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Publication Date

2012

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Private Lands, Public Goods: Engaging Landowners in Ecosystem Management

By

Shasta Patricia Ferranto

A dissertation submitted in partial satisfaction of the

requirements for the degree of

Doctor of Philosophy

in

Environmental Science, Policy and Management

in the

Graduate Division

of the

University of California, Berkeley

Committee in charge:

Professor Maggi Kelly, Co-Chair
Professor Lynn Huntsinger, Co-Chair
Professor Isha Ray

Fall 2012

Abstract

Private Lands, Public Goods: Engaging Landowners in Ecosystem Management

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Doctor of Philosophy in Environmental Science, Policy and Management

University of California, Berkeley

Professor Maggi Kelly, Co-Chair

Professor Lynn Huntsinger, Co-Chair

California currently faces some daunting challenges to the sustainability of its natural ecosystems. Unnaturally high wildfire risk, urban and exurban expansion, the spread of invasive species, insect and disease outbreaks, and the effects of climate change all threaten to disrupt ecosystem function on a broad scale. These problems are complex, and operate at scales that cross jurisdictional boundaries, including those between private and public lands. To address problems at the scale of ecological processes will require ecosystem management, where practices and initiatives cross such boundaries. In California, this will require the engagement of a diverse and increasing group of private landowners.

Forty-two percent of California's forests and rangelands are privately owned (34 million acres). These lands provide important ecosystem services such as carbon sequestration, pollination and wildlife habitat, but little is known about the people who own and manage them, or how they might respond to cross-boundary ecosystem management initiatives. In this dissertation, I address this gap in understanding through the use of a statewide survey of forest and rangeland owners in California. I examined landowner characteristics, ownership motivations, management practices, and support for cross-boundary cooperation to better understand how landowners currently use their land, and how they might most effectively be engaged to participate in cross-boundary land management.

Results show that amenities and financial investment were the most important reasons for owning land, particularly among owners of small properties. Owners of large properties (500 or more acres) were significantly more likely to use their land for income production than owners of smaller properties. They were also more likely to carry out or be interested in environmental improvements or to have received advice about land management from an advisory organization or government agency.

All landowners showed willingness to cooperate for pest and disease control, fire hazard reduction, and wildlife conservation, but their degree of willingness differed with

ownership motivations, who they were expected to cooperate with, and the natural resource problem addressed. All were more willing to cooperate with neighbors and local groups than with state and federal agencies, and preferred to receive advice about land management from advisory organizations over regulatory or land management agencies. Landowners were most willing to cooperate to reduce fire hazard, which is the most direct threat to property and well-being.

These results suggest that ecosystem management will be most effective if implemented with local partners and on topics landowners perceive as relevant. Some landowner groups already are active land managers and may be easy to engage in ecosystem management initiatives, especially using practices they already have experience with. Other landowners, in particular those that own small properties and are solely interested in amenities, were less experienced in land management and received less advice about managing their land. These owners may require more resources to engage in ecosystem management, but still expressed general support for the idea.

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ACKNOWLEDGEMENTS

First and foremost, I would like to thank my co-advisors, Maggi Kelly and Lynn Huntsinger, for their ongoing insight, support and mentorship. I could not have asked for a better dissertation team, and I am immensely grateful for their help. I would also like to thank Isha Ray for serving on my committee and providing excellent feedback along the way.

This research was funded by the University of California Cooperative Extension and many thanks are deserved by the UC Cooperative Extension team that collaborated on the landowner survey: Christy Getz, Gary Nakamura, Bill Stewart, Sabrina Drill, Yana Valachovic, and Mike De Lasaux. I would also like to thank all of the landowners that participated in the survey.

Finally, I would like to thank all of my friends and family for the support, laughter, adventures, and fun you've provided along the way. I couldn't have done it without you.

CHAPTER ONE

Extending sustainability in California: into the future, across the landscape

California currently faces some daunting challenges to the sustainability of its natural ecosystems. A state endowed with an astonishing abundance and diversity of natural resources, including rich agricultural soils, expansive forests, diverse wildlife populations and clear water, is failing to sustain the productivity of these resources for future generations. A century of wildfire suppression has created thousands of forested acres that are primed to burn at unnatural intensities and frequencies (Agee 1998; Agee and Skinner 2005); invasive species threaten our uniquely high levels of biodiversity and can alter ecosystem function (Pimentel, Zuniga, and Morrison 2005); insect and disease outbreaks, such as bark beetles or sudden oak death, have devastated forest ecosystems (Fettig et al. 2012; Rizzo and Garbelotto 2003); urban and exurban growth are quickly expanding into prime agriculture land, rangeland, and wildlife habitat (Merenlender et al. 2005); and the effects of climate change threaten to exacerbate many of these problems (Fried, Torn, and Mills 2004; Hellmann et al. 2008; Westerling and Bryant 2008; Westerling et al. 2006).

The challenges are complex and often driven by a suite of dynamic, interacting factors that operate at multiple scales and cross jurisdictional boundaries, including those between private and public lands. As such, they must be addressed across ownership types, engaging both public land managers and private landowners in cross-boundary management solutions. To say that this is challenging is a gross understatement. Public and private lands are embedded in their own unique management frameworks, driven by different social, political, and legal factors. Moreover, private landscapes are often fragmented into multiple parcels where decisions are made at the parcel scale by a diverse and abundant group of landowners.

In this introductory chapter, I review the concept of sustainability and how it applies to private forest and rangelands, paying particular attention to issues relevant to California. Forty-two percent of California's forest and rangelands are privately owned, amounting to 34 million acres in total. These lands play an important role in sustaining ecosystem health. For example, private lands tend to have higher levels of biodiversity and are often located in areas with better water access and higher productivity than public lands (Scott et al. 2001). Achieving sustainability in California's natural ecosystems will require attention be paid to these private lands, and their unique management constraints and opportunities.

A brief history of “sustainability”

The term “sustainability” has been used in many contexts over the years and with varying definitions. In 1987, the United Nations Commission on Environment and Development (the Brundtland Commission) produced a seminal report on sustainability which emphasized the connection between environment and development issues. This

report, titled *Our Common Future* but commonly referred to as the Brundtland Report, argued that ecological sustainability cannot be achieved without addressing the problem of poverty around the world and proposed that this would be accomplished through sustainable development, defined as development which “meets the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland Report 1987).

The Brundtland Report has been described as having a combination of radical and reformist elements – radical because of its explicit linkage between environment and development issues, and reformist because of its emphasis and support for economic growth, particularly in lesser developed nations (Robinson 2004). Critics of the report argued that there are fundamental contradictions between increased economic growth in developing countries and ecological conservation (Sneddon, Howarth, and Norgaard 2006). Consequently, those who do not align with the pro-growth connotations of “sustainable development” tend to prefer the term “sustainability,” though the terms are often used interchangeably (Kemp and Martens 2007).

Following the Brundtland report, several attempts were made to operationalize the idea of sustainable development (Kemp and Martens 2007). Much of the early literature focused on economic development and its connection to environment. In 2002 the World Summit on Sustainable Development introduced the concept of three pillars of sustainability– environmental protection, social development and economic development. Sustainable development thus began to include social goals such as increased life expectancy, education, equity, and opportunity, in addition to environmental and economic goals (Kates, Parris, and Leiserowitz 2005). The three pillars concept has been widely adopted and has been described and visualized in a variety of ways, including standing pillars, concentric circles, and interlocking circles (Adams 2006). Recently, this concept has been expanded to describe sustainable business models using a framework for business reporting that includes financial, ecological, and social performance (i.e. the triple bottom line: people, planet, profit).

Over the last two decades, research on sustainable development has also burgeoned, coming from a diversity of disciplines including geography, ecology, economics, physics, and political science (Clark 2007). In 2001, Kates and colleagues described an emerging new field of sustainability science that “seeks to understand the fundamental character of interactions between nature and society.” Whereas the sustainable development agenda had come to focus predominately on societal and political processes, sustainability science would integrate research across a broad range of disciplines to understand key processes shaping human-environment interactions (Kates et al. 2001)

More recently, Clark (2007) described the core focus of sustainability science as advancing understanding of coupled human-natural systems (CHNS), i.e. systems “in which human and natural components interact.” Research on CHNS indicates that these systems tend to be highly complex and involve reciprocal interactions and feedbacks between human populations and the natural environment, as well as unique properties that emerge from these interactions (Liu, Dietz, Carpenter, Folke et al. 2007). Coupled systems vary across space, time, and organizational units and often demonstrate non-

linear relationships and behaviors making them difficult to understand (Liu, Dietz, Carpenter, Pell et al. 2007).

In 2005 the Millennium Ecosystem Assessment (MA) introduced a conceptual framework for understanding CHNS through the lens of ecosystem services (i.e the services that ecosystems provide to society) and how human actions alter these services thereby affecting human well-being. Ecosystem services encompass a broad range of benefits derived from natural ecosystems including provisioning, regulating, cultural, and supporting services. The MA showed that human use of ecosystem services is expanding, while the availability of these services is declining. Moreover, the complexity of CHNS has presented significant challenges to understanding ecosystem services and our ability to draw general conclusions in sustainability science remains limited (Carpenter et al. 2009).

Sustainability, as a concept, thus emerged from global discussions on the linkage between poverty alleviation and environmental protection in developing countries, but it has since evolved into a framework for understanding any type of human-environment interactions. Although 25 years has passed since the Brundtland Report, a focus on intergenerational equality continues to permeate thinking on sustainability. Equality, however, now encompasses a broad array of topics including economic development, social justice, access to natural resources, and availability of ecosystem services. At its core, sustainability is about improving or maintaining human welfare, achieved through an integrated and holistic approach. The complexity inherent in this approach has led to the development of concepts such as CHNS, and forced us to consider the connections between human actions and environmental response.

Sustainability and land change

One of the most fundamental ways that humans interact with the environment is through land use. People transform landscapes to grow crops, raise animals, obtain timber or other ecosystem goods, or build homes and infrastructure (DeFries, Foley, and Asner 2004). These activities have altered much of the earth's land surface, often at the expense of natural resources and environmental quality (Foley et al. 2005). As much as 50% of the earth's ice free land area has been transformed and much of this change is a direct consequence of land use. Understanding the drivers and consequences of land change has become a fundamental component of sustainability research (Turner, Lambin, and Reenberg 2007).

Land use patterns vary in space and time, and the causes of land change remain a highly debated area. Although proximate causes of land change have been well documented, distal factors, such as national policies or global economics, tend to be difficult to connect directly to land outcomes. As a consequence, simplifications of cause-consequence relationships have facilitated popular myths about land change. Many of these myths have negatively influenced environment-development policies, and often result in blaming local peoples for the proximate causes of land change with little attention to the distal forces that are shaping them (Turner, Lambin, and Reenberg 2007; Lambin et al. 2001). Still, despite difficulties in connecting cause to outcome,

identifying trends and generalizations remains an important step in understanding the processes of land change.

Patterns of land change

Although substantial variation exists at local scales, broad patterns of historical land change appear to be associated with socio-economic development. Foley et al. (2005) described a sequence of land use regimes that most societies appear to follow beginning with natural ecosystems, to frontier clearing, subsistence agriculture and small-scale farms, and finally to a mix of intensive agriculture, urban areas, and protected recreational lands (Fig. 1-1). Different parts of the world are in different stages of land use, and not all places move linearly through the stages.

Huston (2005) similarly described three phases of economic development associated with land use change – agricultural, industrial, and information/communication. In the agrarian stage, land-use is regulated by environmental constraints on agriculture. Environmental impacts are highest on productive land, and selectively amplified with the transition to industrialization. During the industrial phase, there is a reduction in rural population densities as economic activity and jobs shift to urban centers. This trend is reversed, however, during the information/communication phase, when the transition to an information-driven economy allows population to move back to rural areas, particularly in low-productivity, high amenity areas that attract people with income sources independent of local economies and land production. Land use practices transition away from agricultural production toward the use and enjoyment of amenities (Huston 2005).

Land dynamics have also been explained by the IPAT identity, where environmental impact (I) is explained as a product of population (P), affluence (A), and technology (T). Several variations have been applied to this concept since it was first proposed (Chertow 2000; Waggoner & Ausubel 2002), however at a coarse scale the basic PAT variables appear to track well with land dynamics because they capture the demand for land and resources as well as the means by which they are supplied (Turner, Lambin, and Reenberg 2007).

Land change in the United States

In the United States, the most significant changes in land use have occurred on privately owned lands. On a broad scale, these changes match the stages of land use described by Foley et al. (2005) and Huston (2005). Prior to 1950, rural land use practices in the U.S. typically involved low intensity agriculture, livestock production or natural resource extraction. From 1950 to 1970 rural residents began moving to urban centers for economic and social opportunities. Metropolitan and suburban areas expanded into previously rural regions, and agricultural land use practices intensified and became increasingly more mechanized. In the 1970s people began to move back to rural areas. This slowed in the 1980s, and then picked back up again in the 1990s with what is

commonly referred to as the “rural rebound,” an in-migration of new residents into rural America largely driven by amenity migration (Brown et al. 2005).

The rural rebound has facilitated important changes to rural areas, particularly in amenity-rich regions. New landowners into these regions include retirees, younger people seeking a slower pace of life, professionals who can commute or work remotely from urban areas, and seasonal homeowners who normally reside in urban areas (Clendenning and Field 2005; Clendenning, Field, and Kapp 2005). These groups are drawn to the natural and/or cultural amenities associated with living in rural areas as well as an escape from city life. As a consequence, rural areas have seen a decline in values and practices associated with land production, while experiencing an overall increase in values associated with the enjoyment of amenities (Gosnell and Abrams 2011).

The in-migration of people into rural areas has also led to an increase in low density housing called exurban development. Since 1950 there has been a five-fold increase in exurban development (Brown et al. 2005), resulting in increased parcelization to accommodate new owners and a trend toward smaller property sizes. This pattern of fragmentation is projected to continue in the upcoming decades with more landowners owning smaller-sized parcels (Alig and Plantinga 2004; Nowak and Walton 2005; Theobald 2010; White, Morzillo, and Alig 2009; Theobald 2005).

The ecological and management impacts of exurban development are many, including decreased biodiversity (Hansen et al. 2005; Maestas, Knight, and Gilgert 2003; Parmenter et al. 2003), fragmentation of wildlife habitat (Hobbs et al. 2008) and forest patches (Theobald, Crooks, and Norman 2011) and more-difficult wildfire management (Moritz and Stephens 2008). As ecosystems become increasingly fragmented their ability to provide ecosystems services may also be reduced. For example, the stability of pollination services by wild bees is strongly associated with proximity to natural habitats, and Lyme disease risk has been shown to increase with exurban fragmentation (Kremen and Ostfeld 2005).

The transition from production-focused landowners to amenity-type landowners may also result in a net loss of working landscapes, such as ranches. Biodiversity is higher in ranches and protected areas than exurban development (Maestas, Knight, and Gilgert 2001) and working landscapes often provide a buffer zone between protected areas and more developed land (Groom et al. 1999; Talbert, Knight, and Mitchell 2007). Although amenity-seeking owners may desire the qualities and feel of a ranch or other working landscape when purchasing land, these attributes can be attained with much smaller property sizes than required to actually earn income from land production (Campos et al. 2009), thus making it likely that parcelization will occur with the transition to non-income generating operations such as hobby ranches. Conversion of rangelands to residential use may also result in vegetation changes, as new landowners manage for habitat types other than the open grassland and oak savanna habitats typical of ranched landscapes (Wacker and Kelly 2004).

Land change in California

California, like other rural areas, has experienced extensive urban and exurban development in recent decades. Between 1970 and 2010 approximately 67,000 acres per year of forest and rangeland were converted to urban development (defined as more than one house per 5 acres) and 117,000 acres per year were converted to exurban development (more than one house per 20 acres). These trends are expected to continue with almost 4.8 million acres of forest and rangeland considered at medium to high risk for future development (CDFFP 2010).

As a consequence of this growth, the boundary between developed and wildland areas, commonly referred to as the wildland-urban interface (WUI) or the wildland-urban intermix (WUI) in the case of exurban landscapes (Moritz and Stephens 2008), has also expanded. The WUI is dominated by private land ownership (Theobald and Romme 2007) and California has more homes located in the WUI than any other state (Radeloff et al. 2005). More than 7.8 million acres are located in the WUI in California, and seventy percent of the California WUI is considered between high to extreme wildfire threat (CDFFP 2003). Protecting homes and infrastructure from wildfire in the WUI is difficult and expensive, and reintroduction of natural fire regimes is near impossible because of the risk introduced to homes and communities.

There have also been significant changes in the characteristics and goals of landowners in California. A longitudinal study of California rangeland owners showed that between 1985 and 2004 the number of landowners involved in production of crops or livestock declined whereas the proportion of landowners that own their land for amenity-type reasons such as natural beauty, recreation, and lifestyle benefits significantly increased (Huntsinger et al. 2010). In some situations, changes in landowner values led to conflict between different types of landowners. For example, in Nevada County, a former mining and ranching community in the Sierra Nevada Foothills, efforts in participatory planning were derailed by the conflicting landscape ideologies between amenity-driven in-migrants and long-time residents with ties to production (Walker and Fortmann 2003).

