

Hardwood Rangeland Landowners in California from 1985 to 2004: Production, Ecosystem Services, and Permanence

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Abstract

A longitudinal study of California hardwood rangelands shows significant change in landowner characteristics and goals. Results of three studies spanning 1985 to 2004 were used to develop and evaluate a multiagency research and extension program known as the Integrated Hardwood Range Management Program. Program-sponsored education and research aimed at encouraging landowners to change woodland management has been reflected in a significant reduction in oak cutting and an increase in oak planting. Recent changes have come with the times: landowners were as likely to have consulted land trusts about oaks as Cooperative Extension, and the number engaged in production of crops or livestock continued to decline. On the other hand, the proportion of landowners, including ranchers, reporting that they live in the oak woodland to benefit from ecosystem services such as natural beauty, recreation, and lifestyle benefits significantly increased. Though owners of large properties and ranchers were more strongly against regulation and “government interference” than other respondents, this did not appear to affect oak values and management. Property size remained significantly related to landowner goals, values, and practices, with those producing livestock owning most of the larger properties. There has been a decline in the number of properties being studied due to conversion of some from oak woodland to other uses, though the remaining respondents still own at least 10% of the woodlands. Landowners with conservation easements or those who are willing to consider them, who believe oak recruitment is inadequate, or who use advisory services were significantly less likely to cut oaks and more likely to plant them. Policy, management, and outreach that support synergies between production and conservation activities, and that combine ecosystem service-based income streams that encourage keeping land intact and increased land-use stability, are needed to support conservation of private rangelands.

Resumen

Un estudio longitudinal en California de pastizales asociados con bosques dotados de especies de madera dura indica un cambio significativo en las características y metas de los propietarios de la tierra. Los resultados de los tres estudios que abarcan los años 1985 a 2004 se utilizaron para desarrollar un programa interinstitucional conocido como el Programa de Manejo Integral de los Pastizales asociados a Bosques de Especies de Madera Dura. Este proyecto implementó programas de investigación y extensión con el objetivo de promover cambios en el la gestión del monte que reflejan en una disminución significativa en la tala de *Quercus*, y un alzo en la superficie plantado a especies quercineas. Otros cambios son el reflejo de los tiempos actuales: la probabilidad de que los propietarios realizaran consultas sobre la gestión del monte a fundaciones para la conservación de la tierra o al servicio de Extensión Cooperativa fue similar, mientras que la proporción de propietarios involucrados en la producción de cultivos o ganado continúa declinando. Por otra parte, se aumenta el porcentaje de propietarios, incluyendo productores, que viven en áreas de monte quercinea para beneficiarse de servicios ambientales como la belleza natural, la recreación, y los beneficios del estilo de vida. Aunque los dueños de propiedades más grandes y los productores en general muestran una oposición más enérgica a la regulación y la “interferencia por parte del gobierno,” aparentemente esta actitud no estuvo asociada con los valores de conservación y gestión del monte. El tamaño de las propiedades continuó estando significativamente asociada con las metas, valores, y prácticas realizadas por los propietarios; quienes producían ganado poseían las propiedades más grandes. Ha habido una reducción en el número de la muestra de propiedades por la conversión del quercineas a otros usos, si bien los respondientes que permanecieron en el estudio poseen al menos un 10% del área de monte. Proprietarios que poseían comodatos de conservación de la tierra, o que estaban dispuestos a considerar dichos comodatos, o quienes pensaban que el reclutamiento de robles es inadecuado, eran significativamente menos proclives a talar quercineas y más proclives a plantar quercineas. Es deseable sotener una política, gestión, e consultas con expertos que enlacen conservación y provalucción, crear un sistema que favorece pago a propietarios para servicios ambientales, ye mantner intacto sus propiedades y no vender sus terrenos.

Key Words: attitudes, conservation easements, impermanence syndrome, land use, management, *Quercus*

Research was funded by the Integrated Hardwood Range Management Program of the University of California, the California Agricultural Experiment Station, and the California Division of Agriculture and Natural Resources CORE grant program.

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Manuscript received 18 July 2008; manuscript accepted 11 January 2010.

INTRODUCTION

Development of programs for influencing management of private rangelands should be based on a strong understanding of landowner goals, needs, and circumstances (Coppock and Birkenfeld 1999). A survey approach is often chosen for such an assessment, and for understanding the factors that influence manager decisions. Previous rangeland survey research has linked management practices and goals to aspects of property or operation size (Huntsinger and Fortmann 1990; Rowe et al. 2001; Kreuter et al. 2004); land tenure (Fortmann and Huntsinger 1989; Rowe et al. 2001; Sulak et al. 2008); length of ownership (Gosnell et al. 2007); attitudes toward government, regulation, and property rights (Liffmann et al. 2000; Jackson-Smith et al. 2005; Kreuter et al. 2006; Conley et al. 2007); surrounding levels of urbanization (Liffmann et al. 2000; Sulak and Huntsinger 2002; Huntsinger et al. 2004; Yung and Belsky 2007; Sulak et al. 2008); incentives programs (Huntsinger et al. 2004; Larson et al. 2005); education (Richards and George 1996; Coppock and Birkenfeld 1999); income (Coppock and Birkenfeld 1999); income source (Kreuter et al. 2004); and region (Rowan and White 1994). Several studies have developed typologies of rangeland landowner characteristics and behaviors (Gentner and Tanaka 2002; Brodt et al. 2004; Gosnell and Travis 2005). Though important to understanding rangeland management, none of these surveys followed management over time, something that is needed to assess trends.

