming widespread with the 1849 gold rush. Agricultural conversion, firewood harvest, and development for housing have reduced the extent of the oak woodlands by about half since the 1800s (Burcham 1957). In recent years, conversion of woodlands to housing and vineyards has been increasing at an exponential rate (Huntsinger and Hopkinson 1996). In the 1940s through 1960s, state and federal programs subsidized the removal of oaks for increased forage production, in an era characterized by the drive to increase commodity production and inattention to the environmental costs.

Valuing Oak Woodlands

There is increasing recognition of the value of oak woodlands in Spain and California. Numerous studies of the likely behavior of landowners with regard to land conversion, tree harvest, and wildlife habitat retention have been conducted. Conclusions have often poorly incorporated the economic values of the full range of environmental products and services supplied by these areas to the public, and to the landowners themselves. To compare the value of investment in oak savanna and traditional modes of production with alternative investments, it is important to

understand all the components of that value to society. Here we review several investigations into oak woodland values, on and off-site, and to the public and the landowner.

Value of Commercial Production from Woodlands and Dehesa

The contributions of the three major commercial enterprises to the total net present value of California oak woodlands varies with the quality of the rangeland base *(fig. 3)* (Standiford and Howitt 1993), reflecting the focus on returns from beef. The contribution of various enterprises to the net operating margin in the Spanish dehesa for four case studies carried out in holm oak and holm and cork oak woodlands in the Monfrague Shire varies with site quality and the composition of the woodland (Campos-Palacín and others 2001), stemming from the complex relationship between tree composition, soils, and the diversity of income streams possible in the dehesa *(fig. 4)*.

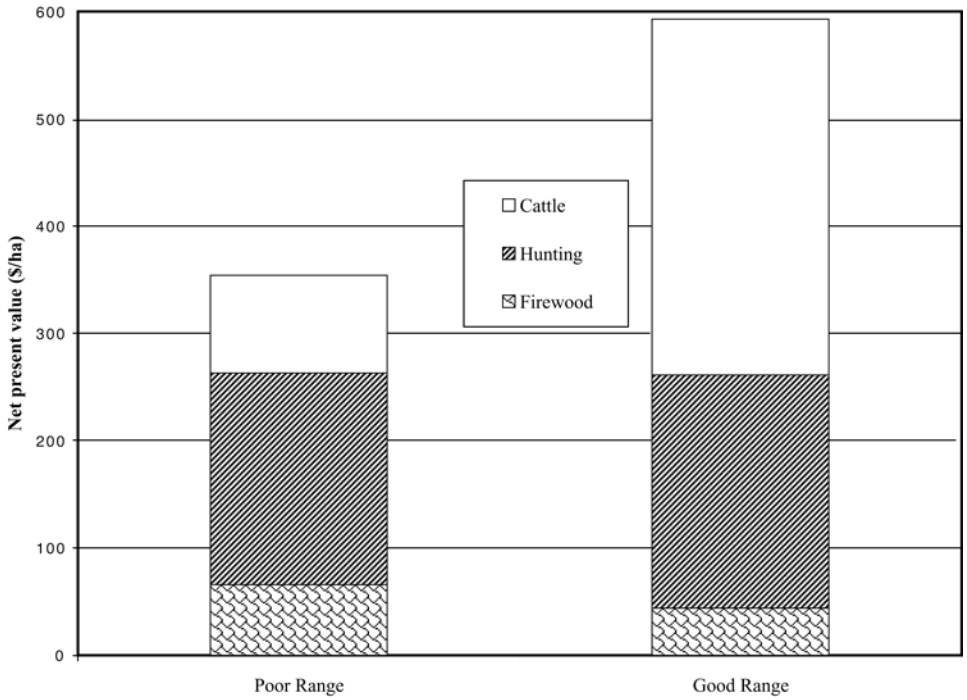

Figure 3—Net present value of Californian oak woodlands from various commercial enterprises, 1992 (Standiford and Howitt 1993).