These studies suggest that similar to other areas in the United States, rural communities in California are also changing. Property sizes are decreasing, natural landscapes are increasingly exposed to urban or exurban development, and ownership values are shifting from a focus on income production to amenity consumption. These changes have important implications for environmental sustainability and the continued production of ecosystem services from private landscapes. As the primary decision-makers on their land, rural landowners play a critical role in either achieving environmental goals or facilitating future problems. Moreover, many of the environmental challenges facing California can only be addressed through landscape scale management solutions. As property sizes decrease, management will need to engage more landowners to cover the same amount of area. This will require cooperation amongst adjacent properties, a prospect which could be difficult if landowners have conflicting ideologies and management practices.

Although previous research has taught us much about the ways in which rural communities are changing, the implications of these changes are still not well understood. For example, how do changes in ownership values influence the management practices that landowners implement on their land or their willingness to cooperate on management? Who are landowners willing to cooperate with? What topics are they willing to cooperate on? And what methods of outreach will be most effective in engaging landowners in sustainable land management?

Chapter overview

In this dissertation, landowner characteristics, values, and management practices were examined through a statewide survey of forest and rangeland owners in California. These data were then used to address the question of how we can most effectively work towards sustainability on privately owned landscapes. Here, I provide a brief summary of subsequent chapters and explain how each contributes to our understanding of environmental sustainability.

Chapter two provides a general profile of forest and rangeland landowners, and examines change in ownership values and land management practices with decreasing property size. Results from this research indicate that owners of smaller-sized properties are more likely to own their land only for amenity reasons and less likely to be involved in land production. They are also less likely to implement management practices for environmental improvement. These results have important implications in the context of land parcelization in California as they suggest that in addition to the direct ecological consequences of fragmentation, there are also indirect ecological consequences that result from changes in social values.

Chapter three focuses on factors related to landowner support for cross-boundary cooperation – a practice that is vital to addressing large scale environmental concerns. Survey results were analyzed using an audience segmentation approach and landowners were grouped into four clusters according to ownership motivations: rural lifestyle, working landscape, natural amenity, and financial investment. All landowner clusters showed willingness to cooperate for pest and disease control, fire hazard reduction, and wildlife conservation, but their degree of willingness differed by cluster, who they were expected to cooperate with, and the natural resource problem addressed. All were more willing to cooperate with neighbors and local groups than with state and federal agencies and to reduce fire hazard, the topic with the most direct threat to property and well-being. These results can be used to guide future cross-boundary initiatives and suggest that cooperative efforts will be most successful if implemented at a local level and on issues that are relevant to landowners, such as fire hazard.

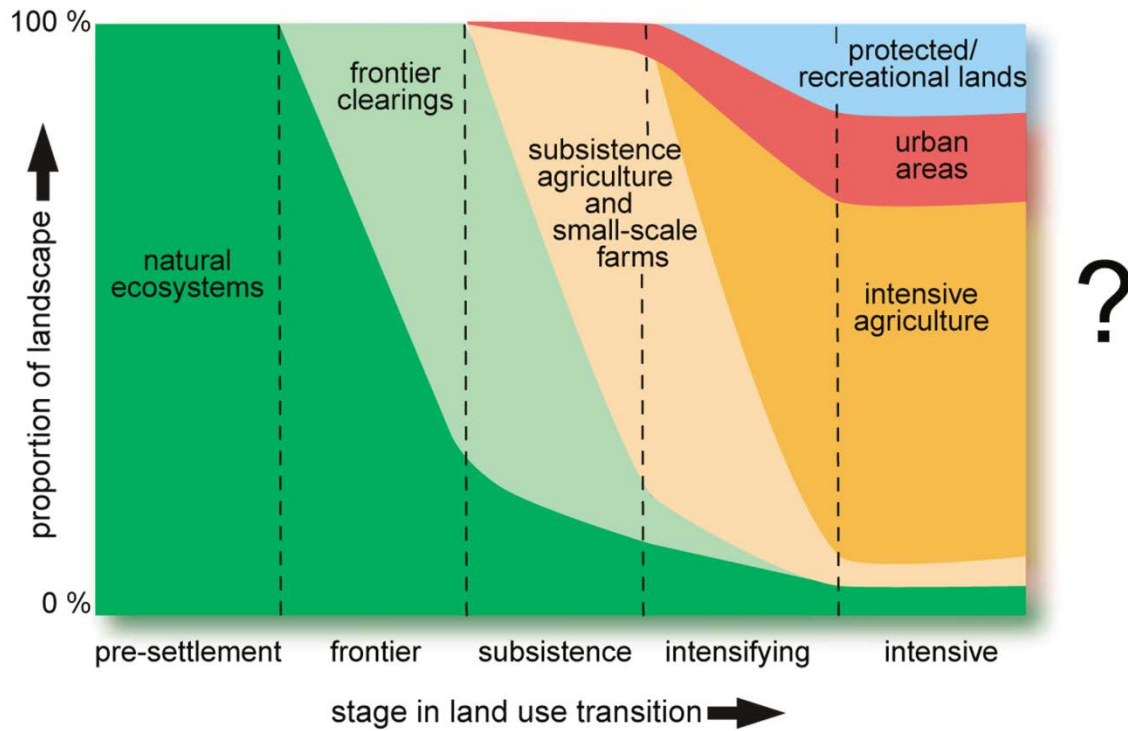
Chapter four focuses on improving outreach to forest and rangeland owners by examining the impact of existing outreach and identifying gaps in information distribution and content. Although a number of organizations provided land management advice to landowners, no individual organization reached more than 30% of forest and rangeland owners, and these groups together reached less than 60% of landowners. The lowest ranked advice came from wildlife and land management

agencies, whereas the highest ranked advice came from private consultants and advisory organizations. Owners of large properties (>500 acres) were substantially more likely to have received land management advice than smaller-sized properties, and from a broader group of organizations. As ownerships become increasingly fragmented, outreach focus and methods will need to shift to more effectively target the owners of smaller properties. On the other hand, some major outreach goals, such as conservation of wildlife, grazing, or agricultural communities, will continue to rely on effective outreach to owners of larger properties.

Chapter five summarizes the key findings from this dissertation and highlights directions for future research. Collectively, these chapters help us understand how social changes, such as amenity migration, influence environmental sustainability on private lands in California, and how conservation can best respond to these changes.

CHAPTER ONE – FIGURES

Fig. 1-1. Conceptual model of land use transitions, taken from Foley et al. 2005.



CHAPTER TWO

A profile of California's forest and rangeland owners

Forty-two percent of California's forests and rangelands are privately owned (34 million acres). These lands provide important ecosystem services such as carbon sequestration, pollination and wildlife habitat, but little is known about the people who own and manage them. We surveyed forest and rangeland owners in California and found that these long-time landowners value their properties for their natural amenities and as a financial investment. Owners of large properties (500 or more acres) were significantly more likely to use their land for income production than owners of smaller properties, and they were also more likely to carry out or be interested in environmental improvements. Many forest and rangeland owners reported they had been previously approached to sell their land for development. Only about one-third had participated in conservation programs; few had conservation easements. This survey can help guide outreach and education efforts, and the development of information, policies, programs and financial incentives for landowners.

Introduction

Over the last 20 years, an “inmigration” of new landowners has occurred in California's forests and rangelands. Rural housing trends in California mirror similar trends in the nation: between 1940 and 2000, 10% of private forests and rangelands were fragmented into areas with more than one house per 20 acres (CDFFP 2003). The ecological and management impacts of exurban parcelization include decreased biodiversity (Hansen et al. 2005; Maestas, Knight, and Gilgert 2003; Parmenter et al. 2003), fragmentation of wildlife habitat (Hobbs et al. 2008) and more-difficult wildfire management (Moritz and Stephens 2008). Changes in land ownership can also bring changes in social values and demographic characteristics. In-migrants seeking a better quality of life may more strongly support protection of amenity values, such as scenery and recreation, and more often participate in environmental activism (Jones et al. 2003). These values may conflict with more traditional views held by long-time residents (Walker and Fortmann 2003; Yung and Belsky 2007). New residents may also have less expertise in land management (Kendra and Hull 2005) or different views than long-term landowners on how undeveloped landscapes should be managed (Gosnell, Haggerty, and Travis 2006). These changes raise questions: As properties become fragmented into smaller management units, how do the goals and needs of landowners change? Do they use or manage their land differently? And what do these changes imply for future environmental sustainability? Several studies have examined the physical patterns of fragmentation in the United States (Brown et al. 2005), and many predict future patterns of increased parcelization (Alig and Plantinga 2004; Nowak and Walton 2005; Theobald 2005; White, Morzillo, and Alig 2009). Few studies, however, have examined the social changes associated with fragmentation or the ecological implications of these changes. These issues are especially pertinent to California forests and rangelands,

where fragmentation is predicted to continue (CDFFP 2003). Limited knowledge of the landowner population in California has made it difficult to assess this population and to establish a baseline for understanding how it might change over time, or with interventions of information, policy or financial resources. To improve outreach and education programs geared to landowners, a team of UC Cooperative Extension and UC Berkeley researchers surveyed California forest and rangeland owners in 2008.

Survey design and analysis

There are approximately 34 million acres of privately owned forest and rangeland in California, concentrated in the Sierra Nevada and coastal regions (CDFFP 2003). Forest and rangeland owners with parcels greater than 3 acres from 10 California counties were mailed a questionnaire. Eight of the state's 10 bioregions contain forests or rangelands, as defined by the California Department of Forestry and Fire Protection (CDFFP, now known as CalFire) for natural resources assessment purposes. A minimum of one county was selected from each. Together, these eight bioregions contain 89% of the state's private forests and rangelands (CDFFP 2003). We sampled counties representative of each bioregion: Contra Costa, El Dorado, Humboldt, Mendocino, Plumas, San Diego, Santa Barbara, Shasta, Sierra and Sonoma (Fig. 2-1). Because they have small populations, Sierra and Plumas counties, which are adjacent to one another, were treated as a single sampling unit.

Within each county, survey recipients were selected using a stratified random sampling design. The sample was drawn from a statewide land parcel database created in 2003 by CDFFP for the Forest and Range Assessment. The database contains information on parcel size derived from county assessor tax records, and vegetation type at the parcel center derived from satellite imagery. Parcel vegetation type was categorized into either forest, including conifer and hardwood, or rangeland, including oak woodlands, grassland and shrubland. Parcel size was then subcategorized into four groups: 3 to 9 acres, 10 to 49 acres, 50 to 499 acres, and 500 or more acres. A random sample of up to 30 parcels was drawn from each subcategory, for a total of approximately 240 parcels per county. All duplicate landowner addresses were dropped, so that landowners received only one survey regardless of how many parcels they owned.

We mailed the survey and follow-ups to 1,730 landowners in spring 2008, following a modified version of the Dillman Total Design Method (Clendenning, Field, and Jensen 2004; Dillman 2007). The questionnaire was a 17-page booklet with 38 questions, many of which contained multiple parts.

Most questions were close-ended, with either categorical or Likert scale response choices. Respondents were also offered the option of taking an identical online survey. Questionnaires were returned by 670 people, with 8% answering online. After adjusting for undeliverable questionnaires and those sent to people who were not forest or rangeland owners, the final response rate was 43% (see Appendix A for detailed response rates).

A stratified sampling design ensured the inclusion of owners from all property sizes but created a sample disproportionate to true population ratios. Unless otherwise indicated, all data was weighted proportionally to sampling intensity to adjust for a disproportionate sampling intensity between different sampling strata. Proportional survey weights were calculated by multiplying the reciprocal sampling ratio (i.e., the total number of landowners in each sampling strata compared to the number of landowners sampled from each strata) by the overall sampling ratio (the overall sample size compared to the overall population) (Maletta 2007). Reported results are thus representative of true landowner population ratios.

All data analysis was done with SPSS 17.0 statistical software. Results are reported as percentages of the total number of respondents to each question.

Several questions were based on a Likert scale from 1 to 5, ranging from “not at all important” (value = 1) to “highly important” (value = 5). Results for all Likert scale questions were grouped so that a response of “not important” included values 1 and 2, and a response of “important” included values 4 and 5. Comparisons between property sizes were based on the same size categories as used in the sampling (3 to 9 acres, 10 to 49 acres, 50 to 499 acres, and 500 or more acres), but respondents were reclassified based on the reported size of all the parcels owned and managed as a single property, rather than on assessor parcel records. (We use the term “property” when referring to the full property, and “parcel” when referring to a single parcel.) Differences in responses by property size were calculated using either Pearson’s chi-square analysis for categorical data or analysis of variance (ANOVA) for continuous data.

Profile of landowners

Respondents were mostly male, over 60 and predominantly married or living with a partner. Few had children living at home, and they tended to be well educated and relatively affluent, with just over half earning more than \$100,000 and just under one-third earning more than \$200,000 per year (Table 1). These results did not vary substantially based on property size, with the exception that property owners with 50 to 499 acres were significantly more likely to have a bachelor’s degree, more likely to have children living at home and more likely to earn over \$200,000 per year than landowners in other property size categories.

The most common careers, with about one-third of landowners in each category, were professional or management positions, retired and self-employed, with only slight variation between property sizes. Only 14% of respondents reported production-oriented enterprises (timber, agriculture or range) as their profession.

Ownership demographics

On average, respondents had owned their land or the land had been in their family for 31 years. The average length of ownership increased with property size; the most notable increase in land tenure was in the largest property size category (500 or more acres)

(Table 2). Most owned their land as private individuals (the landowner's name is on the deed). Owners of the largest properties (500 or more acres) were significantly more likely to be in corporate ownership — often a family corporation (Table 2). The majority of respondents were primary residents. Owners were less likely to be primary residents as property size increased, with an almost equal ratio of primary to nonprimary residents in the largest property size category. Of the nonprimary residents, 46% used the land as a second, seasonal or vacation home, with no significant variation based on property size (Table 2). Nonprimary residents tended to live fairly far from the property — 77% lived more than 20 miles away, and 44% lived more than 100 miles away.

Reasons for ownership

A variety of reasons were reported for owning land. To “live near natural beauty” was the objective ranked by most landowners as important (Fig. 2-2). Other popular reasons included “land value appreciation,” “escape from city crime and pollution,” “financial investment” and “live in a small community.” In general, amenity values and financial investment objectives were important to the most landowners.

When broken down by property size, several notable differences became evident. All property sizes ranked living near natural beauty and financial appreciation of the land as important. Only a small percentage of small property owners (less than 50 acres) considered family tradition or business as important; about half of landowners with 50 to 499 acres marked it as important; but this was the single most important objective for owners of large properties (500 or more acres) (Fig. 2-3). Income source was not considered important to most owners of small properties but was important to over three-fourths of large property owners. In contrast, owners of large properties were less concerned than owners of small properties about escaping from the city, living in a small community or having a simpler lifestyle (Fig. 2-3).

Resource use

Overall, landowners were more likely to utilize their land's resources such as timber, livestock forage or game for personal use than for income production (Fig. 2-4). Only one-third reported earning income in one of the provided ways, while almost three-fourths used their land's natural resources for personal use.

As property size increased, landowners were more likely to use their land for income (Fig. 2-4A). Over half of landowners with the largest properties (500 or more acres) harvested timber for income, and just under 40% raised livestock (Fig. 2-4A). Hunting and fishing for personal use also increased with property size, but raising food crops or livestock, and harvesting timber for personal use all remained constant or decreased slightly as property size increased (Fig. 2-4B). Harvesting fuelwood for personal use increased with property size until the 50-to-499-acre category, then dropped substantially in the 500-or-more-acres category (Fig. 2-4B).

Land management practices

California forest and rangeland owners implemented a variety of land management practices for environmental improvement (Fig. 2-5). Almost all respondents regularly inspected the condition of their land. Over half (for whom the question was applicable) cleared defensible space to reduce fire risk; pruned or cut trees to reduce fire risk or improve forest health; improved wildlife habitat; implemented water-quality management practices; or built erosion control structures (Fig. 2-5). Of those who did not use these practices, many would consider using them in the future. For all of the management practices surveyed, over half of all respondents either currently implemented or would consider the practice in the future. Some practices, such as generating solar or wind energy, or testing the soil, although not currently implemented by many, were of interest to many landowners and may be areas where outreach could improve implementation.

Overall, owners of large properties were more likely to carry out or be interested in environmental improvements than owners of smaller properties. In particular, as the property size increased, landowners were notably more likely to improve wildlife habitat, remove exotic plants, implement water-quality management practices, have their soil tested, develop a written management plan, build erosion control structures or manage streams for wildlife (Fig. 2-6). Practices such as clearing defensible space or pruning or cutting down trees to reduce fire risk were as common on small properties as they were on large ones.

Conservation programs

Only one-third of all respondents had participated in one of the land management or conservation programs identified in our survey (see Appendix B for a description of conservation programs). The Williamson Act (California Land Conservation Act) program had the most participants, followed by the Timberland Production Zone (TPZ) program. These programs provide property tax reductions to eligible participants to encourage agricultural land (Williamson Act) or forest (TPZ) conservation. The Environmental Quality Incentives Program (EQIP) and the California Forest Improvement Program (CFIP) had the next highest participation (Fig. 2-7). These programs provide technical and financial assistance to landowners to address natural resource concerns on private land. Less than 5% of landowners reported that they had a written rangeland water-quality management plan; participated in the Wildlife Habitat Incentives Program (WHIP) under the U.S. Forest Service, which provides technical and financial assistance; had forest certification, a third-party certification of sustainable forest management operations; had a conservation easement limiting development on their property; had organic certification, ensuring that food is grown according to organic standards; or had received a grant from the California State Water Resources Control Board to implement water-quality improvements (319h grant for BMPs). Less than 1% of landowners reported participating in the Ranch for Wildlife Program (AB 580, now known as the Private Land Management Program of the California Department of Fish and Game), which offers increased fee-hunting opportunities in

exchange for habitat improvements on private land; or participated in mitigation banking, a third-party system in which landowners protect or restore wetlands or streams on their property to compensate for impacts to wetlands and streams elsewhere.