In the natural resource sciences, longitudinal surveys of landowners are rare. Research sponsored by California's multiagency Integrated Hardwood Range Management Program (IHRMP) provides an opportunity to follow management over time. When the program began in 1985, a property-based survey of hardwood rangeland (also referred to as oak woodland or foothill woodland) landowners was conducted in order to develop extension programs and research targets. The objective was to identify the goals and practices of hardwood rangeland landowners and to examine relationships between landowner characteristics, values, and management. The survey was repeated when funding and personnel were available, in 1992 and 2004, with the objectives of identifying changes in landowner characteristics, practices, land uses, and attitudes over time in order to update education and research activities, and to provide information for legislators considering regulation of oak harvest. Results of the 1985 survey were published in 1990 (Huntsinger and Fortmann 1990) and compared landowners with properties of less than 80 ha, between 80 ha and 2 008 ha, and more than 2 008 ha. A comparison of the 1985 and 1992 surveys was published in 1997 (Huntsinger et al. 1997). Here we compare the results of the third survey to those from the earlier surveys, covering a period of almost 20 yr.

Most oak woodlands are privately owned. Development and overharvest, coupled with inherently variable and often low levels of oak recruitment, put them at risk. As coordinated among the University of California Cooperative Extension, CalFire, and other agencies, IHRMP goals at the outset included reducing the loss of oaks in the state and researching ways to encourage oak-positive management of the woodlands by landowners. Areas of inquiry in the survey include

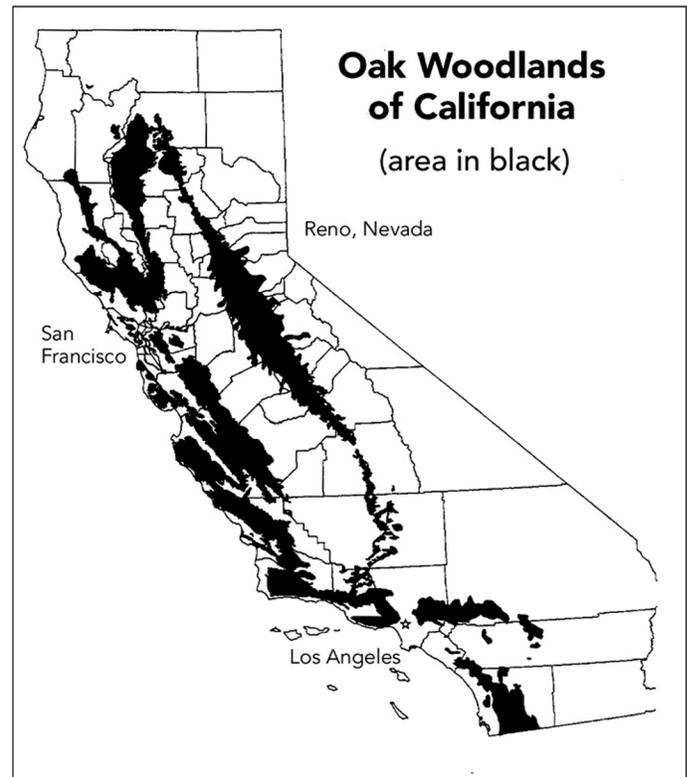


Figure 1. Distribution of hardwood rangelands in California (Allen-Diaz et al. 2007).

landowner demographics, how and why landowners are managing their oaks, what they use and value oaks for, their motives for living in the oak woodlands, their receptivity to environmental regulation, where they get management information from, their participation in conservation programs, and whether or not they are involved in production agriculture. Each is important for developing outreach and further research.

California's Hardwood Rangelands

The 2 million ha of California hardwood rangeland (California Department of Forestry and Fire Protection–Fire and Resource Assessment Program [CDF–FRAP] 2003) are characterized by an oak (*Quercus* spp.) overstory and annual grass understory; they occupy coastal and valley foothills throughout most of the state in the Mediterranean climate zone from sea level to about 2 000-m elevation (Fig. 1; Allen-Diaz et al. 2007). Canopy cover varies from complete closure in canyon thickets to open savanna woodlands on foothill slopes (Allen-Diaz et al. 1999, 2007). California's oak woodlands have been recognized worldwide as significant for biodiversity conservation as part of the California floristic province biodiversity hot spot (Myers et al. 2000). More than 80% of the woodlands are in private ownership (CDF–FRAP 2003), and grazing has been the dominant use since European settlement (Burcham 1982). Oak woodland landowners in California are notable for their production of diverse ecosystem services and for the value landowners place on private amenity benefits from woodland ownership (Campos et al. 2009).

The woodlands are also highly desirable for residential development (Huntsinger and Hopkinson 1996). A comparison

of 1982 and 2002 oak woodland data from the State of California shows a decline in woodland extent of almost a third, though changes in methodology and plant community classification make this estimate a rough one (Ewing et al. 1986; CDF-FRAP 2003; Huntsinger et al. 2008). In addition to fragmentation from development, there is concern about a lack of oak recruitment in some areas (Muick and Bartolome 1987). In 1985, the harvest of oaks for fuel and for increased forage production, and the impacts of grazing on oak seedlings were identified as potential contributing factors. Since then, further study has indicated that regeneration and recruitment vary greatly by geographic location and substrate, and are limited or stimulated by a variety of factors not necessarily related to management (Tyler et al. 2006).