In general, ranching with typical cow-calf enterprises has a positive economic value in California. In the Spanish dehesa, the margin for livestock from the case studies was negative, but grazing services (leased land) was positive. The negative economic value of livestock was compensated for by the European Union Common Agricultural Policy (CAP) subsidy for livestock production. In both countries, there is some indication that livestock producer goals and oak woodland management are becoming decoupled in some areas, as oak woodland and dehesa properties are purchased by new kinds of owners. There is increasing ownership by wealthier

individuals with other sources of most of their household income. In California where speculative opportunities exist, purchase by developers and land speculators is common. However, tax breaks for keeping land in agricultural production mean these lands are often grazed.

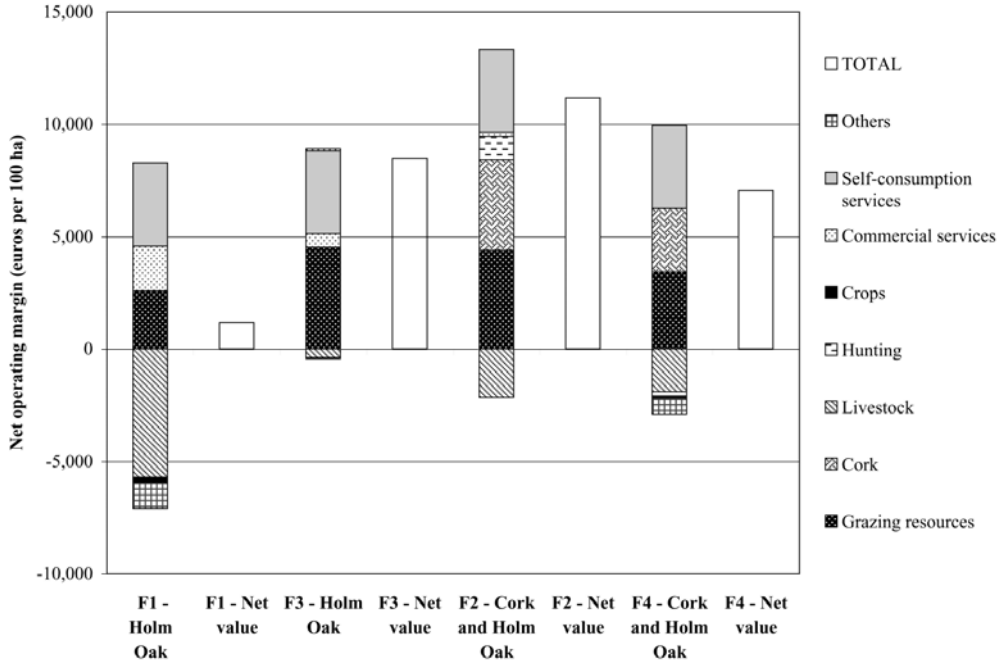

Figure 4—Net margin of various production values for four dehesa case studies in Monfrague Shire.

California studies of the value of hunting shows it has the potential to be an important enterprise for owners with fee hunting operations, ranging from 40 percent (on good range sites) to 70 percent (on poor range sites) of the total commercial value of the woodland. In Spain, for the four ranches interviewed, hunting was a significant economic enterprise for one. The economic contribution of wood harvesting is low when compared with cattle or hunting enterprises in California. A similar trend is observed in Spain on holm oak properties. However, when cork oaks are present, the value from the harvest of cork represents a significant contribution to value.

Conservation Values

One method for conserving oak woodlands is though land trust purchase of "development rights" from landowners, removing from the title the right of the landowner to develop or convert the property. Instead, the NGO-land trust holds this part of the title. The contribution of oak woodland open space from one such land trust area in southern California to community land and home value was evaluated using hedonic pricing. A decrease of 10 percent in the distance to the nearest oak stands and to the edge of the permanent open space land resulted in an increase of $4 million in total home value, and an increase of $16 million in total community land value (Standiford and Scott 2001), demonstrating the significant off-site benefits of open space areas and native oak woodland stands.

A study of public demand for environmental values in Monfrague National Park's oak dehesa ecosystems demonstrated their value to the Spanish public (Campos-Palacín 1996). The demand curve developed showed that the value of recreation and conservation services to dehesa visitors was high, and inversely related to an individual's frequency of visits.