Participation varied only slightly based on property size, and in most instances owners of the largest properties (500 or more acres) were no more likely to participate in land management or conservation programs than owners of smaller properties.

Future intentions for land use

When asked about their long-term plans, almost two-thirds of respondents reported that they planned to pass their land on to children or other family members, while one-sixth planned to sell their land. Few landowners were undecided or had never thought about it. Owners of large properties (500 or more acres) were more likely to plan to pass their land to children and less likely to sell than owners with other property sizes (Table 2-3).

Landowners were also asked what reasons would influence a hypothetical future decision to sell their land. Almost 20% reported that none of the reasons applied to them because they would never sell. Of the remaining 80%, just over half chose “it is too much work to maintain,” followed by “can’t afford to keep it,” “property taxes too expensive,” “to finance retirement” and “inheritance taxes too expensive” (Fig. 2-8).

Development pressure

A high percentage (43%) of landowners reported that they had been previously approached to sell their property for development. As property size increased, landowners were significantly more likely to have been approached ($\chi^2 = 86.4$, $P = 0.00$). Of the owners of large properties (500 or more acres), 73% had been approached, compared with 49% for 50 to 499 acres, 32% for 10 to 49 acres and 21% for the smallest properties.

Conservation easements

Conservation easements are voluntary contracts between a landowner and land trust or agency that restrict real estate development, certain land-use practices, and other relevant activities on private property in exchange for payment or tax relief for the owner. Of the landowners surveyed, 41 had a conservation easement on their property (unweighted data), or 6% of all landowners from the weighted sample. Because of this small number, all subsequent statistics on easement holders are unweighted. There were no significant differences in easements based on property size. Together, the 41 easements covered approximately 41,000 acres and represented 3% of the total acres reported. Of the 41 landowners, 30% indicated that they sold the easement, 30%

donated the easement, 13% reported a combination of selling and donating, and 28% purchased the property with an existing easement.

Easements were sold or donated to more than 23 different land trusts. Pacific Forest Trust, a regional land trust focused on protecting private working forests, held seven easements from our sample. Two-thirds of the easements were obtained since 2000. The most popular reasons for selling or donating the easement were “to conserve the land,” “for tax benefit” and “to preserve land for heirs.” When asked whether they would sell or donate the easement again, 92% of landowners said they would.

Although most respondents did not have a conservation easement, there was general interest: 33% of owners without easements indicated that they would consider selling one in the future, and 9% would consider donating an easement. Another 34% indicated that they did not know enough about easements to make a decision.

Ownership trends, fragmentation

Although a small percentage of the surveyed forest and rangeland owners earned income from their land, the majority earned little to no income; they predominantly benefited from its amenity and investment value. Only landowners with the largest properties ranked ownership objectives such as “family tradition or business” and “income source” as important reasons for owning their land and reported income-generating land uses (Figs. 2-3 and 2-4A).

These results are consistent with other studies of California landowners. In a study of California oak woodland owners with more than 20 acres, Campos et al. (2009) found that landowners were willing to forgo significantly greater income from using their land equity for alternate investments in order to keep their land and enjoy its amenities. Drawing on the same population of oak woodland owners, Huntsinger et al. (2010) found that while the acreage grazed by livestock has remained relatively consistent since 1992, the number of owners selling livestock declined, reliance on other income sources increased and the number of owners with small parcels increased.

These findings imply an overall shift from production-oriented owners to amenity and investor ownership in California forests and rangelands. The shift is more pronounced among smaller properties. How this shift might influence the ecological integrity of California’s forests and rangelands is not clear. Rural landowners clearly value the scenic qualities of their land — the most common reason chosen for owning land was to “live near natural beauty.” “Preservation” and “protecting the environment” were also important to a strong majority of landowners of all property sizes (Figs. 2-2 and 2-3), indicating that many feel a sense of stewardship and want to preserve their land’s scenic and environmental qualities. Many of these qualities provide ecosystem services that are shared by society and benefit the public (Huntsinger et al. 2010).

However, owners of large properties, the category with the longest land tenures, were more likely than owners of small properties to implement environmental management or improvement practices (Fig. 2-6). These results raise the question of whether

fragmentation may affect environmental health by facilitating an in-migration of landowners less likely to implement environmental practices. Addressing this question will be an important challenge for conservation in California. The fact that landowners from all property sizes expressed widespread interest in implementing environmental management practices in the future gives cause for optimism, and it highlights the importance of outreach and assistance designed to help landowners better manage their properties.

Landowners face land management costs as well as liquidity challenges when a major portion of their assets is tied up in forest and rangeland. Four of the five most popular reasons why respondents might someday sell their land were related to financial concerns (Fig. 2-8). California has some of the highest land values in the country (Kroll 2009), and landowners can tap into this monetary value only if they choose to sell land or some of the associated development, timber harvesting, mineral or other rights. Since landowners obtain significant amenity benefits from moderate to small properties (Campos et al. 2009), owners of large properties can capture considerable monetary value by selling off parcels, while still maintaining the quality of life they value on their remaining, slightly smaller, property. In fact, this is a tradition among cash-poor livestock producers.

Future of privately owned lands

What will happen when privately owned forests and rangelands change ownership — either through generational transfer of land or sale — is unknown. Family land transfers across the United States are expected to be substantial in the next 10 to 20 years (Butler and Leatherberry 2004). California forest and rangeland owners are 62 years old on average, with a high proportion retired, and many more nearing retirement. The majority of these landowners, especially owners of large properties, plan to pass ownership on to their children or family members. Without proper estate planning, inheritance taxes and disagreements among heirs could make it difficult for many families to keep their properties. Without technical knowledge on environmental management and improvement practices, it may be difficult to maintain the desired amenities.

New owners, through inheritance or in-migration, may bring a new set of ownership goals and objectives, or the current trend toward valuing amenities more than revenue generation may continue. It will be important to update knowledge of these landowners so that forestry and range professionals can effectively provide advice, assistance and outreach, and encourage protection of the ecosystem services that support quality of life for all Californians.

CHAPTER TWO – FIGURES

Fig. 2-1. The study was conducted in 10 counties (outlined in white), within eight of California's 10 bioregions that contain forests or rangelands.



Fig. 2-2. California forest and rangeland owners' reasons for owning land ($n = 578$).

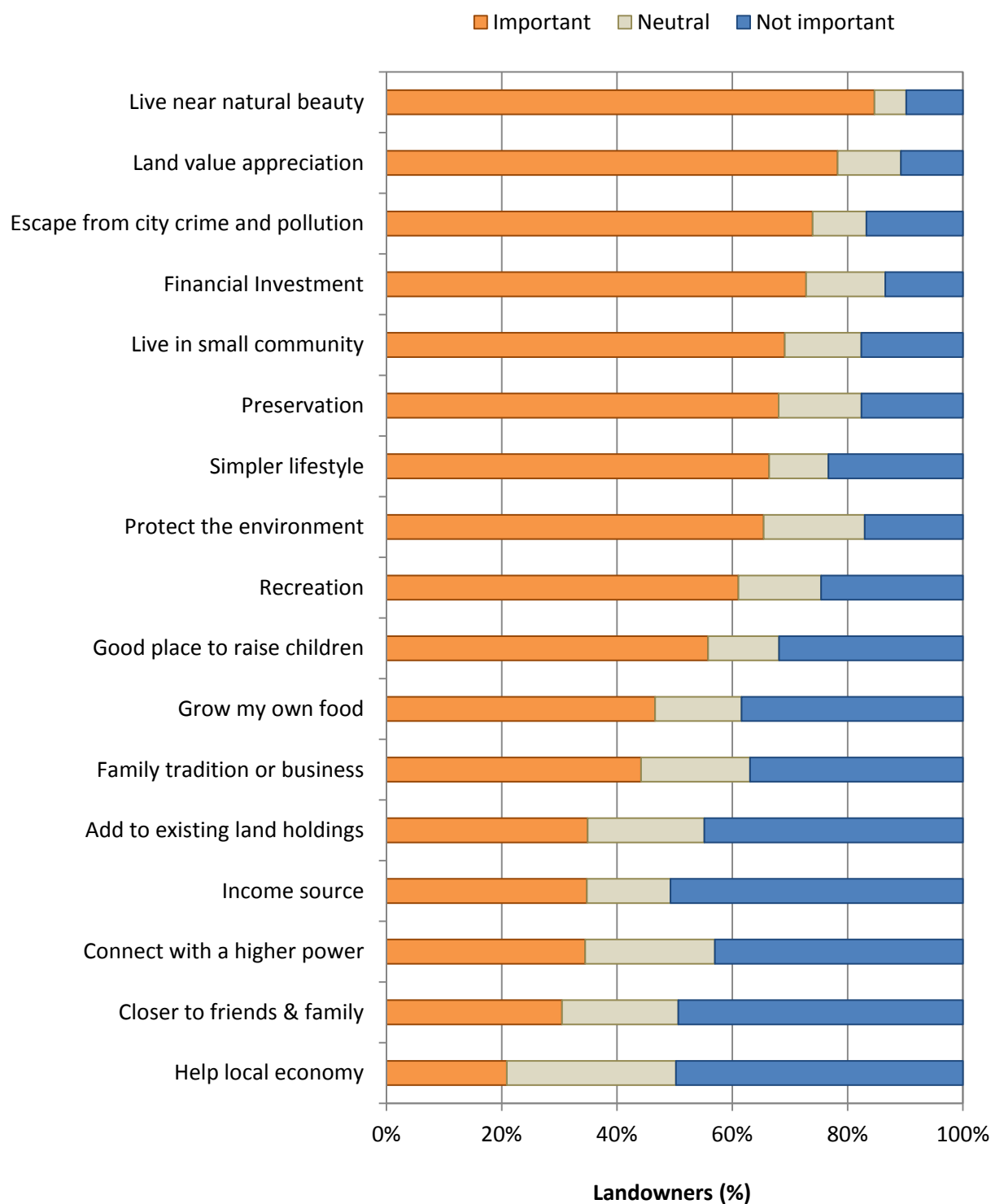


Fig. 2-3. California forest and rangeland owners' reasons for owning land based on property size, 2008. Ownership objectives with significant differences between property sizes are shown (chi-square analysis, $P < 0.01$, $n = 566$).

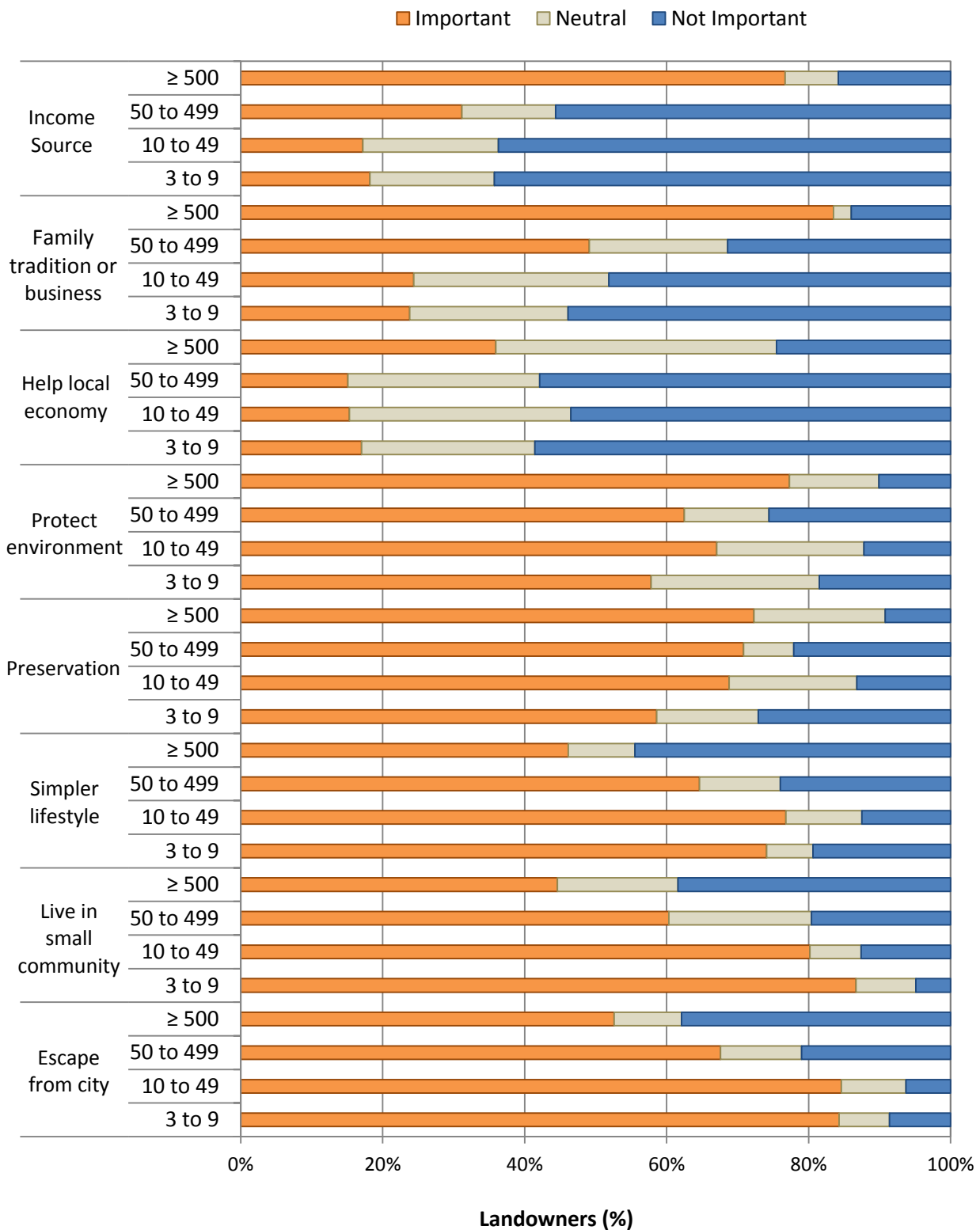
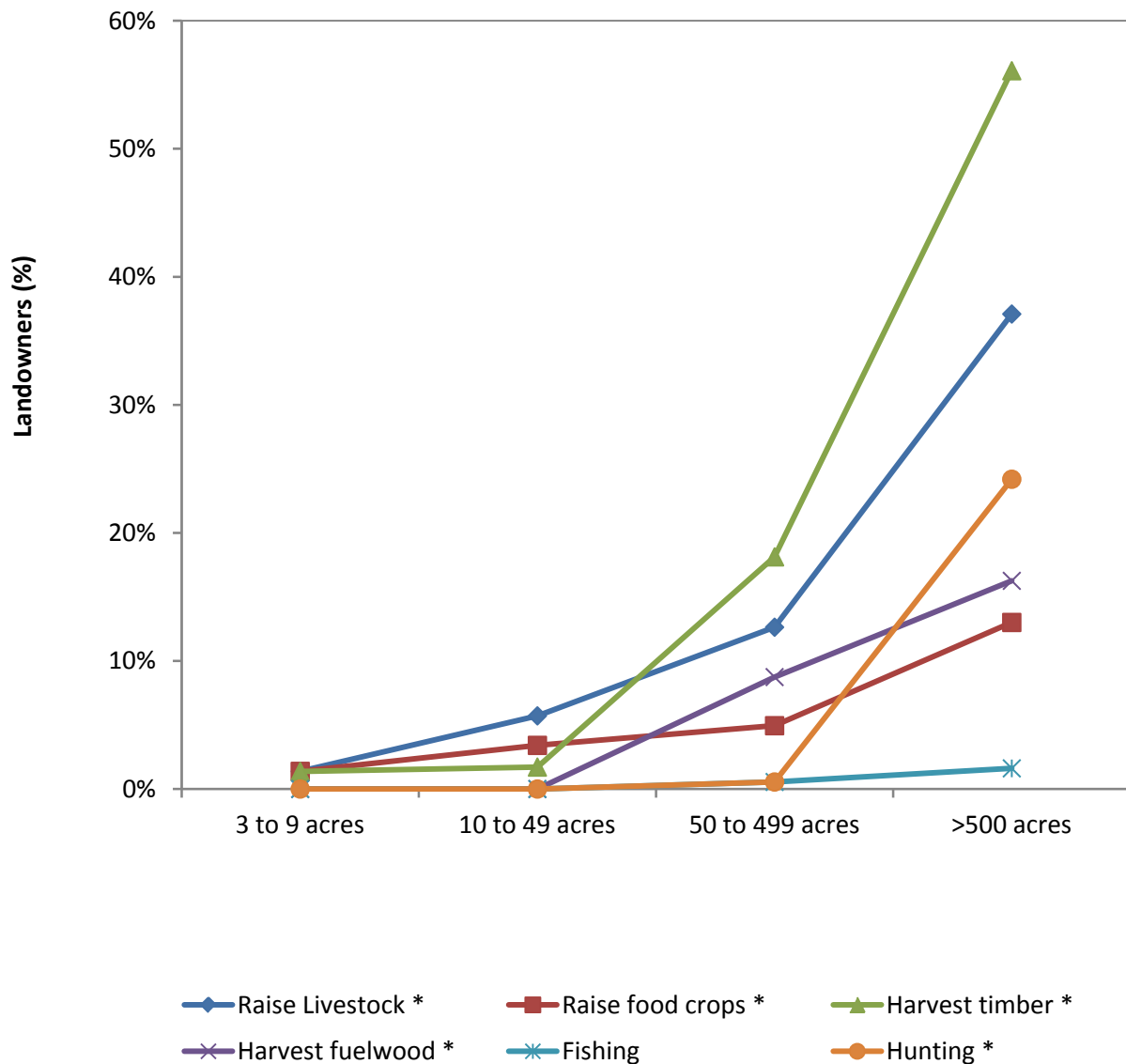


Fig. 2-4. (A) Income production from and (B) personal use of natural resources based on property size for California forest and rangeland owners, 2008; 80% of owners use resources in one of the ways shown (* = significant difference between property sizes, chi-square analysis, $P < 0.01$, $n = 627$).