Though a variety of other surveys have been conducted in California's hardwood rangelands during the study period (McClaran and Bartolome 1985, Stewart 1991, Johnson 1997, Larson et al. 2005), none have been based on a randomly selected, statewide sample of hardwood rangeland ownerships. However, they have generally supported the results of the 1985 and 1992 surveys (Huntsinger et al. 1997), showing that the majority of landowners value at least some oaks on their property for a variety of reasons and are most often actively managing them. Field-based inventory and monitoring projects examining land use and oak management practices have also helped verify the results of the 1985 and 1992 surveys (Huntsinger et al. 1997), finding, for example, that about two-thirds of hardwood rangelands are grazed by livestock and that conversion and fragmentation are serious problems (Bolsinger 1988; Ewing et al. 1988; Holzman 1993; Swiecki et al. 1997).

METHODS

Survey Design

Sampling and methodology is consistent for all three surveys, but in 2004 questions were added about conservation easements and land trusts because of their high visibility in oak woodland conservation. Surveys were pretested, and then owners of hardwood rangeland throughout the state were surveyed by mail, using the standard four-wave technique described by Dillman (1978) to achieve a high response rate. The greater the response rate, the less "self-selection" bias influences responses and hence the more representative the sample (Clendenning et al. 2004).

Questionnaires were sent to owners of land containing the Forest Inventory Assessment plots previously used to assess hardwood volume in California (Bolsinger 1988). Plots were established at the intersection points of a randomly established 11-km² grid overlaid on the state. Plots designated as the nonindustrial forest "hardwood woodland type" by the Pacific Northwest Field Experiment Station (US Department of Agriculture, Forest Service 1981) were selected if an overstory of 10% or greater canopy cover was predominately *Quercus* species and the plot was on private land. Selected plots occurred in 38 of the state's 58 counties, at elevations ranging from 80 m to 1 800 m.

Usable questionnaires were returned by 126 of 166 eligible respondents for a response rate of 76% in 1985; 121 of 151 eligible respondents for a response rate of 80% in 1992; and 98

of 154 eligible respondents in 2004 for a response rate of 64%. Despite losses from the sample population due to subdivision of properties that made locating new owners often impossible, an estimated 10% or more of California's hardwood rangelands were owned by the respondents at each date. The 2004 respondents include those who purchased, inherited, or took over management of a family property since 1985, and some who did not respond to previous surveys, as well as those maintaining ownership of the property since 1985.

The grid method used to establish forest inventory plots means that larger properties have a greater probability of being selected (Wensel 1983). Although this resulted in good representation of landowners of each property size, responses about land use practices cannot be directly extrapolated to the hardwood rangeland as a whole. Analysis using a sample weighted inversely to property size (if property size \leq grid size, weight = grid size/property size; if property size $>$ grid size, weight = 1) can be used to extrapolate to a spatial proportion of the oak woodland meeting our selection criteria (Wensel 1983). Another consideration is that although a landowner may report "cutting oaks," we do not know how many oaks or hectares the landowner cut.

The χ^2 statistic was used to determine significance for categorical variables, whereas Student's *t* test was used to compare continuous variables such as age or property size (Spicer 1972). Unless otherwise stated, statistical comparisons were between 1985 and 2004 responses to survey questions, using the χ^2 statistic. With our small sample size, the low cost of a type I error in this case, and our desire to identify variables for further study, we chose to prioritize avoiding type II error and used the $P < 0.1$ level for interpreting results as significant (Kreuter et al. 2006; Labovitz 2006). However, we have presented all *P* values smaller than 0.2 so that the reader may prioritize avoiding error as desired. Small sample size precluded multivariate analysis. Questions are condensed in the tables presenting results.

RESULTS

Owner Characteristics and Rangeland Use

There has been no significant change in landowner demographics, but significantly fewer owners are earning their income from ranching, and more are relying on "other sources" of income, such as investments, pensions, and self-employment (Table 1). In 2004, respondents owned a total of 272 000 ha. Using the weighted sample, an estimated 20% of the woodlands belong to absentee owners, and 17% belong to landowners with a paid property manager.

There have been significant changes in land use since 1985. The number of owners selling livestock, and with livestock grazing on their property, declined (Table 2). Yet more than 80% of properties larger than 80 ha are grazed by livestock, a proportion that has not significantly changed since 1985. In 1985, 78% of landowners with livestock grazing on their property sold livestock, compared to 62% in 2004 ($P < 0.04$, $df = 2$), indicating increased grazing by lease. Using the weighted sample, an estimated 10% of grazed woodlands are owned by those who do not produce or sell livestock (Table 2). Though this was not asked about on previous survey dates, in

Table 1. The percentage of California hardwood rangeland landowners with the following characteristics in 1985, 1992, and 2004.

Landowner characteristics	Landowners (%)			$P(\chi^2)$, df = 1, 1985 vs. 2004
	1985 (n = 126) ¹	1992 (n = 115) ¹	2004 (n = 98) ¹	
College graduate	50	54	60	ns ²
Mean age	58	58	61	ns ³
Mean length of ownership of land	35	44	39	
Major source of income				ns ³
Ranching	27	20	14	0.02
Other self employed	31	29	24	ns
Wage employment	27	29	31	ns
Other	15	20	32	0.00
Absentee owner	25	26	22	ns
Have a paid manager	22	16	10	0.02
Female	18	24	20	ns

¹n varies slightly with each question.

²ns indicates not significant.

³P > 0.1, Student's *t* test.