Self-Consumption of Environmental Values

Important components of the full value of savanna ecosystems are the environmental and other benefits consumed by the landowner. Livestock producers in Spain and California place high value on their "way of life." California studies have shown that despite minimal profits or even losses when opportunity costs are considered, ranchers persist for the less tangible returns of ownership (Hargrave 1993 Huntsinger and others 1997, Sulak and Huntsinger 2002). And of course there are increasingly owners whose interests in owning the woodland are not at all related to the profitability of a livestock enterprise.

In Spain, recent studies have considered how a landowner's self-consumption of environmental services is incorporated into their private capital income. The concept of rancher self-consumption appeared in the scientific literature more than 25 years ago (Smith and Martin 1972, Torell and others 2001). Application of the concept to forest landowners has just recently emerged (Crabtree and Appleton 1992, Samuel and Thomas 1999). In Spain, self-consumption of environmental services has been quantified for the dehesa of Monfrague Shire (Mariscal and Campos-Palacín 2000). The results of detailed questionnaires of Monfrague landowners about management practices reveal that they are willing to lose a significant amount before selling their dehesa land, and that the smaller the property, the greater the proportion of the value they get from the property is self-consumed. They prefer to assure current and future self-consumption of recreational and environmental services from their dehesa.

This same phenomena was addressed in California bioeconomic studies by incorporating the concept of hedonic pricing (Standiford and Howitt 1992). A normative dynamic model of the full range of products supplied by oak woodlands (cattle, firewood, hunting), without including this concept of self-consumption, led to the conclusion that existing markets would lead to the clearing of oaks on rangelands. Although this was once quite common in the 1940s to 1970s (Bolsinger 1988), clearing has been rare in recent years. Oak woodland landowners commonly conduct partial harvesting with tree retention. The shortcomings of the normative model were a result of a failure to account for a landowner's utility from maintaining a certain stock of trees for their amenity and other non-market values. A positive mathematic programming (PMP) approach (Howitt 1995) was used to derive missing elements of the true costs of firewood harvest that were omitted from the normative model. This resulted in a firewood revenue model that combined market information with actual landowner behavior. The "cost" of overcutting firewood, or the self-consumption value of retaining trees, was derived. This specification gives a much better representation of expected landowner behavior.

Total Economic Value

It is clear that oak savanna landowners in Spain and California are not acting "rationally" according to normative economic assumptions and models. We would

argue that their behavior is quite rational when all the components of value or "income" are accounted for. This has been addressed in studies of the dehesa by applying the concept of "total economic value." The essential feature of the total economic value model (Bateman 1992, Pearce 1993), proposed as an alternative to financial flow models, is that it extends income measurement to the monetary values associated with scarce environmental services *(table 2)*. The scarcity of these services translates to monetary value for oak woodland visitors and landowners.

Table 2—*Four dehesa case studies in Monfrague Shire: private total sustainable income (annual data from 1997/1998) (euros per 100 hectares).*

	Holm oak dehesa		Mixed holm and cork oaks	
Income source	**Case F1**	**Case F3**	**Case F2**	**Case F4**
Labour (LC)	9,754	8,855	2,669	4,639
Net operating margin (NOM)	1,173	8,481	11,173	7,046
Grazing resources	2,582	4,518	4,386	3,429
Cork			4,031	2,818
Livestock	-5,710	-392	-2,160	-1,912
Hunting			1,042	-188
Crops	-225	-47		-37
Commercial services	1,991	607	181	-47
Self-consumption services	3,696	3,696	3,696	3,696
Others	-1,162	99	-3	-713
Operating subsidies (OST)	24,114	3,367	-296	1,146
Net value added (NVAfc)	35,041	20,703	13,546	12,831
Capital gains (CG)	20,582	19,948	13,351	26,058
Capital income (CI)	45,869	31,796	24,228	34,250
Total sustainable income (TSI)	55,623	40,651	26,897	38,889

In addition to the ecological value of oak woodlands, including wildlife habitat, watershed, and carbon sequestration, and the commercially-marketed outputs from the woodlands, "option value" and "existence value" can also be defined. Option value is the visitor and landowner's willingness to pay to ensure continuous and lasting consumption of current environmental services. Existence value is not linked to active consumption, but to the consumer's perception that by protecting the resource he or she is ensuring conservation of threatened resources. These might include endangered species in Spain and California, and in Spain, autochthonous livestock species.