(A) Income production



(B) Personal use

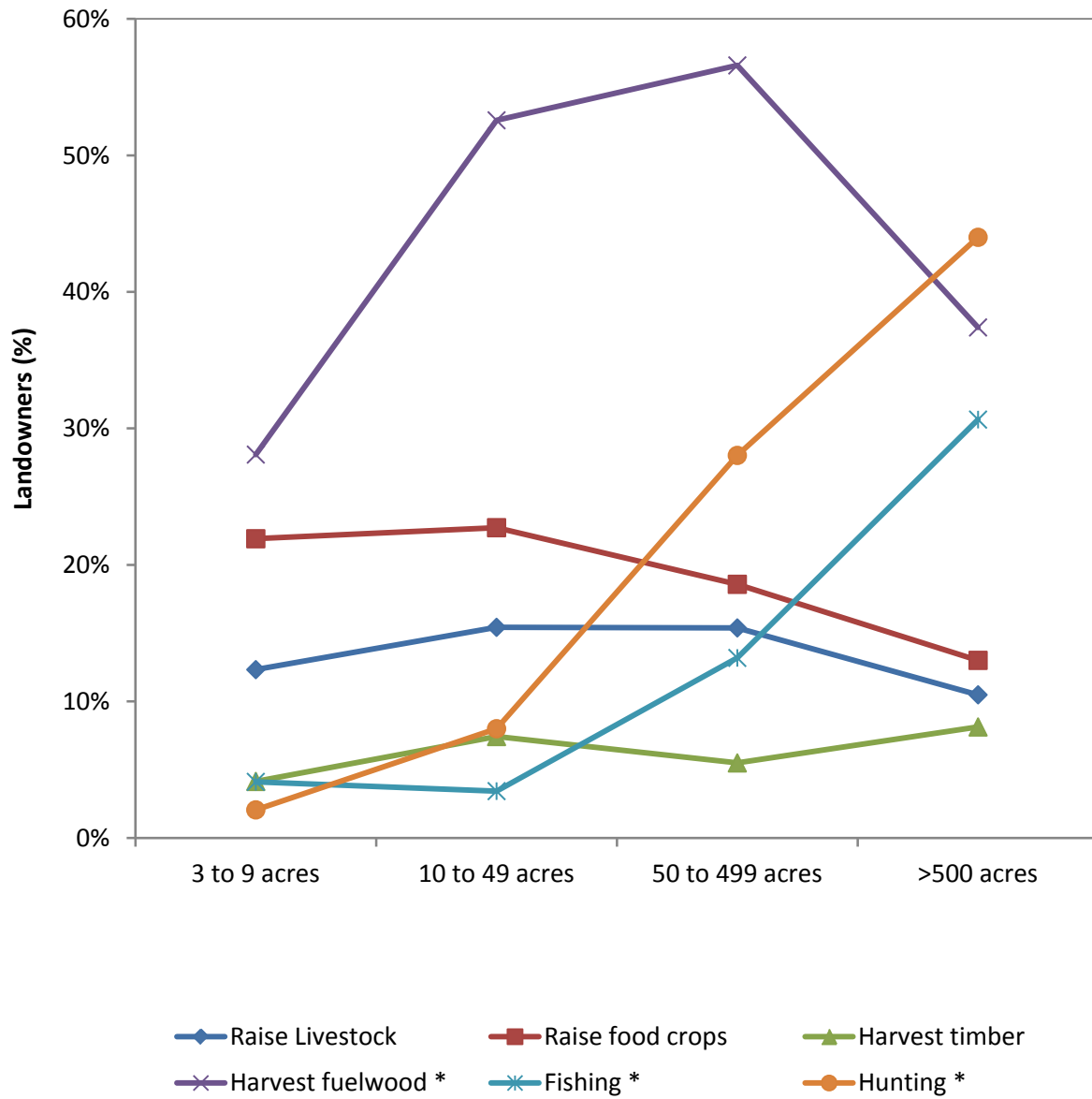


Fig. 2-5. Management practices used by California forest and rangeland owners ($n = 615$).

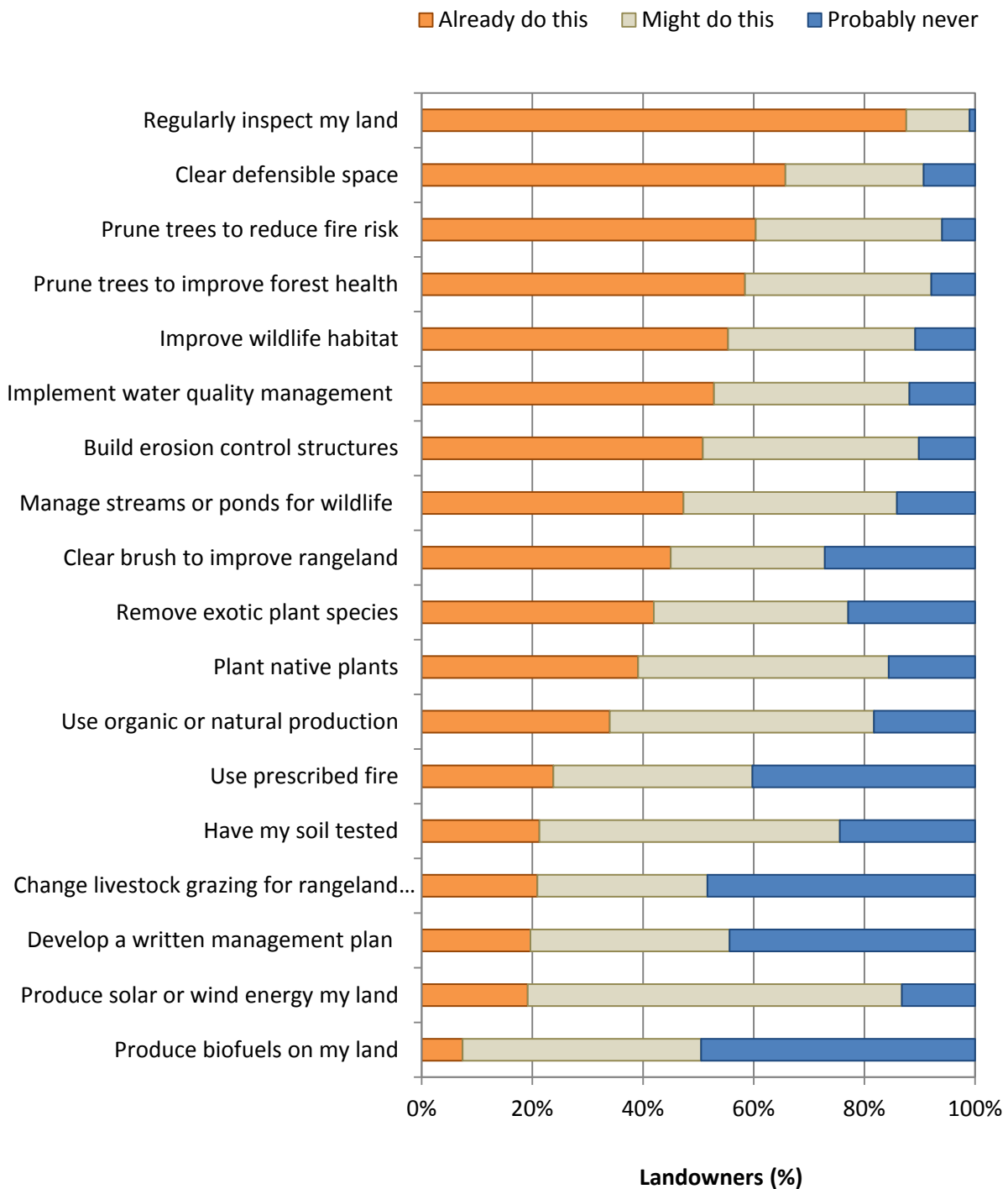


Fig. 2-6. Management practices commonly used by owners of larger properties (in acres) than owners of smaller properties ($P < 0.01$, $n = 596$).

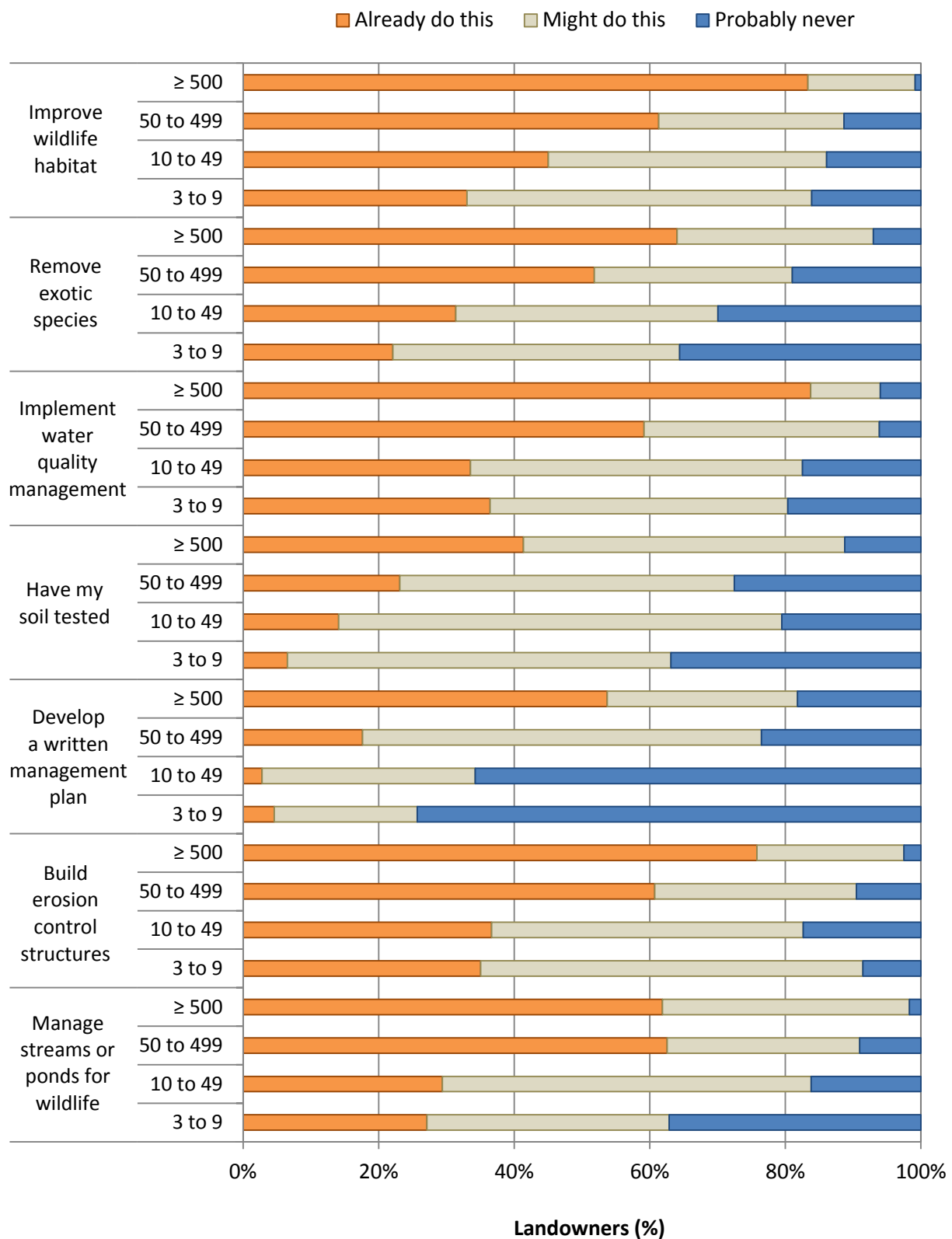


Fig. 2-7. California forest and rangeland owners participating in land management or conservation programs ($n = 624$).

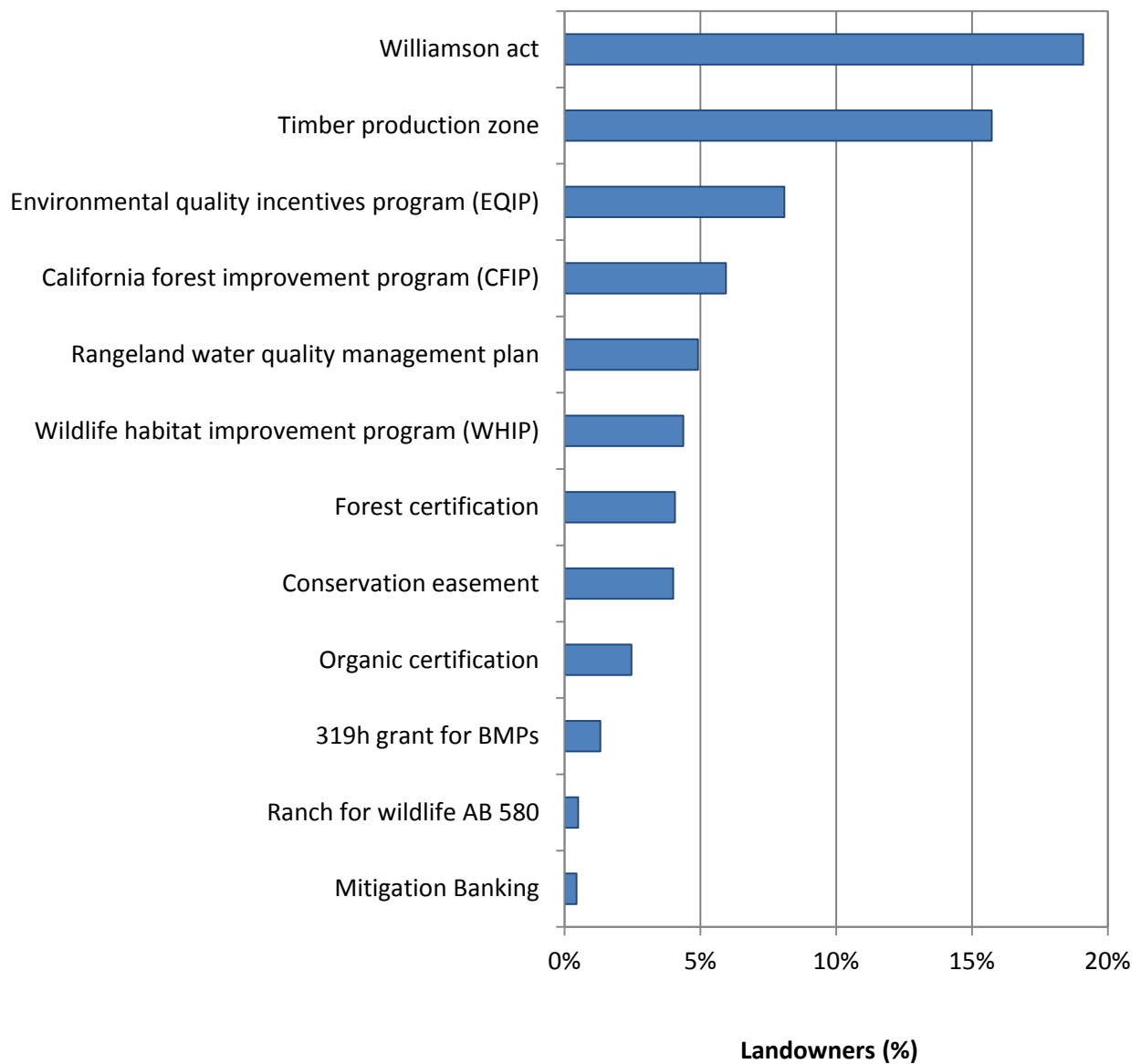
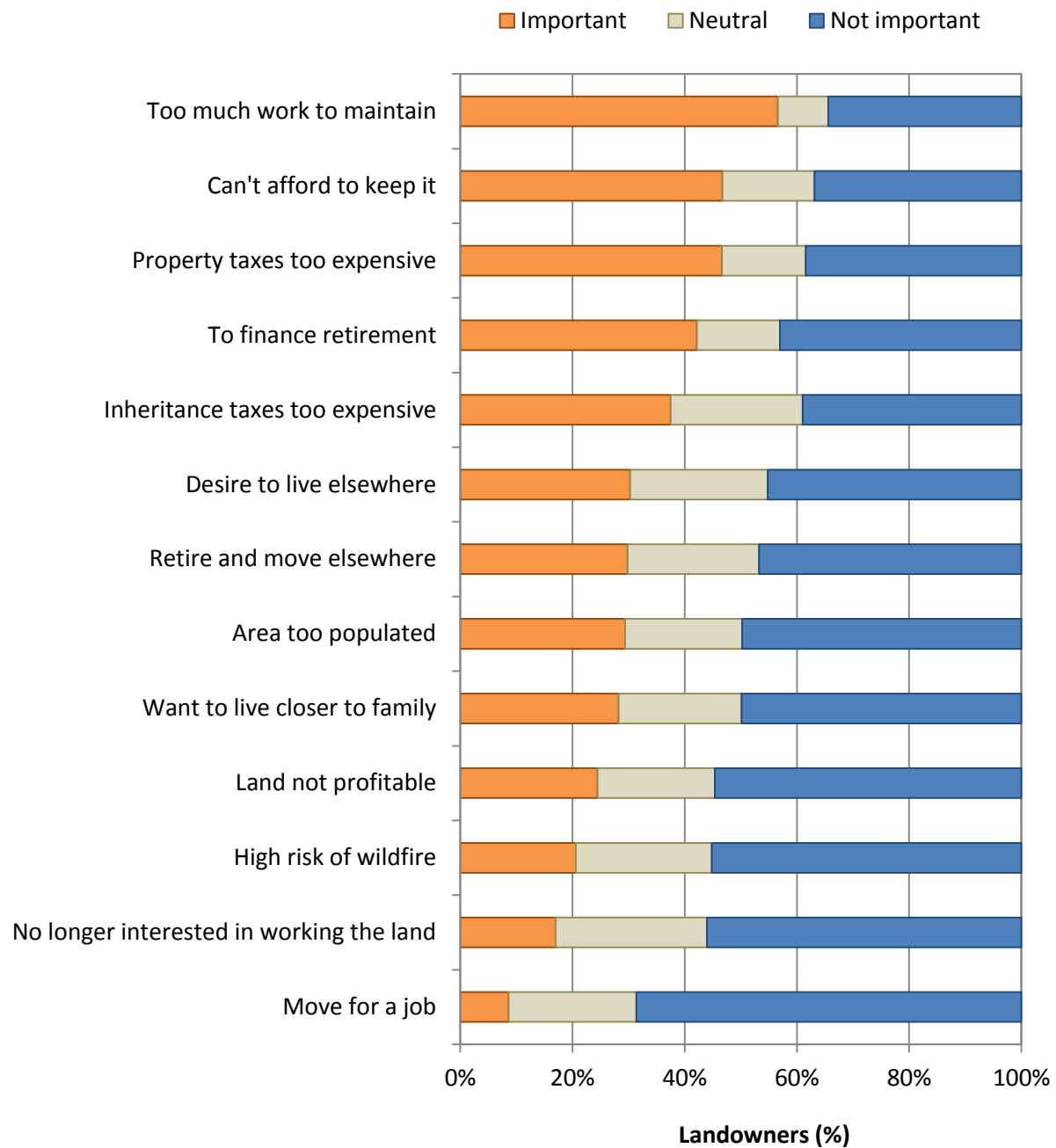