2004 10% of respondents grazed stocker cattle only, another 18% grazed stockers with a cow-calf herd, and 32% of respondents grazed a cow-calf herd only. Approximately 4% grazed sheep, 4% grazed llamas, and 3% grazed goats.

Selling fuelwood declined significantly, and fee hunting and fishing remains small and without detectible trend (Table 2). The proportion of owners with their land enrolled under the California Land Conservation Act of 1965 (CLCA) or in a Timber Production Zone, two voluntary conservation programs that limit land development for 10 yr in exchange for tax relief, has remained steady. Three landowners in our sample had worked with Cooperative Extension to create a rangeland water quality management plan for their properties as part of voluntary compliance with the state's Clean Water Act (Larson et al. 2005), and one landowner reported participating in the California Department of Fish and Game's Ranching for

Wildlife program (AB 580), which provides benefits to landowners who improve habitat. All three owned more than 2 008 ha.

Goals and Motivations of Landowners

The motives landowners gave for choosing to live in the oak woodland changed dramatically and significantly from those given in 1985, with amenities such as recreation, natural beauty, getting away from the city, and having a different lifestyle becoming significantly more important (Table 3). Considering livestock sellers or ranchers only, the trends are the same, with amenities much more important in 2004. At all three survey dates, more than 60% of ranchers reported a family business or property as an important reason to live in the oak woodlands, but in 2004, 86% of ranchers reported that the natural beauty of the oak woodlands was important, compared to 59% in 1985 ($P < 0.08$, $df = 4$). Though it was only asked about in 2004, 59% of ranchers stated that hunting and fishing influenced their choice, and 82% said that opportunities to view wildlife influenced them.

Unlike other responses analyzed in this survey, significant changes in motives for living in the oak woodland were reported by landowners in the three property sizes between 1985 and 2004 (Fig. 2). In 1985, owners of < 80 ha were highly influenced by the amenities of owning oak woodlands, including lifestyle, getting away from the city, natural beauty, and recreational opportunities (Huntsinger and Fortmann 1990), whereas owners of more than 2 008 ha were significantly less likely to report these as important influences. In 2004, however, owners of more than 2 008 ha much more frequently reported being motivated by such amenities, with 30% saying "having a different lifestyle" was an important influence in 1985, and 76% saying it was in 2004 (Fig. 2; $P < 0.027$, $df = 4$). Summing the four amenity variables above (notated in Table 2) into an "amenity" score (Table 3) with a higher total indicating more amenity values, the score for properties of less than 80 ha has not changed significantly over time, with a mean of 15.3 in 1985, and 16.6 in 2004. On the other hand, for landowners with more than 2 008 ha the score increased significantly from a mean of 9.1 in

Table 2. The percentage of California hardwood rangeland landowners engaged in each land use in 1985, 1992, and 2004.

Land use	Landowners (%)			$P(\chi^2)$, df = 1, 1985 vs. 2004	Estimated % ha 2004 ²
	1985 (n = 126) ¹	1992 (n = 115) ¹	2004 (n = 98) ¹		
Cattle/sheep graze property	73	63	62	0.09	66
Produces livestock	65	58	52	0.04	56
Sells livestock	61	55	41	0.00	42
Sells fuelwood	20	11	9	0.03	9
Sells any products from land	68	63	47	0.00	48
Produces food crops	20	18	21	ns ³	28
Sells fee hunting or fishing	11	9	8	ns	9
Uses as vacation home	15	23	20	ns	18
Land registered in California Land Conservation Act	51	45	46		50
Land in Timber Production Zone	9	16	14	ns	16

¹n varies slightly with each question.

²Estimate of percentage oak woodland owned by landowners engaging in each activity, calculated using the weighted sample (if property size \geq grid size, weight = 1; if property size < grid size, weight = grid size/property size).

³ns indicates not significant.

Table 3. The percentage of California hardwood rangeland landowners who agreed that the following factors strongly influenced their decision to live in hardwood rangelands in 1985, 1992, and 2004.

Factors	Landowners (%)			$P(\chi^2)$, df = 2, 1985 vs. 2004
	1985 (n = 126) ¹	1992 (n = 115) ¹	2004 (n = 98) ¹	
I wanted to live near natural beauty	46	60	71	0.00
Job opportunities	21	19	10	0.09
To get away from city life	39	41	54	0.09
So I could have a different lifestyle	29	35	48	0.00
Recreational opportunities	31	30	43	0.03
It is cheaper to live here	9	12	10	ns ²
Family business or property	55	57	48	ns
Hunting and fishing—2004 only	—	—	21	na ²
View wildlife—2004 only	—	—	45	na ²

¹n varies slightly by question.

²ns indicates not significant; na, not applicable.

1985 to 12.9 in 2004 ($P < 0.07$, t test), though the difference in amenity scores of landowners with less than 80 ha and more than 2 008 ha remained significant in 2004 (mean = 12.9 vs. 16.6; $P < 0.08$, t test).

Memberships and Sources of Information

Changes in memberships reflect the trends away from production land use, and trends in consultation reveal the importance of land trusts (Table 4). Landowners were asked if they had consulted with an advisory service during the “last

two years,” and more than a third had done so. Cooperative Extension, the Natural Resources Conservation Service, and land trusts were most commonly used.