Results of detailed surveys of four dehesa estates in Monfrague Shire (Campos-Palacín and others 2001) include values for marketed commercial products, as well as self-consumption of environmental services, ecological function, option values such as legacy value, and existence values *(table 2* and *fig. 4)*. California production studies have not quantified the self-consumption of oak woodland environmental values. The positive policy modeling approach described above considers this effect with the hedonic pricing method, but has not quantified this as part of the total economic value of the property. Studies in Spain have shown the significant values of self-consumption. The omission of environmental service income in national assessments of dehesa values is a crucial undervaluation of dehesa contribution to

private and social income levels. Capital gains, also omitted in national accountings, have been the dehesa's most important source of private income returns over the past 25 years. These same techniques of evaluating total economic value will be applied in California oak woodlands in future joint studies. This will help to more accurately portray the true value of oak woodland open space.

Institutional Capacity

In California, most oak woodlands are in private ownerships that evolved from Spanish or Mexican land grants, or the Homestead Act of 1862, or various other nineteenth century land disposal mechanisms. The woodlands are subject to many levels of oversight and regulation. Oak protection, land use, and development ordinances may affect a landowner's management at local and county levels. At the state level, water quality, fire protection, and timber harvest regulations may be a factor. Pro-active, incentive-based programs are rare. One of the few incentive programs is the California Land Conservation Act of 1965, or Williamson Act. This Act provides a property tax break to those who contract with the county not to develop their lands for ten years, and is automatically renewed each year until the landowner withdraws. The state provides funds to counties to reduce the loss in tax revenues. Approximately 70 percent of the oak woodlands of the state are under this type of contract (Huntsinger and others 1997), but it is acknowledged that it is not a long-term policy (McClaran and others 1985). A state sponsored voluntary education program appears to have contributed to a reduced rate of oak cutting over the last ten years, but in general, oak woodland landowners are hostile to government intervention (Huntsinger and others 1997).

Instead, non-governmental organizations are playing a growing role in conservation. The Nature Conservancy, local land trusts such as the Marin Agricultural Land Trust, and other privately-funded groups have brought significant oak woodland properties into land trusts and conservation easements. California has more land in conservation easements, surpassing 40 million ha, than any other state. Four percent of ranchers surveyed in two regions of California reported having some sort of conservation easement on their land (Liffmann and others 2001). There is an increasing recognition that maintaining extensive ranching operations may be cost-effective large-scale landscape conservation. Governmental action affecting oaks directly has mostly been at the municipal level, with ordinances protecting specific kinds or sizes of trees within town limits. Saving and Greenwood (2002) offer insight into the very limited efficacy of these approaches.

In Spain, the extensive transhumance, political and demographic upheavals, and property changes that occurred in the Middle Ages favored creation of large extensive farms under the military, clergy, and nobility (Trujillo and Mata 2001). A complex of land title reforms in the nineteenth century shifted these and many common properties into private hands. A proactive program of dehesa conservation has been developed at the provincial, national, and pan-European levels, commonly providing direct subsidies to agricultural producers. Typically, dehesa landowners get a quarter to a third of their income as a subsidy. In recent years, there has been a shift away from European Union (E.U.), "Common Agricultural Policy" (CAP) subsidies that emphasize intensification of livestock production. There is a deepening interest in the maintenance and viability of what is described as "low intensity agriculture," of which the dehesa landscapes of Spain and Portugal and many of the grazed

landscapes of France, Hungary, and other E.U. states are examples. These "less productive" forms of agriculture are to be supported in an effort to reduce environmental degradation, and to provide employment for remnant local community members in picturesque (and perhaps ecotourism-friendly) modes of production. In the long term, they may result in greater levels of rural self-sufficiency.

In Spain it is widely acknowledged that the dehesa is of cultural as well as environmental import. With so little public land, the need to conserve privately owned landscapes is well-recognized. National Preserves normally encompass active agricultural enterprises. In addition, there is a long tradition of overlapping property rights. Villages often had or have usufructuary rights of various kinds to estate lands; livestock migration trails and some village lands were and are used and/or owned in common, and so forth. There is not the same inclination to assert such individualistic private landownership in Spain. It is not a reach to recognize a public interest, and a responsibility to the public, in private landownership. Some conservation initiatives draw on the Spanish regional pride that is re-asserting itself after Franco era suppression. Beef, ham, and cheeses carry regional government regulated appellations similar to those of U.S. wines. Premium prices can be charged for some products, such as acorn-fed hams, helping dehesa profits.