Fig. 2-8. Reasons California forest and rangeland owners stated they might sell their land someday ($n = 552$).



CHAPTER TWO – TABLES

Table 2-1. Demographic profile of California forest and rangeland owners based on property size

		All Landowners	3 to 9 acres	10 to 49 acres	50 to 499 acres	≥ 500 acres	<i>P</i> value*	<i>n</i>
Age (years)	Mean Age	61	63	61	60	64	0.02	516
Gender (%)	Male	65	67	65	62	65	0.62	578
	Female	35	32	33	38	35		
Education (%)	At least some college	90	92	86	92	90	0.19	568
	Bachelor's degree or higher	65	56	65	75	61	0.01	568
Marital Status (%)	Married	81	77	81	84	83	0.48	576
Children (%)	<18 years living in household	22	14	19	35	15	0.00	515
Income (%)	>\$100,000	56	55	48	64	56	0.06	523
	>\$200,000	30	23	22	39	36	0.00	523

* Differences between property sizes, chi-square analysis for categorical data and ANOVA for continuous

Table 2-2. Ownership demographics among forest and rangeland owners in California based on property size

		All Landowners	3 to 9 acres	10 to 49 acres	50 to 499 acres	≥ 500 acres	<i>P</i> value*	<i>n</i>
Land Tenure (years)	Mean length of ownership	31	19	21	29	60	0.00	629
	Std. Deviation	29	12	15	23	41		
Ownership Type (%)	Fee-simple	70	80	79	67	45		
	Trust	19	16	18	24	17		
	LLC	3	0	0	0	18	0.00	596
	Partnership	2	1	2	1	7		
	Other	5	3	2	7	13		
Residency (%)	Primary	60	72	63	55	49	0.00	600
Non-Resident Property Uses (% of non- primary residents)	Vacation or Second Home	46	43	54	35	54	0.09	218
	Rental Unit	7	2	7	15	0	0.01	218

* Differences between property sizes, chi-square analysis for categorical data and ANOVA for continuous

Table 2-3. California forest and rangeland landowner future intentions for their land, shown as a percent of the total for each group.

Future Intentions	All Landowners	3 to 9 acres	10 to 49 acres	50 to 499 acres	≥ 500 acres
Pass it to Children or other Family Member	62	48	63	61	79
Sell it	16	26	13	18	6
Undecided	11	12	14	11	5
Other	6	7	5	5	9
Never thought about it	3	7	3	2	0
Donate it	2	1	2	2	1

CHAPTER THREE

Management without borders? A survey of landowner practices and attitudes towards cross-boundary cooperation

Ecosystem management requires cross-jurisdictional problem-solving and, when private lands are involved, cross-boundary cooperation from many individual landowners. Fragmented ownership patterns and variation in ownership values, as well as distrust and transaction costs, can limit cooperation. Results from a statewide survey of forest and rangeland owners in California were analyzed using an audience segmentation approach. Landowners were grouped into four clusters according to ownership motivations: rural lifestyle, working landscape, natural amenity, and financial investment. All landowner clusters showed willingness to cooperate for pest and disease control, fire hazard reduction, and wildlife conservation, but their degree of willingness differed by cluster, who they were expected to cooperate with, and the natural resource problem addressed. All were more willing to cooperate with neighbors and local groups than with state and federal agencies. Landowners were most willing to cooperate to reduce fire hazard, which is the most direct threat to property and well-being.

Introduction

Since the 1980s “ecosystem management” has been recommended by conservation scientists for managing natural resources (Grumbine 1994). Although several definitions have been used key principles include a focus on environmental sustainability; recognition of ecosystem complexity and connectedness; importance of context and scale; and use of adaptive management to account for uncertainty, dynamism, and limits to knowledge. This approach explicitly acknowledges the need to actively manage ecosystems at the scale of ecological processes (Christensen et al. 1996). Though it has been formally adopted by land management agencies at both the state and federal level (Malone 2000; Butler and Koontz 2005), it is challenged by a variety of political, cultural, and legal barriers, including fragmented land ownership patterns (Koontz and Bodine 2008).

Ecosystem management requires cross-jurisdictional problem-solving (Yaffee 1996). Even extensive public lands are often intermixed with and bordered by private lands. Typically, private landscapes are fragmented into multiple parcels and embedded in an “ownership-centric” framework where decisions are made at the parcel scale (Rickenbach et al. 2011). Conservation strategies and policies are often implemented on a parcel-by-parcel basis. Cross-boundary cooperation among landowners provides one method to achieve multi-scalar management within a fragmented ownership landscape.

More than half of the United States is privately owned. Private forest and rangelands provide ecosystem services and are crucial to biodiversity conservation (Scott et al. 2001). Absent the political will to create an extensive, cross-jurisdictional regulatory

framework, coordinated ecosystem management must engage landowners as willing partners, despite their widely varying goals, objectives, and constraints, and the “transaction costs” of cooperation (Goldman, Thompson, and Daily 2007). Yet we have little empirical knowledge of how different types of landowners might respond to cross-boundary management initiatives. In this paper, the results of a statewide survey are used to characterize forest and rangeland owners in California, to assess their current management practices, and to determine attitudes toward cross-boundary cooperation for natural resources management as related to their motives for owning the land. California is faced with many cross jurisdictional environmental problems, such as wildfire, insect and disease epidemics, and fragmentation of wildlife habitat. Addressing these issues will require engaging private landowners in cooperative ecosystem management.

Cross-boundary cooperation

Cross-boundary cooperation is defined as a voluntary behavior in which landowners account for the plans and practices of adjacent or nearby properties when making management decisions about their land (Bergmann and Bliss 2004; Kittredge 2005; Gass et al. 2009; Rickenbach et al. 2011). This ranges from information sharing to cooperation in planning and management implementation (Kittredge 2005; Rickenbach et al. 2011). The literature on cross-boundary cooperation generally falls within three categories: landscape feasibility and impacts, institutional environment, and landowner receptivity (Rickenbach et al. 2011). The benefits of coordinated management are well documented within the landscape impacts literature and include the protection of ecosystem services (Goldman, Thompson, and Daily 2007), habitat connectivity (Grant and Quinn 2007), wildfire prevention (Field and Jensen 2005), or increased economies of scale for production-oriented landowners (Schulte, Rickenbach, and Merrick 2008). These benefits may be synergistic, independent, or require tradeoffs among them.

Institutional studies, in contrast, assess the policies and organizations that support cross-boundary cooperation, such as landowner cooperatives or associations (Kittredge 2005, 2003; Blinn, Jakes, and Sakai 2007; Wolf and Hufnagl-Eichiner 2007; Hull and Ashton 2008; Rickenbach 2009), watershed councils (Rickenbach and Reed 2002), or voluntary incentive programs (Goldman, Thompson, and Daily 2007). Institutional support, although not sufficient alone for cooperation, can provide the resources and infrastructure that catalyze cooperation (Rickenbach et al. 2011).

Landowner receptivity studies focus on what influences a landowner’s willingness to cooperate. These factors vary, but often revolve around social relationships, including relationships with neighbors (Yung and Belsky 2007), relationships with “boundary spanners” – such as a professional forester or other natural resource professionals (Gass et al. 2009), and relationships with partnering organizations (Bergmann and Bliss 2004). Although landowners have demonstrated willingness to consider cross-boundary cooperation (Finley et al. 2006), successful outcomes are heavily influenced by factors such as trust, reciprocity, shared values, and shared purpose (Bergmann and Bliss 2004; Rickenbach et al. 2011).

This research contributes to our understanding of landowner receptivity by comparing values, management practices, and support for cross-boundary cooperation across different landowner types. Rural communities throughout the United States are in the midst of “rural restructuring” largely driven by amenity migration – the movement of people based on the draw of natural and/or cultural amenities (Gosnell and Abrams 2011). New landowners bring new values and land use practices to the landscape, which can conflict with longer-time landowners (Walker and Fortmann 2003; Yung and Belsky 2007). These conflicts can create strong barriers to successful cooperation. Moreover, a simple dichotomy of “new landowners” versus “old landowners” does not always capture the variation necessary to understand landowner behavior. Both groups can vary substantially in their beliefs and views about land ownership and management. Understanding differences in landowner willingness to cooperate is a first step for building future cooperative partnerships.

Landowner segmentation

Audience segmentation separates a heterogeneous population like landowners into homogeneous subgroups based on shared characteristics (Surendra, Mehmood, and Schelhas 2009). It has been widely used in the marketing field for identifying subgroups of consumers (Wedel and Kamakura 2000), in communication campaigns for health education (Slater 1996), and more recently to segment landowner populations for targeted outreach or policy interventions.

To date, landowner segmentations in the United States have focused heavily on forest landowners (Table 3-1). Most articles use land ownership motivations (i.e. the landowners’ reasons for owning their land) as an input into segmentation (Richter 2005; Kurtz and Lewis 1981; Finley and Kittredge 2006; Marty, Kurtz, and Gramann 1988; Butler et al. 2007; Ross-Davis and Broussard 2007), and many articles base segmentation solely on ownership motivations (Kline, Alig, and Johnson 2000; Kendra and Hull 2005; Finley and Kittredge 2006; Salmon, Brunson, and Kuhns 2006; Majumdar, Teeter, and Butler 2008; Kaetzel, Hodges, and Fly 2011). Other variables used in segmentation include rural versus urban residency (Surendra, Mehmood, and Schelhas 2009), future plans for the land (Butler et al. 2007), management behavior (Finley et al. 2006), residency status (Kluender and Walkingstick 2000; Ross-Davis and Broussard 2007), property size and land tenure (Ross-Davis and Broussard 2007), and other demographic characteristics.

Emtage et al. (2006) found that typologies developed independently in five different studies in Australia picked up like patterns of similarities and differences between landholders, and concluded that they reflect fundamental variations in landowners. This appears to also be the case for forest owners in the United States. Features used to characterize landowner segments in multiple papers include a focus on land-production (timber-management in the case of forest owners), value placed on natural amenities, the landowner’s environmental or conservation ethic, the residency status of the landowner, the income tier of the landowner, indifferent or passive ownership objectives, or financial investment ownership goals. Moreover, in several studies,

significant differences were found in how landowner groups manage their land. For example, landowners with passive ownership motivations and absentee landowners have been shown to have less active management activities than other types of landowners (Kendra and Hull 2005; Ross-Davis and Broussard 2007; Surendra, Mehmood, and Schelhas 2009), whereas multiple-objective, production-oriented or utility landowners are more likely to implement management activities related to timber harvest (Majumdar, Teeter, and Butler 2008; Ross-Davis and Broussard 2007; Kaetzel, Hodges, and Fly 2011). Amenity and environmental focused landowners tend to manage forests for wildlife habitat, scenic beauty and other natural amenities (Kluender and Walkingstick 2000; Kendra and Hull 2005).

Audience segmentation is exploratory in nature. The most extensive literature on segmentation is found in the market-based literature; however, there is no single recognized way to perform this type of analysis. A wide range of methods have been proposed and utilized to create landowner typologies. A distinct advantage to basing clustering on ownership motivations is that it can capture the variation necessary to form meaningful clusters, yet still leave other variables available for hypothesis testing. Here we present results from a cluster analysis based on ownership motivations of a forest and rangeland landowner survey in order to:

1. Identify distinct groups of California forest and rangeland landowners based on their objectives for land ownership;
2. identify differences between landowner groups in implementation of land management practices;
3. identify differences between landowner groups in attitudes towards cross-boundary cooperation; and,
4. assess landowner support for cooperation based on potential partner and topic.

Methods

Sampling design

We surveyed owners of private forest and rangeland parcels in ten counties in California selected by a group of experts to be representative of bioregions designated by the state's natural resources assessment program (CDFFP 2003). The counties included in the survey were Humboldt, Mendocino, Sonoma, Contra Costa, Santa Barbara, San Diego, Shasta, Plumas, Sierra, and El Dorado counties (see Fig. 2-1 for a map of study area). Because they have small populations, the adjacent Sierra and Plumas counties were combined and treated as a single sampling unit. Within each county, survey recipients were selected from a statewide land parcel database created in 2003 by CalFire, the state forestry and fire protection agency, using a stratified random sampling design. The database was stratified first by vegetation type at the parcel center using two general vegetation categories – forest (conifer and hardwood forest) or rangeland (oak woodlands, grassland, and shrubland). These groups were then stratified again into four parcel size groups: 3 to 9 acres (~1 to 4 ha), 10 to 49 acres (~5 to 19 ha), 50 to 499 acres (~20 to 202 ha), and ≥ 500 acres (>202 ha). A random sample of 30 parcels was pulled from each stratum when possible, for a total of approximately 240 parcels per county.

All duplicate addresses were dropped from the sample. Questionnaires were mailed to 1,730 landowners.

Survey design

The questionnaire included questions modified from previous landowner surveys (Liffmann, Huntsinger, and Forero 2000; Kendra and Hull 2005; Huntsinger et al. 2010) and several new questions designed to address regionally unique issues or new areas of concern. All questions were pre-tested in January of 2008. Questionnaires were mailed spring of 2008 following a modified version of the Dillman Total Design Method (Clendenning, Field, and Jensen 2004; Dillman 2007). An identical Internet version of the survey was also offered. Questionnaires were returned by 670 people. After adjusting for undeliverable questionnaires and questionnaires sent to non-forest or rangeland owners, the adjusted response rate was 43% (see Appendix A for detailed response rates).

Nonresponse bias is an important concern in survey research and occurs when survey respondents differ systematically from nonrespondents. Nonresponse bias was tested using an extrapolation method of successive waves. This method compares early respondents to later respondents and is based on the assumption that subjects who respond less readily (i.e. in later waves and with more prodding) are more like nonrespondents (Armstrong and Overton 1977).