Attitudes Toward Government and Regulation

The generally negative attitude of oak woodland landowners toward government regulation and control observed in 1985 continued to be observed in 2004 (Table 5). About half of all landowners continue to agree that regulation with compensation is acceptable, though few believe that citizens are adequately consulted. One significant trend is that landowners are less likely to believe that landowners should be able to use the natural resources on their property without state permission. Based on a scale developed from the variables notated in Table 5, excluding oak-related variables, with a higher total indicating greater opposition to regulation, landowners in the largest size category (mean = 17.7 vs. 14.2; $P < 0.01$, t test), and ranchers (mean = 18.2 vs. 14.8; $P < 0.01$, t test), were more likely than other respondents to be opposed to a strong government regulatory role in natural resources management. On the other hand, opposition to regulation did not relate to landowner oak management practices, values for oaks, motivations for living in the woodlands, age, or land tenure. Owners of properties greater than 2 008 ha were significantly more likely to agree that oak are being lost in 2004 (56%) than in 1985 (21%; $P < 0.03$, $df = 1$).

Landowner Management Practices and Values for Oaks

Landowners were asked if they had carried out specific practices during the previous 5 yr, and about their values for oaks. In 2004 they reported more reasons to value and plant oaks, and less oak cutting than in previous surveys (Table 6). In 1985, owners of properties greater than 2 008 ha were more likely to cut oaks than those with properties of less than 80 ha ($P < 0.05$, $df = 1$), but there was no significant difference by property size category in 2004 (Table 6), with a lower proportion of all owners cutting oaks.

In 2004, cutting living oaks was related to perceptions of oak replacement, oak canopy cover, the overall status of oaks, and the value of oaks for beauty, soil holding, and water conservation (Table 7). About 56% of owners said there were enough “young oaks coming up to replace the old oaks,” 25% of owners reported that young oaks were insufficient to replace the old oaks, and 18% reported that they did not know. Planting oaks is related to making use of advisory services, perceptions of oak replacement, residence on property, and valuing oaks for habitat, natural beauty, browse, and water conservation (Table 7). Property size, income level, ranching, oak canopy cover, receptivity to government intervention, CLCA participation, belief oaks are being lost, cutting oaks, gender, and education level had no relationship to planting oaks, and neither did valuing oaks for shade, property values, water conservation, soil holding, and forage.

Conservation Easements and Land Trusts

In 2004 six landowners, owning together more than 10 000 ha, reported having conservation easements (Table 8). Each easement covered half or more of the property, and four of the six landowners produced livestock. Two easements were

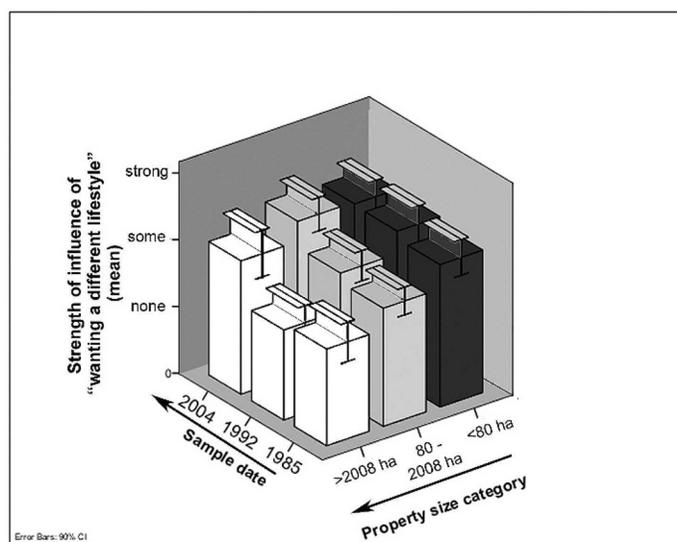


Figure 2. The influence of “having a different lifestyle” on landowner decisions to live in the oak woodlands in 1985, 1992, and 2004 (error bars are the 90% confidence interval of the mean). There was no change in relative values by property size in 1985 and 1992, but in 2004, owners of properties larger than 80 ha were significantly more likely to report being influenced by the desire to have a different lifestyle than they were in 1985 ($P < 0.02$, χ^2 , $df = 2$). Very similar patterns and levels of significance were found for being “influenced by natural beauty.”

Table 4. Percentage of California hardwood rangeland landowners who belonged to, or got advice from, the following organizations in 1985, 1992, and 2004.

	Landowners (%)			$P(\chi^2)$, df = 1, 1985 vs. 2004
	1985 ($n = 126$) ¹	1992 ($n = 115$) ¹	2004 ($n = 98$) ¹	
Landowner memberships and use of advice				
Member of wildlife or environmental group	25	30	31	ns ²
Member of livestock association or farm bureau	58	49	41	0.06
Consulted the following during the 2 yr previous to the survey about oaks				
Private tree consultant	9	12	7	ns
Cooperative Extension	7	15	16	0.05
Department of Fish and Game	7	7	12	ns
Natural Resource Conservation Service	6	6	15	0.02
Any advisory service	24	26	37	0.04
Book—2004 only	—	—	23	na ²
Land Trust—2004 only	—	—	17	na

¹ n varies slightly with each question.

²ns indicates not significant; na, not applicable.

established prior to 1990. One landowner purchased the land with a conservation easement on it. The trust holder for each differed, including three different county land trusts, a local open space district, a state agency, and a statewide land trust. Landowner motives were equally variable, including tax relief for two owners. One landowner said he/she wanted to preserve land for heirs, another wanted to obtain funds to reinvest in the property, and another wanted to leave a legacy. However, the most common response, given by four landowners, was simply to “conserve the land.” Four said that if they “knew then what they know now” they would put an easement on it again, or purchase the land with an easement. The two who would not choose to have an easement if they had it to do over again had

the smallest proportion of their land in easement, and both easements were donated rather than sold.