In California, significant oak woodlands have the potential for conversion to vineyards and other crops (Heaton and Merenlender 2000). Land use planning policies are not coordinated at local, county, regional or state levels, and many hardwood rangeland areas permit subdivision of large parcels into ranchettes of 5 to 40 acres, or large urban developments (Doak 1989). This creates an increasing economic tension for the remaining ranch owners to shift out of ranching. For example, in the central coast, grazing land value may be less than 10 percent of the value of the land for alternative uses with higher environmental costs (Standiford 1999). Previous work has shown that while retained oak trees in rural subdivisions have been shown to contribute up to 27 percent of the value of the property (Diamond and others 1987), they seldom survive the transition in land use. Since this tree value is typically not realized until the land is sold for development and subdivided, many oaks are lost even though they would have significant long-term value.

In Spain, livestock rearing subsidies still constitute the main source of public funds going to dehesa owners. Animal numbers are at an all-time high, threatening oak regeneration. Yet today there are aggressive and comprehensive strategies to minimize land use conversion in the dehesa. The European Commission, the Spanish government, and even regional authorities, can intervene in dehesa land use. In 1985, the European Economic Community (EEC) integrated nature conservation measures in CAP reform for the first time. The new CAP is aimed towards land uses compatible with nature and cultural heritage conservation. Trading rules for certain strategic rural goods can be specified under the new CAP. Subsidies for production technologies compatible with the protection of the bio-physical environment, natural area conservation, and reforestation of agricultural land with oaks are also clear examples of the new kinds of EU interventions. EU subsidies cover plantation costs, maintenance costs through the first 5 years, and provide a premium to cover the loss of income resulting from reforestation. By December of 1998, more than half a million hectares were artificially reforested in Spain. A stunning 53,563 ha were reforested with holm oak, 21,353 ha with cork oak, 42,391 ha with mixed plantations of cork oak and holm oak, and another 108,681 ha with these two species mixed with

other tree species. Additionally, 82,405 ha of mature cork oaks have also been improved under these programs.[6]

Future Work

Oak savanna conservation has three facets: extent, regeneration, and stewardship. The needs in each area vary in priority and importance at local, regional, and national scales. In Spain, the focus of effort is shifting to the gradual attrition of the trees at least partly due to changes in management starting in the 1960s, as government intervention has stabilized woodland extent. The E.U.'s forthcoming regulatory Natura 2000 network will soon replace or complement regional and national authority in environmental policymaking. It remains unknown how successful regeneration was under traditional management, so restoration of traditional practice may not be sufficient. In California, a lack of coordination in planning at local, regional, and state scales has resulted in haphazard and increasing conversion of oak woodlands for housing and vineyards. Changes in the oak woodlands since the mid-nineteenth century are believed to be contributing to a lack of oak regeneration in many areas.

Oak woodlands in both California and Spain have been undervalued by traditional agricultural production models. New approaches to evaluating the self-consumption of environmental services, and the quantification of the real utility of amenity values offer promising approaches to better represent their value to landowners. A positive mathematical programming approach using optimal control policy runs is being initiated in Spain. Detailed questionnaires and case studies of will be carried out in California to quantify self-consumption of environmental resources.

California studies of oak woodland open space shows their effect on overall community values. This provides information on the supply side of open space. Studies in Spain on public demand curves for recreation and conservation values shows the demand side for oak open space values. Future work will apply demand and supply studies in both countries.

Given differences in ecological dynamics and public policy, how can the full range of oak woodland values be analyzed and represented in ways that will stimulate their conservation? The concept of "total economic value" in Spain has contributed to a fuller appreciation of low value agriculture in the public policy arena. In California, it is less certain where a full accounting of value will find channels for application. Collaboration between Spain and California offers an opportunity to contrast the effectiveness of public subsidy approaches widely used in Europe to private investments through land trusts and other means. Trends in investment in conservation and their effect on land use patterns, economic functioning, and the ecological structure and function of oak savanna will be compared.

[6] Unpublished data on file, Spanish Ministry of Agriculture, Fish, and Food.

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