We compared three waves of survey respondents: those who responded following receipt of the initial survey or follow up postcard; those who responded following receipt of the second survey or follow up postcards; and those who responded following receipt of the third and final survey. No significant differences were found for all demographic variables including age, gender, marital status, children living at home, education, and income. Reasons for land ownership (see description below) formed the basis for cluster analysis and were tested for nonresponse bias using the Kruskal-Wallis test. Of the 17 potential reasons for land ownership, only two varied between response waves. Late respondents had slightly higher mean values for “it is a good financial investment” ($p=0.05$) and “to benefit from land appreciation” ($p=0.01$) as reasons for land ownership. These results suggest that non-respondents may be slightly more motivated by the financial benefits of land ownership than respondents.

Landowner segmentation

Respondents were asked to rate 17 potential reasons for land ownership using a Likert scale from 1 to 5, where a value of 1 indicates a reason is *not at all important* and 5 indicates a reason is *highly important* (see Table 3-3 for a list of all 17 ownership motivation variables). Factor analysis was used to reduce the dimensionality of the 17 ownership motivation variables. Principal components analysis (PCA) using a polychoric correlation matrix was used to determine the number of common factors based on the number of principal components with eigenvalues > 1 (Johnson and

Wichern 2007). An iterated principal factor analysis was then performed using the polychoric correlation matrix. Polychoric correlations can be used in place of a standard correlation matrix when using ordinal data without violating an assumption of normality (Kolenikov and Angeles 2004). The polychoric correlation matrix was downloaded as an add-on module in Stata statistical software (Kolenikov 2010). Results were rotated using Varimax rotation to improve interpretation.

Four of the initial variables had high uniqueness values (> 0.5) in the rotated pattern matrix, and did not load heavily on any single component. These variables were removed, and the PCA and factor analysis were repeated with the remaining 13 ownership motivation variables only. All 13 variables loaded (>0.5) on at least one factor and none had high uniqueness values (Table 3-2). Factor scores were then calculated using a regression method and the rotated factor analysis for the 17-variable solution and alternatively for the 13-variable solution.

Using the factor analysis scores as input, we tested several hierarchical and non-hierarchical clustering techniques on both the 17-variable solution and the 13-variable solution. A hierarchical method using Ward's minimum variance on the 13-variable factor scores provided the most stable and interpretable cluster solution. Ward's method is based on least squares criteria and seeks to minimize the increase in error sum of squares after joining two cluster groups (Johnson and Wichern 2007). A four-cluster solution was chosen based on visual interpretation of the cluster dendrogram (see Appendix D for a detailed explanation of why this cluster solution was selected). Cluster names were chosen based on group mean values for the original ownership motivation variables (Table 3-3).

Factor scores used in cluster analysis were then used in a quadratic discriminant analysis (QDA) to validate cluster results. A leave one-out classification summary was used to assess cluster stability. Misclassifications were under 12% for each group, thus clusters were assessed to be adequately stable.

The segmentation method described here improves on previous landowner segmentation methods in several important ways that are worth noting. First, many studies use a standard correlation matrix in data reduction to de-correlate data prior to cluster analysis. If clustering variables are ordinal this violates assumptions of data normality. Instead, we utilized a polychoric correlation matrix in data reduction which does not require normal data (Kolenikov and Angeles 2004). Second, landowner segmentation studies predominately use the K-means clustering algorithm which is sensitive to initial seeding and requires a priori information on the final number of groups (Jain 2010). We implemented a hierarchical clustering algorithm to avoid these problems and determined clustering solution empirically using the cluster dendrogram. Third, few studies assess cluster stability following cluster analysis; we used QDA to assess clustering results.

Unless otherwise noted, differences between clusters in demographic characteristics, land tenure, or property size were tested using chi-square analysis for all categorical variables, and ANOVA for all continuous variables. Differences between groups for ownership objective variables were tested using a Kruskal-Wallis test.

Management practices

Respondents were provided a list of management practices and asked to choose between: *I already do this*, *I might do this*, *I will probably never do this*, or *this does not apply to my land*. For each practice, any respondent that chose *this does not apply to my land* was removed from further analysis for that variable only. Responses were then recoded to separate respondents that already implement each practice from respondents that do not currently implement the practice. Differences between clusters were tested using Chi square analysis.

Cross-boundary cooperation

Respondents were asked to rate their level of agreement with 13 different statements about land management cooperation using a Likert scale from 1 (*strongly disagree*) to 5 (*strongly agree*). Statements included three potential topics for cooperation (reduce fire hazards, protect wildlife areas and corridors, or control insect and disease outbreaks) and up to four possible partners in cooperation, ranging from neighbors to different types of government organizations. These specific topics were chosen because they require landscape scale management solutions and are of high concern in California, thus increasing the likelihood that landowners have a priori knowledge of the topic. Differences between clusters were tested separately for each potential partner and topic using a Kruskal-Wallis test. Differences between potential partners were tested for each topic using the full sample and separately by cluster using the Friedman Test.

Cooperation indices were then calculated by adding the score for all potential partners associated with each topic then dividing by the number of variables used. Differences between index scores were tested using the Wilcoxon signed rank sum test.

To assess other potential factors that could influence landowner support for cooperation, an ordered logistic regression was run for each cooperative scenario (i.e. partner and topic) with indicators for the landowner groups and four explanatory variables – age, absenteeism, land tenure, and property size.

All statistical analysis was performed using Stata 11.0 statistical software.

Results

Four groups were identified and characterized by ownership motivations as *rural lifestyle*, *working landscape*, *natural amenity*, and *financial investment* owners. The four groups were similar in terms of age, gender, marital status, education level, retirement status, and in the proportion with conservation easements on their land. The groups differed significantly, however, in length of land tenure, residency status, income, property size, and earning income from the land through raising livestock, growing food crops, harvesting timber, harvesting trees for fuelwood, or allowing fishing or hunting on their land for fee (Table 3-4).

Cluster 1: Rural Lifestyle

This group had high mean values for variables associated with living and raising a family in a rural area including “live near natural beauty,” “escape from city crime and pollution,” “live in a small community,” “good place to raise my children,” and “live a simpler lifestyle” (Table 3-3). This group had the highest percentage of primary residents and tended to own small properties (<50 acres). On average they had owned their land for 33 years, second only to landowners in the working landscapes cluster. Approximately one-third of rural lifestyle landowners reported earning income from their land (Table 3-4).

Cluster 2: Working Landscape

The working landscape group had high mean scores (≥ 3.5) for most ownership variables, and very high scores (≥ 4.5) for environmental variables such as “live near natural beauty,” “protect the environment,” and “preserve open space or natural resources.” The name of this group, however, was chosen based on variables uniquely important to this cluster including “family tradition or business,” “income source,” and “help the local economy” (Table 3-3). Sixty percent of respondents in this group earned income from their land. These landowners tended to be primary residents and had owned their land or it had been in their family significantly longer than all other clusters. This group also had the highest median property size, and the highest percentage of ownerships 500 or more acres in size (Table 3-4).

Cluster 3: Natural Amenity

The natural amenity group had the highest mean value out of all four groups for “live near natural beauty.” Lifestyle variables such as “escape from city crime and pollution,” “live in a small community,” and “live a simpler lifestyle” were also important to this group, however unlike the rural lifestyle group, natural amenity owners had high scores for “protect the environment” and “preserve open space or natural resources” and low scores for “good place to raise my children” (Table 3-3). These landowners had the shortest mean land tenure of all groups, and the smallest median property size. This group was also the least likely to earn income from their land (Table 3-4).

Cluster 4: Financial Investment

Unlike other groups, only two ownership motivation variables were important to this group: “benefit from land appreciation over time,” and “financial investment” (Table 3-3). Less than one-fourth of financial investment landowners were primary residents, substantially fewer than all other groups. They also tended to own large properties, with a higher median property size than all groups except working landscape owners (Table 3-4).

Management practices

Landowners reported carrying out a wide variety of management practices for environmental improvement. Overall, the practice with the highest percent implementation was to clear defensible space to reduce wildfire risk (63%), followed by prune or cut down trees to reduce wildfire risk (59%) or improve forest health (59%), improve wildlife habitat (56%), implement water quality management (54%), build erosion control structures (47%), manage streams or ponds for wildlife benefit (47%), plant native plant species (37%), and remove exotic plant species (36%).

Working landscape owners were significantly more likely to implement management practices on their land than other groups of landowners (Fig. 3-1). This pattern was consistent for most practices but did not hold for those related to wildfire prevention, where rural lifestyle and natural amenity owners were almost as likely, or more likely to currently implement the practices.

Cross-boundary cooperation

Most landowners agreed that it is important to cooperate on the three natural resource initiatives asked about in the survey. The strength of agreement, however, varied by topic, possible collaborating partner, and cluster. Landowners agreed most strongly with importance of cooperation to reduce fire hazard on their property, indicated by a cooperation index score of 4.12 for fire hazard (based on a scale from 1 to 5). This was followed by insect and disease outbreaks (3.71 index score), and wildlife areas and corridors (3.53 index score). Differences between cooperative topic index scores were statistically significant ($p < 0.05$).

For each topic, there was also variation in the strength of agreement based on potential partners. Respondents expressed strongest support for cooperation with neighbors, and the least support for cooperation with federal agencies for all three management topics (Fig. 3-2). Differences between potential partners were significant ($p < 0.05$) when tested separately by landowner group, and with all four groups combined.

For all but one potential scenario, natural amenity owners expressed strongest support for cooperation, followed by working landscape owners, rural lifestyle owners, and financial investment owners (Fig. 3-2). Differences between groups were most pronounced for variables associated with cooperation on wildlife areas and corridors, however, for each potential partner and topic, differences between groups were statistically significant ($p < 0.05$). Although most scenarios received a mean score greater than three (i.e. neutral), two groups (rural lifestyle and financial investment) had mean scores under three for cooperation with federal agencies to protect wildlife areas and corridors.

For all potential scenarios, landowner group membership was significant ($p < 0.05$) in the ordered logistic regression analysis. The other four explanatory variables (age, absenteeism, land tenure, and property size) were not significant. These four variables analyzed as a set without the landowner groups were also not significant.

Discussion

Four distinct groups of forest and rangeland owners in California were defined and characterized based on their ownership motivations. These groups are distinguished in ways also found important in typologies derived in other studies (Table 3-1) suggesting that they reflect fundamental variation in landowners. For example, most studies define a group focused on land production or multiple-ownership objectives, many identify a group of environmental and/or natural amenity focused owners, several identify a group of investment focused owners, and many identify residential and family oriented groups. Butler (2005) proposed that most landowners can be placed along a profit-amenity continuum according to utility maximization theory, i.e. landowners maximize utility from their land by optimizing profit and amenity values. Our results also provide support for this theory as all four groups placed high value on financial profit, natural amenities, cultural amenities, or a combination of these. Moreover, understanding where these groups fall on this continuum can help guide the creation and implementation of cooperative ecosystem management initiatives.

Financial investment owners were interested solely in the financial value of their land placing them on the extreme end of the profit-amenity continuum. These owners are comparable to the “absentee-investors” identified by Kendra and Hull (2005) as they were predominately absentee landowners and were the group least likely overall to implement management practices. Rural lifestyle owners, in contrast, had the highest percentage of primary residents and were primarily interested in the cultural amenities associated with land ownership, specifically those related to living and raising a family in a rural area. This group demonstrated similarities to the “woodland retreat” owners described by Butler et al. (2007). However, unlike the woodland retreat owners, rural lifestyle owners expressed neutrality toward the importance of environmental protection or preservation.

Natural amenity owners, like rural lifestyle owners, also valued the cultural amenities associated with landownership but additionally expressed a strong environmental ethic. Much has been written about amenity-type landowners (e.g. Gosnell and Abrams 2011) and natural amenity landowners in this study most closely match the descriptions of post-productivist landowners that are more interested in the consumption of rural landscapes than natural resources. These landowners had characteristics similar to the “woodland retreat” owners described by Butler et al. (2007), the “preservationists” described by Kendra and Hull (2005), the “resident conservationists” described by Kluender and Walkingstick (2000), the “John Muir” segment described by Finley and Kittredge (2006), and the “conservation cooperators” described by Finley et al. (2006).

Of all four groups, working landscape owners had the broadest ownership objectives, with high value placed on financial objectives, cultural amenities, and natural amenities. They were the only group to consider ownership motivations such as continuing a family tradition or business or earning income from the land important, and had the highest mean scores for variables associated with environmental protection and enjoyment of the natural landscape. Similar to the “working the land” group described by Butler et al. (2007) and the “multiple-objective owners” described by Majumdar et al. (2008), these landowners appear to maximize both the amenity and financial benefits of land

ownership. Working landscape owners were also significantly more likely to implement management practices for environmental improvement on their land. Although previous studies have documented higher implementation of income generating activities, such as timber harvest, by production-oriented landowners (Majumdar, Teeter, and Butler 2008; Ross-Davis and Broussard 2007; Kaetzel, Hodges, and Fly 2011), our results indicate that working landscape owners are also actively managing their land for environmental benefit. The concept of working landscapes reflects a goal of combining commodity and ecosystem services production (Huntsinger and Sayre 2007). The characteristics of this group suggest that they are motivated by both kinds of goals, and reveals that they are active managers of the land.

Overall, landowners supported the idea of cooperation and gave high scores (above neutral) to all scenarios posed in the survey. Landowners understand the need to address some natural resource issues at scales larger than their own properties, particularly for reduction of fire hazard, which had the highest scores. Natural amenity owners demonstrated strongest support overall for cooperation. This is unsurprising considering the posed scenarios, as amenity-type landowners tend to support environmental protection and conservation of wildlife habitat (Kluender and Walkingstick 2000; Kendra and Hull 2005). It is possible that cooperative scenarios more utilitarian in nature, such as timber harvest or recreation access would have yielded different results, as was the case for “conservation cooperators” identified by Finley et al. (2006). More surprising is the fact that financial investment owners were moderately supportive of cross-boundary cooperation for almost all topics and potential partners. Investment owners have been described as being uninterested in their land (Kendra and Hull 2005) and financial investment owners from this study did not consider environmental protection an important reason for land ownership. Still, these landowners appear willing to consider cross-boundary management solutions to solve landscape scale environmental problems.

For each topic, all landowner groups showed most support for cooperating with neighbors and least with federal agencies. As shown in Fig. 3-2, there is a general trend where support for cooperation decreased moving from the local level (i.e. neighbors and local agencies) up to the state and finally federal level. Bergmann and Bliss (2004) identified several reasons landowners were reluctant to work with the U.S. Forest Service and other federal agencies for wildfire prevention in eastern Oregon. These included concerns over *accountability* as agency personnel not only have short tenure compared to landowners but are also accountable to multiple national publics and must consider their differing values in management decisions; awareness of *power* differentials and the fear that cooperating with federal agencies will lead to further concessions of power; *uncertainty* that agency interest in cooperation will be sustained if political support changes; and residual *distrust* and resentment from past events involving federal dominance. Although our study did not address why landowners are more reluctant to cooperate with federal agencies, it is likely that the themes identified by Bergman and Bliss are relevant to California, and suggest that cooperative efforts may be more successful if implemented at a local level with local partners. Also relevant is the fact that although landowners are less supportive of cooperating with federal agencies, with only a few exceptions they are not unsupportive of the idea (i.e. mean scores were above neutral for most groups).

Conclusion

Results from this survey are encouraging for those seeking cross-boundary cooperation. Landowners, in general, supported the idea of cooperation and many landowners already implement active management on their land. Landowner group membership proved to be important for predicting both management activities and support for cooperation. This information is valuable to guide future cross-boundary ecosystem management initiatives and helps build our understanding of the factors influencing landowner receptivity to cooperation. The landowner groups identified roughly match those from other studies suggesting these results can be generalized beyond California.

In California's forest and rangelands, fire hazard is clearly a topic for which all landowners support cooperative management, and many landowners are already implementing management to reduce fire risk on their land. Of the environmental problems asked about that are amenable to cooperative solutions, wildfire has the most direct and potentially devastating impact to all categories of landowners throughout the fire-prone west. While incentives for cooperation are recognized for their potential in overcoming the "transaction costs" of cooperation for a landowner, the clarity and level of perceived threat and the potential for risk reduction is likely also to motivate cooperation. In working with landowners to encourage cooperation, the relative costs and benefits of cooperation should be made clear, and it can be expected that problems with obvious high benefits will be more likely to engender cooperation.

CHAPTER THREE - FIGURES

Fig. 3-1. Percent landowners that reported they currently implement each management practice on their land. Differences between groups were tested using Chi-square analysis and are significant at $p < 0.05$ (except when indicated by *). WL = working landscape; NA = natural amenity; RL = rural lifestyle; FI = financial investment.