Although $3\,204\text{ ha} \pm 1\,362\text{ SE}$ ($n = 85$) was the mean property size of respondents who knew what a conservation easement was in 2004, the mean property size of those who did not know about easements was $29\text{ ha} \pm 12\text{ SE}$ ($n = 10$; Table 8). Those who had an easement or would consider acquiring one were significantly more likely to plant oaks and less likely to cut oaks than other property owners (Table 7). Though it was only asked about in 2004, two-thirds of landowners reported that they planned to keep their land intact for the next 10 yr, whereas 11% reported that they planned to sell or give away all or part of their property within

Table 5. The percentage of California hardwood rangeland landowners with the following attitudes toward regulation in 1985, 1992, and 2004.¹

Respondents agree that:	Landowners (%)			$P(\chi^2)$, df = 1, 1985 vs. 2004
	1985 ($n = 126$) ²	1992 ($n = 115$) ²	2004 ($n = 98$) ²	
State regulation means a loss of liberties and freedom ³	82	88	74	0.13
State can regulate private land resource management ³	22	25	30	ns ⁴
State can regulate private land with compensation ³	46	53	47	ns
Oaks are being lost in California	59	79	77	0.02
Oak use should be regulated	32	39	43	0.15
Protecting water quality should be a state responsibility ³	88	85	83	ns
The state consults adequately with citizens before regulating resources ³	21	22	17	ns
State has a responsibility to protect natural resources ³	80	81	83	ns
State and federal regulation is bringing the country closer to socialism ³	67	69	56	0.14
Citizens should be able to use natural resources on their own land without asking state permission ³	90	84	72	0.00

¹Neutral responses excluded from analysis.

² n varies slightly with each question.

³Used to develop scale of “receptivity to regulation.”

⁴ns indicates not significant.

Table 6. The percentage of California hardwood rangeland landowners with the following reasons to value oaks, and who carried out the following oak management practices in the 5 yr previous to the survey date in 1985, 1992, and 2004.

	Landowners (%)			$P(\chi^2)$, df = 1, 1985 vs. 2004
	1985 ($n = 126$) ¹	1992 ($n = 115$) ¹	2004 ($n = 98$) ¹	
The respondent values oaks for:				
Erosion control	73	83	80	0.13
Wildlife habitat	80	84	86	ns ²
Natural beauty	84	87	86	ns
Property value	57	61	60	ns
Shade	77	79	70	0.17
Browse	51	67	68	0.01
Having more forage underneath	29	37	35	ns
Conserving water	46	58	62	0.05
Fuelwood	63	57	37	0.00
Management practices carried out in the 5 yr previous to the survey date:				
Improve wildlife habitat	37	44	47	0.14
Plant oaks	6	14	32	0.00
Cut mistletoe out of trees	21	19	29	0.17
Divert water from stream or spring	—	33	25	0.18 ³
Stabilize stream banks	17	30	25	0.04
Build stream erosion control structures	—	14	22	0.09 ³
Stream channelization	—	20	11	0.09 ³
Fence riparian areas	17	25	21	ns
Cut oaks and treat stumps	16	13	16	ns
Burn scrub oaks	12	11	8	ns
Thin softwoods to promote oaks	12	9	9	ns
Spray, poison, girdle oaks	7	2	1	0.04
Thin oaks	35	26	34	ns
Cut or remove any oaks	85	76	65	0.00
Cut living oaks	43	29	32	0.02
Cuts oaks and agrees an important reason is:				
Removing dead or diseased oaks	74	72	60	0.07
Improving access	36	25	25	0.06
Home firewood	41	24	16	0.00
Increasing forage production	39	23	24	0.03
Increasing water flow	20	12	14	ns
Clearing for development	17	11	9	0.07

¹ n varies slightly with each question.

²ns indicates not significant; na, not applicable.

³Compares 1992 and 2004.

10 yr. Those planning to dispose of their property in the next 10 yr were more interested in donating or selling easements than those planning to keep their properties over the next decade (67% vs. 35%; $P < 0.07$, $df = 1$).

DISCUSSION

Overall, relationships between property size and the goals, attitudes, and practices of landowners remain consistent with the simple typology developed from the 1985 survey, where properties < 80 ha, 80 ha to 2008 ha, and > 2008 ha were compared (Huntsinger and Fortmann 1990). Summarizing the results for then and now, owners of larger properties usually produce livestock and live in the woodlands primarily because

of a family business, participate in voluntary land conservation programs such as the CLCA, more often live on their oak woodland properties year-round, have stronger antiregulation sentiments, cut some oaks from their land, are concerned about oaks suppressing forage production, and get their information from advisory agencies, professional associations, and Cooperative Extension. The growing numbers of smaller parcel holders do not usually sell products, graze livestock, or cut oaks, and are more amenable to regulations for conserving oaks. More often they are absentee owners, have owned their land for less time, and are unlikely to have received or used information about oaks from any major advisory organization. Owners of smaller properties primarily live in the woodlands to enjoy its natural beauty and to “get away from the city.” Unless differences associated with property size have changed since the

Table 7. The percent of hardwood rangeland landowners that agree or disagree with the following statements who have cut or planted oaks in the five years previous to 2004. To be read, for example, as “Of landowners who agree that oak replacement is adequate on their land, 82% cut some oaks in the previous five years, while of those who disagree, 48% cut some oaks during this period.”

Statement	% that agree & cut oaks	% that disagree & cut oaks	$P(\chi^2)$ $n = 96^1$
Oak replacement is adequate on my land	82	48	0.01
Oak canopy is greater than 50% on my land	94	57	0.01
Oak harvest should be regulated	39	75	0.00
Oaks are being lost in California	53	79	0.01
I have/am interested in a conservation easement	57	76	0.07

Statement	% that agree & plant oaks	% that disagree & plant oaks	$P(\chi^2)$ $n = 96^1$
Oak replacement is inadequate on my property	46	32	0.06
I live on my property all year	37	18	0.11
Oaks are valuable for habitat	37	7	0.03
Oaks are valuable for natural beauty	37	7	0.03
Oaks are valuable for browse	41	13	0.00
Oaks are valuable for firewood	22	38	0.10
I have/am interested in a conservation easement	45	23	0.06
I used UC advisory services (previous 2 yr)	57	27	0.03
I used any advisory service (previous 2 yr)	50	26	0.03

¹ n varies slightly with each question, $df = 1$.

earlier surveys, they were not reported here because they are described in Huntsinger and Fortmann (1990). However, when considering all landowners, there are changes in land use, income source, management, and attitudes about oak woodlands, when comparing 1985 and 2004 results.

Since 1985, changes that reflect IHRMP goals have occurred in the practices and values of hardwood rangeland landowners. Although the survey cannot “prove” these changes are a result of the program, there has been a shift to stewarding and valuing oaks. Outreach and education programs oriented toward nonproduction landowners, land trusts, and other “conservation owners” are needed, as well as research on the functioning of “working landscapes” programs—programs that seek to use privately owned production enterprises for land and habitat conservation, and to provide ecosystem services (Kreuter et al. 2006).

Hardwood Rangelands as “Working Landscapes”

The major hardwood rangeland land use remains livestock grazing and production, but more landowners, including ranchers, now report they value diverse ecological, cultural, and lifestyle benefits from oak woodland properties. These benefits or amenities fall well within the definition of ecosystem services, “the condition and processes through which natural ecosystems, and the species that make them up, sustain and fulfill human life” (Daily 1997). Many of the ecosystem

Table 8. Percentage of hardwood rangeland landowners with the following attitudes towards conservation easements in 2004.

	Respondents, 2004 (%)
Among all respondents ($n = 99$)	
Have a conservation easement	6
Do not have a conservation easement	84
Do not know what a conservation easement is	10
Among respondents knowing about conservation easements but without one ($n = 82$)	
Have been approached about a conservation easement	26
Would not consider selling or donating an easement	49
I would consider selling	26
I would consider donating	11
I do not know enough about it	20
Of those who know enough about easements to answer ($n = 76$)	
I would donate to a public agency	13
I would donate to a land trust or other private NGO	22
It makes no difference to me	11

services valued by landowners, such as natural beauty and wildlife habitat, are shared by society and benefit the public. Some ecosystem services are consumed mostly by the landowner, as with an enjoyment of the lifestyle of owning and managing oak woodland, and the satisfaction of having property to leave to heirs. Although in surveys ranchers consistently rate the monetary profits of ranching low as an overall motive for ranching, this survey and many other studies of Western rangeland owners have reported strong ecosystem service motivations for landownership and management decisions (Smith and Martin 1972; Bartlett et al. 1989; Huntsinger and Fortmann 1990; Liffmann et al. 2000; Rowe et al. 2001; Torell et al. 2001; Gentner and Tanaka 2002; Gosnell and Travis 2005; Campos et al. 2009). Oak woodland ranchers are therefore engaged in the joint production of ecosystem services and production of food and fiber, which is the conceptual underpinning of “working landscapes” as a conservation goal (Huntsinger and Sayre 2007).

Part of the working landscapes idea is that management activities of ranchers and grazing itself may be considered ecosystem services when they augment or support environmental benefits. In some woodland areas oak recruitment might be augmented by removal of livestock grazing (Tyler et al. 2006) when other factors, such as drought and insect and mammalian herbivores, are not suppressing seedling growth. On the other hand, there are some settings where livestock grazing has a role in maintaining wildlife habitat and ecosystem services at multiple scales: at the landscape scale, extensive ranching properties provide contiguous habitat that offers the best opportunity for the survival of many species; at ranch and pasture scales, activities such as stock pond maintenance can benefit wildlife (US Department of the Interior–Fish and Wildlife Service 2006); and grazing at the plant community scale can support species of concern (Weiss 1999; Marty 2005, Pyke and Marty 2005; DiDonato 2007). Grazing is broadly considered to be useful in diminishing fire hazard in California, by reducing

fine fuels and suppressing brush. Management can enhance the use of grazing to meet conservation goals, and reduce potential problems including overgrazing, soil and stream bank erosion, introduction of invasive species, grazing of species of concern, and water contamination. Using working landscapes to meet conservation goals involves developing management strategies and technologies that reduce conflict between production and conservation activities and enhance synergies (Brunson and Huntsinger 2008).