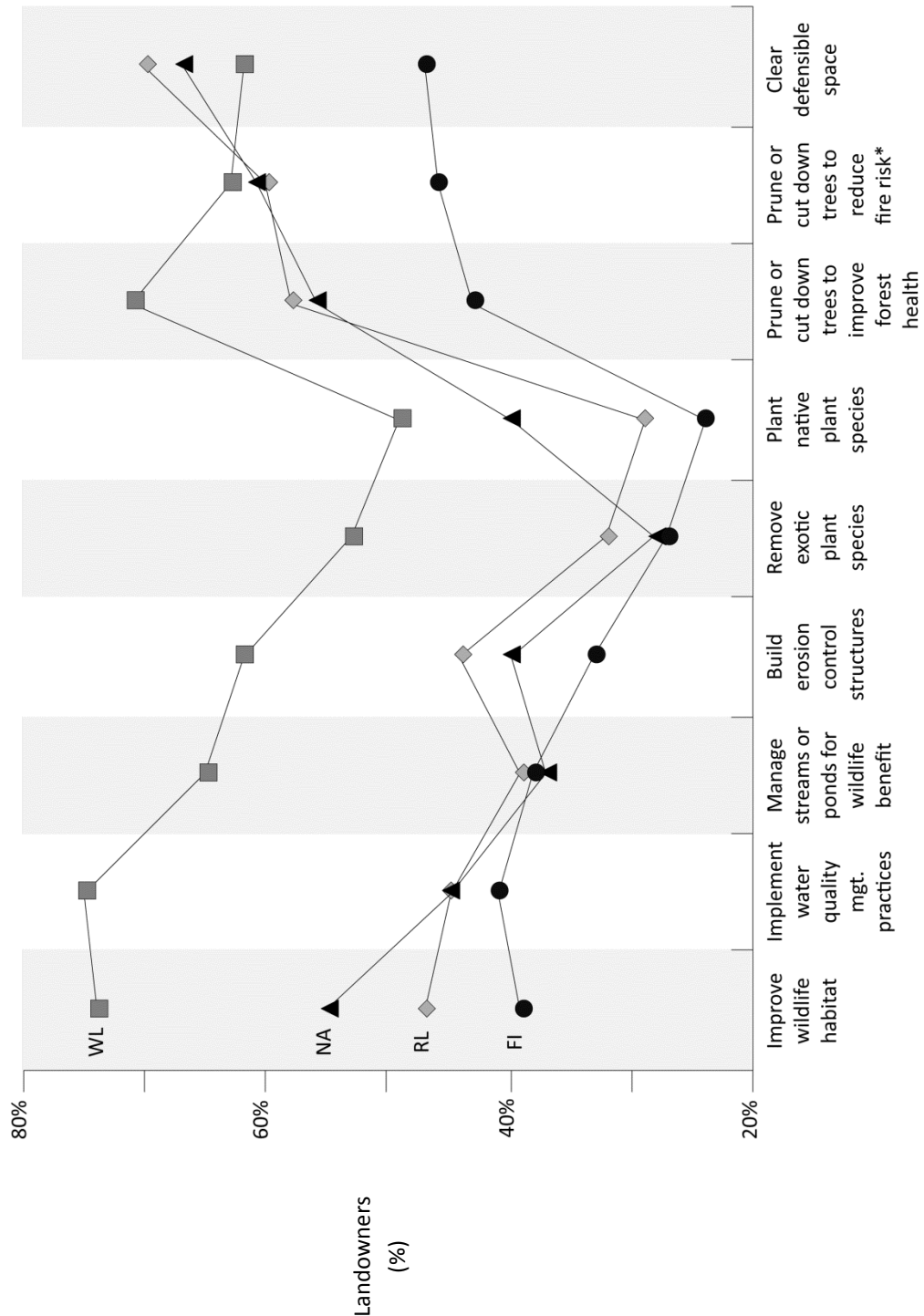
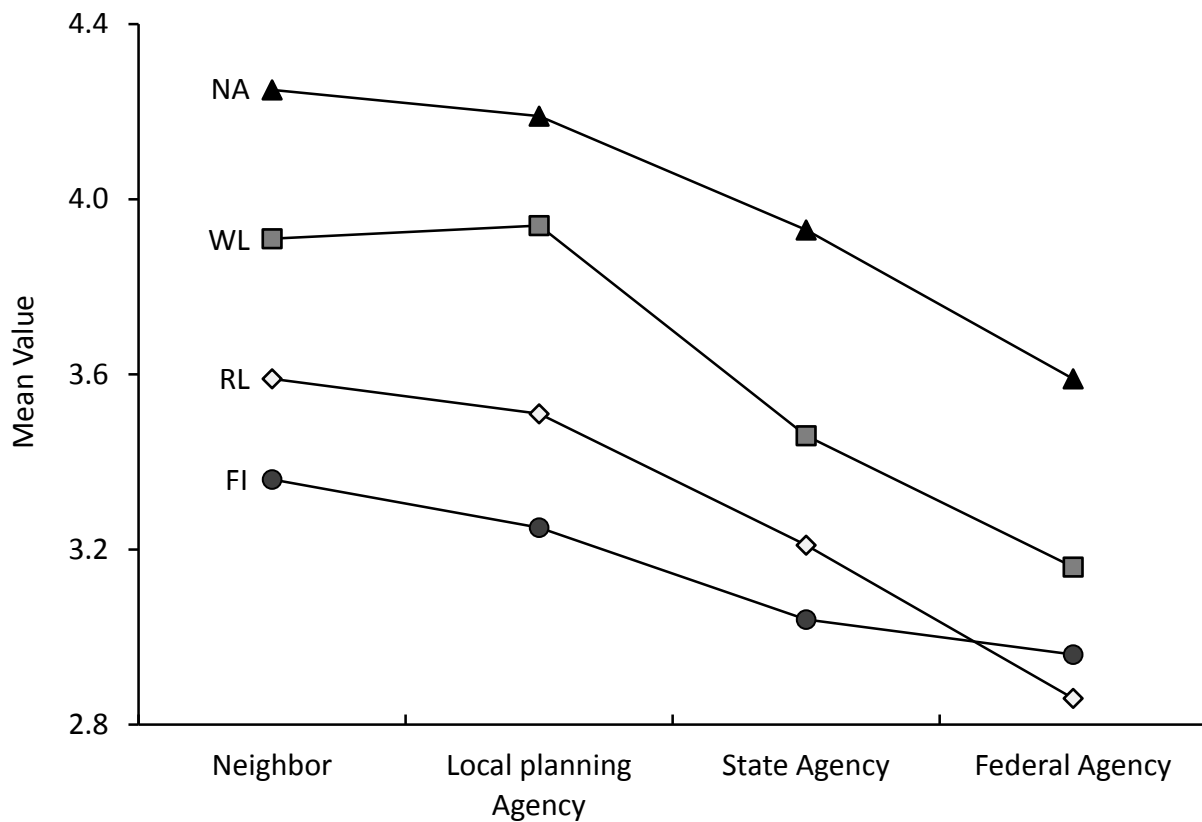
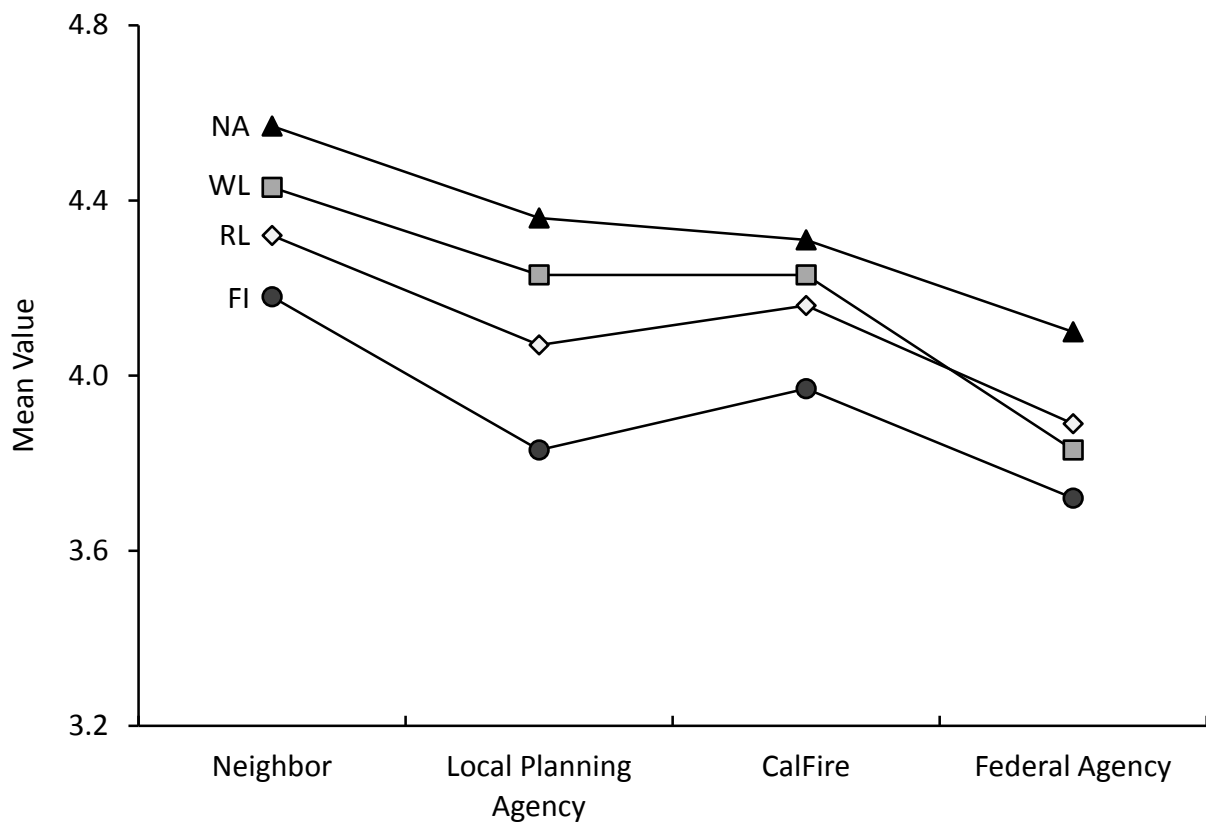


Fig. 3-2. Landowner support for cross-boundary cooperation across a range of potential partners and topics. Mean scores are based on a Likert scale from 1 (strongly disagree) to 5 (strongly agree). Differences between groups were tested for significance using the Kruskal-Wallis Test and differences between potential partners were tested for significance using the Friedman test; all tests were significant $p < 0.05$. WL = working landscape; NA = natural amenity; RL = rural lifestyle; FI = financial investment.

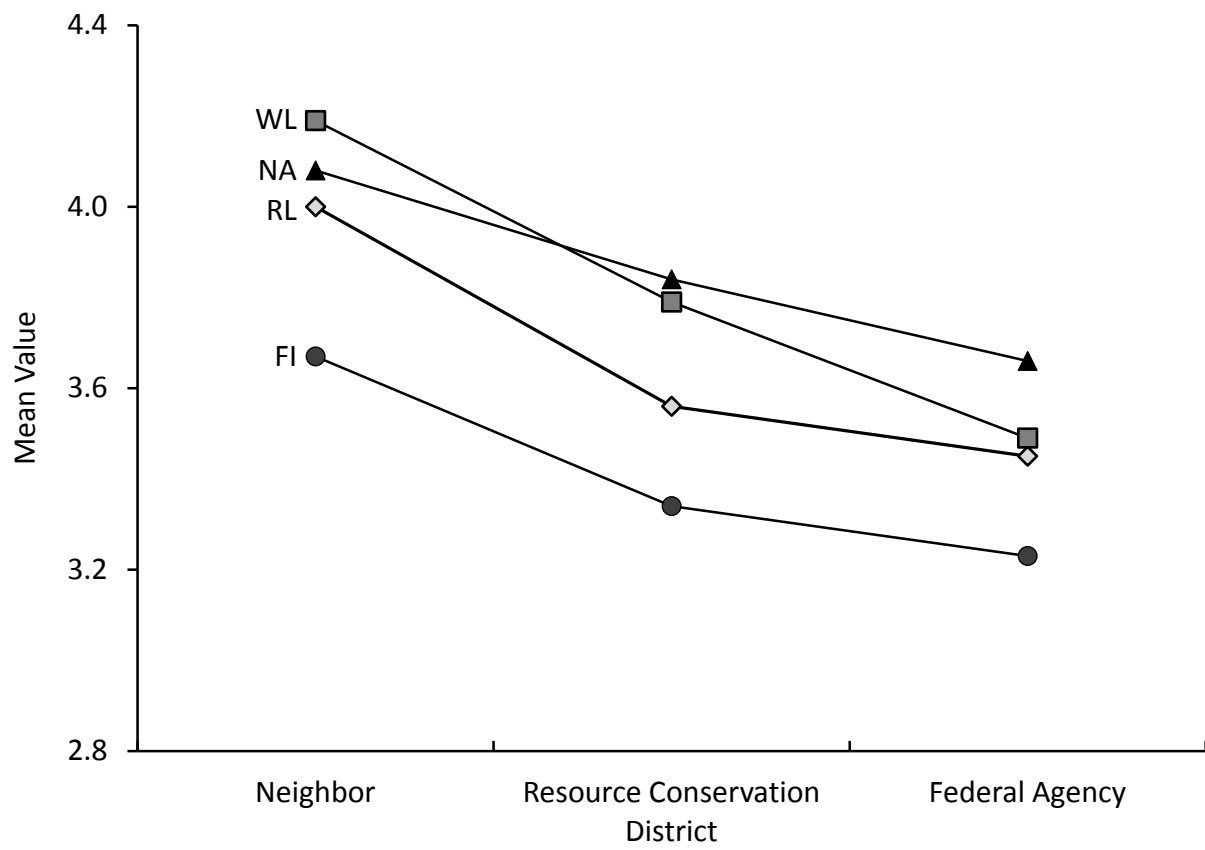
(A) Wildlife Areas and Corridors



(B) Fire Hazard



(C) Insect and Disease Outbreaks



CHAPTER THREE - TABLES

Table 3-1. Literature review of landowner segmentation studies in the United States, and groups derived from each study.

Author, Year	Region of Study	Target Population	Landowner Groups Identified
Butler et al., 2007	United States	Forest and Woodland owners	woodland retreat, working the land, supplemental income, ready to sell
Finley and Kittredge, 2006	Massachusetts	Forest Owners	Thoreau (privacy and contemplative values), Muir (environmental quality and protection), & Jane Doe (unknown values)
Finley et al., 2006	Massachusetts	Forest Owners	non-cooperators, conservation cooperators, general cooperator, neutralist
Kaetzel et al., 2011	Tennessee	Forest owners	privacy, utility, and heritage
Kendra and Hull, 2005	Virginia	Forest Owners	absentee investors, professionals, preservationists, farmers, forest planners, young families
Kline et al., 2000	Oregon and Washington	Forest Owners	timber producers, multi-objective owners, recreationists, passive-owners
Kluender and Walkingstick, 2000	Arkansas	Forest Owners	timber managers, resident conservationists, affluent weekenders, poor rural residents
Kurtz and Lewis, 1981	Missouri	Forest Owners	timber agriculturalists, timber conservationists, forest environmentalists, range pragmatists.
Majumdar et al., 2008	United States	Forest and Woodland owners	multiple-objective owners, timber, non-timber
Marty et al., 1988	Wisconsin	Forest Owners	resource conservationist, forest recreationist, forest utilitarian
Richter, 2005	Missouri	Forest Owners	legacy owners, detached owners

Table 3-1 (Continued). Literature review of landowner segmentation studies in the United States, and groups derived from each study.

Author, Year	Region of Study	Target Population	Landowner Groups Identified
Ross-Davis & Broussard, 2007	Indiana	Forest Owners	forest managers, new forest owners, passive forest owners
Salmon et al., 2006	Utah	Forest Owners	amenity, multiple-benefit, passive
Surendra et al., 2009	Arkansas	Forest owners	amenity rural, amenity urban, passive rural, passive urban

Table 3-2. Factor loadings for the 13 ownership motivation variables used to create factor scores. The values displayed represent the correlations between derived factors and the input variables.

Reasons for owning land	Factor 1	Factor 2	Factor 3	Factor 4	Uniqueness
To live near natural beauty	0.76	-0.01	0.38	0.06	0.28
To escape from city crime and pollution	0.82	0.07	0.15	0.26	0.23
To benefit from land appreciation over time	0.12	0.09	0.04	0.93	0.12
To live in a small community	0.78	0.08	0.26	0.05	0.31
To live a simpler lifestyle	0.71	-0.01	0.33	0.06	0.39
To help protect the environment	0.27	0.17	0.91	0.02	0.08
To preserve open space or natural resources	0.30	0.17	0.73	0.02	0.36
It is a good financial investment	0.11	0.26	-0.02	0.68	0.45
It is a good place to raise my children	0.61	0.50	0.05	-0.01	0.38
To continue a family tradition or business	0.12	0.67	0.18	0.11	0.49
It provides a source of my income	-0.10	0.86	0.06	0.16	0.22
To live closer to friends and family	0.45	0.64	0.05	0.07	0.39
To help the local economy	0.08	0.81	0.26	0.11	0.27

Table 3-3. Mean values of ownership motivation variables for each landowner group. Differences between groups were tested using the Kruskal Wallis test and are all significant at $p < 0.05$.

How important to you are each of the following reasons for owning your land?