Emerging Markets for Ecosystem Services

When many people think about markets for ecosystem services, they think of the Chicago Climate Exchange or other organizations that offer payments for carbon sequestration on rangelands. However, less obviously, various policies and private demand have created relatively longstanding “markets” for ecosystem services that have placed a monetary value on services such as lifestyle benefits, undeveloped land, targeted grazing, wildlife habitat improvement, grass-fed meats, and water quality protection. Cost-sharing programs for water quality or wildlife improvements, payment for conservation easements, value-added prices for grass-fed meat, and tax relief for land conservation all place a monetary value on the production of ecosystem services desired by society. Amenity-driven land prices for rangeland, and the willingness of ranchers to subsidize ranches and forgo opportunity costs, are part of the price that ranchers and landowners pay for the ecosystem services they consume and can be used to determine at least a minimum monetary value for services that are considered difficult to value, such as a beautiful view or the ranching lifestyle (Torell et al. 2005; Campos et al. 2009). There are also markets specifically for grazing. In California, payment for prescription grazing is a growing market, and in the case of goats used for brush reduction, can bring in more than $\$700.00 \cdot \text{ha}^{-1}$.

Numerous surveys have documented and reflected on the tendency of ranchers to supplement ranch income with outside work by members of the household (Smith and Martin 1972; Workman and Evans 1993; Liffmann et al. 2000). This study showed that hardwood rangeland landowners were more likely to be obtaining a majority of their income from off-ranch sources in 2004 than they were on previous sample dates. Owner subsidies for ranch operations translate into what ranchers “pay” to ranch and to consume the associated ecosystem services (Martin and Jeffries 1966; Marsh and Sumner 1999; Torell and Bailey 2000; Torell et al. 2001, 2005). Surveys show that ranchers are well aware of how much they are paying for the lifestyle and the other ecosystem services they value and consume (Rowe et al. 2001; Sulak and Huntsinger 2002). In addition, oak woodland land prices reflect such values, as they are considerably higher than the prices that can be justified by agricultural production alone (Torell and Kincaid 1996). Unfortunately, one of the ways that the owners of large oak woodland properties can “cash out” this value after years of marginally or occasionally profitable livestock production and lost opportunity cost is to sell to developers (Hargreave 1993). This does not foster oak woodland sustainability, and results in the loss of ecosystem services valued by society.

A trend toward stronger amenity-related motives for ranchers and owners of larger properties has positive as well as potentially

negative aspects, and creates some unknowns (Fig. 2). That landowners recognize and appreciate ecosystem services would suggest that they are better equipped to manage for them, aiding themselves and society, and to take advantage of emerging and potential markets for carbon sequestration, habitat restoration and protection, and so forth. On the other hand, recent research indicates that amenity values or landowner-consumed ecosystem service values reach a saturation point, and that keeping a large property intact is not necessary to satisfy the landowner’s desire for amenities: most of these values, as with natural beauty, or a different lifestyle, can be satisfied with a property of a few hectares (Campos et al. 2009). The results of this study are illustrative, as owners of even small properties perceive high amenity values for their properties. On the other hand, those producing livestock or other products where income increases as the number of hectares owned increases are highly motivated to keep land intact (Campos et al. 2009). Markets for maintaining undeveloped land and wildlife habitat, value-added livestock products, and other goods and services that provide income streams that increase with the size of holdings can also help to reduce subdivision and land fragmentation.

IMPLICATIONS

Programs that will help livestock producers to jointly produce ecosystem services and livestock products are needed to conserve unfragmented private rangelands. This includes developing management strategies that create production and conservation synergies, and developing income streams for ecosystem service provisioning that increase as the area conserved increases. Hardwood rangeland landowners and rangeland landowners in much of the West have demonstrated a willingness to financially support the production of ecosystem services from rangelands that benefit society. However, the high costs reduce profitability and enterprise sustainability. Through policy mechanisms and markets, society can share some of the costs of production of ecosystem service production and stimulate increased services of public benefit. Half of the landowners in the survey indicated that they were receptive to environmental regulation, if it came with “compensation” that shared the cost of compliance. On the other hand, some public policy initiatives, regulations, and social trends may detract from the benefits reaped by the landowner, and eventually weaken landowner willingness or ability to continue ranching or landownership. We tend to think of landowner costs in terms of money, but “costs” can be a reduction in any of the ecosystem services consumed by the landowner or rancher, including a reduction in the enjoyment of lifestyle and work, or a belief that society is hostile to ranching (Liffmann et al. 2000).

Finally, most cost-sharing programs and many other conservation incentives programs do not necessarily address land use stability—a landowner might obtain public funds for pond restoration one year and sell the land for development the next, making such public investments risky. However, results here appear to indicate that landowners who want their land to remain intact, as indicated by having or being interested in conservation easements, are more likely to engage in restoration practices such as planting oaks. In contrast to a posited “impermanence syndrome” that states that an uncertain future for the land leads to property neglect or “a lack of confidence in

the stability and long-run profitability of farming in urbanized areas, leading to disinvestment of human and capital resources” (Heimlich and Anderson 1987; Heimlich 1989), we could posit here a “permanence syndrome,” where landowners envisioning a long time horizon for their land as a ranch or woodland are more active conservationists. Therefore, the interlinkage of land use stability and management incentives could prove mutually reinforcing, with feedbacks resulting in higher levels of efficiency in conservation.

ACKNOWLEDGMENTS

Thanks are especially due to the landowners of California’s oak woodlands, especially those who have stalwartly participated in this survey over the years. Adriana Sulak, Jose Oviedo-Pro, and Adina Rissmann all contributed their expertise to aspects of the research and write-up. Thanks to the journal reviewers and Paul F. Starrs for their very helpful reviews.

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