Reasons for owning land	All Landowners	Rural Lifestyle	Working Landscape	Natural Amenity	Financial Investment
To live near natural beauty	4.3	4.4	4.6	4.8	2.9
To escape from city crime and pollution	3.9	4.3	4.2	4.4	2.4
To benefit from land appreciation over time	3.9	3.7	3.9	3.8	4.1
To live in a small community	3.7	4.0	4.1	4.3	1.7
To live a simpler lifestyle	3.6	3.9	4.0	4.3	1.8
To help protect the environment	3.6	2.8	4.7	4.3	2.3
To preserve open space or natural resources	3.6	3.2	4.5	4.0	2.5
It is a good financial investment	3.6	3.6	3.9	3.3	3.7
It provides recreational opportunities [†]	3.5	3.3	3.9	3.7	2.7
It is a good place to raise my children	3.2	4.0	4.1	2.6	1.5
To continue a family tradition or business	3.0	3.1	4.1	2.1	2.1
To be able to grow some of my own food [†]	2.8	3.0	3.4	2.8	1.6
To add to my existing land holdings [†]	2.7	2.8	3.1	2.5	2.4
It provides a source of my income	2.6	2.6	3.9	1.3	2.2
To live closer to friends and family	2.5	3.1	3.4	1.8	1.4
To connect with a higher power [†]	2.5	2.4	3.0	2.7	1.5
To help the local economy	2.4	2.4	3.5	1.4	1.7

[†] variables not used in final factor analysis

Table 3-4. Comparison of landowner groups for a range of demographic and ownership variables. P-values indicate statistical differences between clusters and were tested using Chi square analysis for all categorical variables, and ANOVA for continuous variables.

	All Respondents	Rural Lifestyle	Working Landscape	Natural Amenity	Financial Investment	P-value
Group Size (<i>n</i>)	525	141	155	130	99	---
Mean Age	62	61	62	63	61	0.40
Gender (% male)	64	62	62	65	69	0.26
Married (%)	78	80	80	72	78	0.37
Children < 18 years old living at home (%)	20	17	22	15	24	0.29
Bachelor's degree or higher	57	59	58	57	52	0.99
Tenure (years owned or in family)	33	33	45	23	29	0.00
Primary residence (%)	53	70	60	51	23	0.00
Live on the land (%)						
Never	17	11	10	10	48	
< 4 months	21	14	16	32	25	0.00
4 – 8 months	5	4	7	5	2	
> 8 months	57	72	66	53	25	
Annual income ≥ \$100,000 (%)	58	50	66	62	55	0.03
Earn income from land (%) [†]	38	35	60	12	40	0.00
Retired (%)	34	36	36	30	33	0.76
Median property size (acres)	62	23	232	20	160	0.00
Property size ≥ 50 acres (%)	52	44	68	31	64	0.00
Property size ≥ 500 acres (%)	27	19	46	9	31	0.00
Conservation Easement (%)	7	7	9	2	8	0.24

[†] includes: raising livestock, growing food crops, harvesting timber, harvesting trees for fuelwood, and fishing or hunting on the land for fee

CHAPTER FOUR

Consider the source: The impact of media and authority in outreach to private forest and rangeland owners

Over half of the United States is privately owned. Improving environmental sustainability requires that the scientific and management communities provide effective outreach to the many landowners making decisions about land use and management practices on these lands. We surveyed California forest and rangeland owners in ten counties throughout the state to assess the impact of existing outreach and identify gaps in information distribution and content. Although a number of organizations provide land management advice highly-ranked by landowners, no individual organization currently reaches more than 30% of forest and rangeland owners, and these groups together reach less than 60% of landowners. The lowest ranked advice came from wildlife and land management agencies, whereas the highest ranked advice came from private consultants and advisory organizations. The ecosystem services provided by forests and rangelands are strongly influenced by conservation scale, and this appears to be recognized in current outreach efforts. Owners of large properties (>200 ha) were substantially more likely to have received land management advice than smaller-sized properties, and from a broader group of organizations. As ownerships become increasingly fragmented, outreach focus and methods will need to shift to more effectively target the owners of smaller properties. On the other hand, some major outreach goals, such as conservation of wildlife, ranchland, or agricultural communities, will continue to rely on effective outreach to owners of larger properties.

Introduction

Approximately 60% of the United States is in private ownership (Hilty and Merenlender 2003). Partly as a function of historic land allocation policy, private lands in the United States tend to have better water access, more biodiversity, and higher soil quality than public lands (Scott et al. 2001). The conservation value of private lands is well-documented in the literature (Wilcove et al. 1996; Wilcove et al. 1998; Knight 1999; Kautz and Cox 2001; Hilty and Merenlender 2003; Maestas, Knight, and Gilgert 2003; Hansen et al. 2005). Management and conservation, however, is challenged by the fact that private lands are fragmented into individual ownerships each managed by a landowner with unique goals, constraints, and characteristics.

Since 1950, there has been a five-fold increase in the United States in low-density rural housing – typically called “ex-urban” development (Brown et al. 2005). This pattern of fragmentation is projected to continue in the upcoming decades with more landowners owning smaller-sized parcels (Alig and Plantinga 2004; Nowak and Walton 2005; Theobald 2010, 2005; White, Morzillo, and Alig 2009). The cumulative impact of the many discrete decisions made by these individuals will undeniably play an important role in shaping future forest and rangeland ecosystems and the services they provide.

Landowners are beset with many challenges, including economic and environmental uncertainty, changing social goals, and evolving regulations (Best 2002). It is crucial that agencies, scientists, policy-makers, educators, and outreach professionals work with landowners to create practical approaches to mitigating environmental problems, and to encourage sound land management. Working with landowners, however, requires an adaptive approach. Recent studies indicate ownership dynamics are changing on forest and rangelands across the United States (Gosnell, Haggerty, and Travis 2006; Butler and Leatherberry 2004; Hansen and Brown 2005; Kendra and Hull 2005). New landowners often have less experience with vegetation management than traditional foresters and ranchers, and a greater focus on recreational and residential qualities. Outreach to these landowners will require effective communication from the scientific and management communities (Butler and Leatherberry 2004; Kittredge 2004) which will in turn require a clear and comprehensive understanding of the needs and characteristics of these landowners, and a critical analysis of existing and potential outreach strategies and sources. This chapter reports the results of a statewide survey of California forest and rangeland landowners, with a focus on their use of and response to existing outreach strategies and information sources.

Forests and rangelands, loosely defined as land that is not cultivated or developed, are faced with a variety of environmental issues, including habitat fragmentation and loss of ecological integrity through conversion to urban or ex-urban uses (Maestas, Knight, and Gilgert 2003); risks due to catastrophic insect epidemics (Hicke and Jenkins 2008) and disease (Rizzo and Garbelotto 2003); or wildfire hazard (Moritz and Stephens 2008). In California, there are many organizations that provide land management information about these topics to landowners, including government resource agencies, non-profit organizations, or university Cooperative Extension. This breadth of information and information providers makes California a good location to study the efficacy of landowner outreach.

Landowner outreach

Educational outreach can be an effective strategy to influence landowner attitudes toward natural resource management (Marynowski and Jacobson 1999; Loomis, Bair, and Gonzalez-Caban 2001; Rhodes, Leland, and Niven 2002; Lauber and Knuth 2004). The overall impact of educational outreach, however, can vary substantially based on the type of information being delivered (Lauber and Knuth 2004), the method of communication (McCaffrey 2004; Morris, Jacobson, and Flamm 2007), the geographic location of the recipients (Brunson and Shindler 2004), awareness of the landowner that information is available (Measells et al. 2005), or by the general regard for the organization providing the information (Wright and Shindler 2001; Shindler, Toman, and McCaffrey 2009; Olsen and Shindler 2010).

Among these, the method of communication has been shown to be a particularly important factor influencing the impact of educational outreach. Several recent studies examined the effectiveness and/or “trustworthiness” of different media sources and found significant differences between media types. In general, landowners appear to

prefer direct personal contact over mass media as an information source (Wright and Shindler 2001; Shindler, Toman, and McCaffrey 2009; Toman, Shindler, and Brunson 2006; Ryan 2009; McCaffrey 2004). Toman et al. (2006) distinguished between unidirectional information sources (those that provide a one-way flow of communication) and interactive information sources (personal contact or on-the-ground learning experiences) and found that people are significantly more likely to be familiar with unidirectional methods, but interactive methods were rated as more helpful. Measures of perceived trustworthiness, however, were similar for both methods, though individual media sources within each method were rated differently. Most notably, public meetings and the Internet consistently received low ratings for trustworthiness.

Several studies have also looked at the perceived trustworthiness of the information provider and found it to be an important factor influencing outreach effectiveness. Wright and Shindler (2001) looked at information sources in watershed management in Oregon and found that the majority of landowners in their study felt that environmental groups were untrustworthy and of little use as an informational source, whereas the state forestry and wildlife departments, and university representatives were trusted by most respondents. Shindler et al. (2009) similarly found that university representatives, public agencies, and personal contacts were considered trustworthy by a majority of landowners in regards to information on fire management, forest industry groups were only considered trustworthy by about half of the respondents, and very few respondents rated environmental groups as trustworthy. However, trust in agencies, general knowledge, and attitudes can vary substantially across study areas, indicating that a “one-size-fits all” approach to management, outreach, or relationship building will be less successful than an approach which integrates local contextual factors (Brunson and Shindler 2004; Olsen and Shindler 2010).

Based on these studies, it is clear that outreach can be an effective strategy to influence landowner attitudes, but the ultimate success of the outreach depends on the method of communication, the agent of delivery, and the geographical context. A review of the literature, however, found limited information on the current distribution of landowner outreach, and whether information is effectively reaching all landowners or just targeted subgroups. To fill this gap, and to help inform future landowner outreach, we surveyed a sample of California forest and rangeland owners from ten counties across the state.

The overall objectives of this chapter are to:

1. provide a general profile of our sample population;
2. assess the extent and perceived quality of land management information and advice from a range of natural resource organizations;
3. identify where landowners of different parcel size classes receive land management information and advice; and
4. identify factors that influence the receptivity of forest and rangeland landowners to outreach.

Methods

Survey methodology

We sent a mail questionnaire to forest and rangeland owners on parcels greater than three acres in size (1.2 ha) from ten counties in California. At least one county with forest and/or rangeland from each of six California bioregions defined by the Department of Forestry and Fire Protection (CalFire) for natural resources assessment purposes (CDFFP 2003) was chosen for the survey by a group of University of California (UC) Cooperative Extension specialists and faculty. The selected counties were considered typical of each bioregion. Counties included in this study were Humboldt, Sonoma, Mendocino, Shasta, Sierra, Plumas, El Dorado, Santa Barbara, San Diego, and Contra Costa (see fig. 2-1 for a map of the study area). Because they have small populations, the adjacent Sierra and Plumas counties were combined and treated as a single sampling unit. Although the results of statistical inference apply to the ten counties rather than the entire state, their wide distribution and representativeness of major bioregions captures the variation we would expect in a state sample.

Within each county, individual survey recipients were selected based on a stratified random sample. The sample was drawn from a statewide land parcel database created in 2003 by CalFire for the Forest and Range Assessment (CDFFP 2003). Using ArcGIS 9.2 (ESRI 2008) and the Universal Transverse Mercator (UTM) coordinates of each parcel centroid, all parcels whose centroid fell within public land boundaries were deleted. Parcels were then sorted first by county, then by vegetation type, again using the parcel centroid, and finally by parcel size. Vegetation was categorized into two general categories – forest or rangeland. Forest included all conifer and hardwood forest vegetation types. Rangeland included oak woodlands, grassland, and shrubland vegetation types. Parcels were sub-categorized by parcel size into four groups: 3 to 9 acres (~1 to 4 ha), 10 to 49 acres (~4 to 20 ha), 50 to 499 acres (~20 to 200 ha), and 500 or more acres (>200 ha). This stratification created 8 separate categories for each county. A random sample of 30 parcels was pulled from each category when possible, for a total of approximately 240 parcels per county. All duplicate addresses were dropped from the sample. The final mailing sample size was 1730 landowners.

The questionnaire was modified from prior landowner surveys (Liffmann, Huntsinger, and Forero 2000; Kendra and Hull 2005; Huntsinger et al. 2010) with the addition of several new questions to address recently emerging or regionally unique areas of concern. Questions were pre-tested on a small sample of forest and rangeland owners from the study area in January of 2008. Questionnaires were mailed over the spring of 2008 following a modified version of the Dillman Total Design Method (Clendenning, Field, and Jensen 2004; Dillman 2007). Survey response rates have been gradually declining over the last 30 years (Connelly, Brown, and Decker 2003). To maximize the response rate, we sent out a total of seven mailings over four months: the full survey packet was sent three times, and reminder postcards sent a total of four times in between survey mailings. The final mailing included a UC Berkeley College of Natural Resources pen as an incentive and thank you gift. Respondents were also offered the option of taking an identical Internet version of the survey. Questionnaires were returned by 670 people. After adjusting for undeliverable questionnaires and

questionnaires sent to non-forest or rangeland owners, we received a final adjusted response rate of 43% (see Appendix A for detailed response rates).

Analyses

The stratified sampling design ensured the inclusion of small sized groups, such as owners of large parcels (500 or more acres), that might otherwise be missed through a random sample. As a consequence, these groups are disproportionately represented in the dataset. To maintain a consistent sampling intensity, all data were weighted proportionally to sampling intensity prior to statistical analysis (Maletta 2007). All statistical analysis was done using SPSS 17.0 statistical software. Results are summarized as percentages out of the total number of landowners that responded to each question.

To better understand where landowners get information and advice about land management, and how they perceive the quality of the information, we asked landowners if they had received information or advice about land management in the last five years from a list of natural resource organizations (Table 4-1); and if so, to rate the quality of the information or advice they received based on a Likert scale from 1 to 5, ranging from very low (value = 1) to very high (value = 5). This question did not specify between types of information, thus responses could include land management information that is either unidirectional or interactive in nature, and could include any type of media, ranging from an informational pamphlet to a personalized recommendation for a management decision. In this paper, we refer to this broad category of information as “land management advice.”

Results from this question were used to calculate the percentage of landowners that had received land management advice, the “quality of advice metric”, and the “impact metric”. The quality of advice metric was calculated for each organization by summing the weighted percentage of respondents that chose each of the five rating categories. The weights used for each category were: Very Low: -2, Low: -1, Neutral: 0, High: +1, Very High: +2. The impact metric was calculated as the product of the percent of landowners that received advice, and the quality of advice metric, such that a high impact ranking means that an organization not only reached a comparatively high percentage of landowners, but that the advice was rated highly by recipients. Impact groups were based on a qualitative assessment of the impact metric.

We looked at several variables, including age, vegetation type, residency, and property size, to identify factors that distinguish the landowners that had received land management advice from those that had not. Vegetation type included two categories: forest owners or rangeland owners. Any owner that characterized their land as greater than 50% forest cover was classified as a forest owner; owners with less than 50% forest cover were classified as a rangeland owner. If there was no response to this question, the owner was classified based on the parcel centroid used in the original sample selection. Comparisons between property size groups were based on the same size categories as used in sampling, however, respondents were reclassified into these size categories based on their reported property size for all parcels owned and managed as a single unit,

rather than assessor parcel records. We indicate this distinction by using the term “property” when referring to the full property, and “parcel” when referring to a single parcel. Assuming that this sample of forest and rangeland owners is roughly similar to the family forest and woodland owners described by Butler (2008) then the 3 to 9 acres class¹ represents <5%, the 10 to 49 acres class represents ~15%, the 50 to 499 acres class represents ~37%, and the ≥ 500 acres class represents ~43% of total private forest and rangelands in California. A simple T-test was used to identify any significant differences in age, the only continuous variable, and Pearson’s Chi Square tests to identify significant differences for all other variables.

Information preferences were assessed through a set of questions asking landowners what kinds of land use information they would like to receive and how they prefer to receive information. Respondents were specifically asked: “What kinds of land use information would you find interesting or helpful?” and were provided 19 different choices of general land use topics (see Tables 4-2 to 4-4 in the results section for a list of provided options), from which they could choose multiple, or could write-in their own answer. Pearson’s Chi Square tests were used to identify significant differences between forest and rangeland landowners, and owners of different property size categories. Respondents were also asked “How do you prefer to get information about land management?” and could choose any of six unidirectional forms of media, including: website, pamphlet, written newsletter, e-mail newsletter, book, or CD-ROM, or fill in their own response. Finally, respondents were asked: “Do you use the Internet?” and could choose only one answer from four different options: one or more times per week, less than once per week, only for e-mail, or never. Primary residents were compared to non-primary residents using a Pearson’s Chi Square test.

Results

Profile of survey respondents

Forest and rangeland owners from the 10 sample counties averaged 62 years in age, similar to the national average age of forest owners of 60 years found by Butler and Leatherberry (2004), and the average age of California oak woodland owners of 61 found in 2005 by Huntsinger et al. (2010). A majority, 81%, reported that they are married or live with a partner, but only 22% have children under 18 years old living at home. Respondents tended to be well-educated, with 89% having attended some college or more, and 57% holding a bachelor’s degree or higher. This is considerably higher than the national average of Americans over the age of 25 with 52% having attended some college and only 24% with a bachelor’s degree or higher (US Department of Commerce 2002). About 1/3 of respondent were employed in a professional or management position, 1/3 were retired, and 1/3 self-employed. Fifty-nine percent were primary residents and, on average, they had owned their land or the land had been in their

¹ Butler’s classification includes properties from 0.4 ha to 1 ha (1 to 3 acres) in the smallest size category which were not included in our sample.

family for 31 years. Just over half reported that they had spent most of their life in a city with greater than 5,000 people.

Sources and ratings of land management advice

Fifty-seven percent of landowners had received some form of land management advice from one of the natural resource organizations asked about in the survey in the last five years, but no single organization reached more than 1/3 of the sample (Table 4-2). The two organizations from which the highest percentage of landowners had received advice were CalFire, the state resources and fire protection agency, and local Fire Departments² (Table 4-2). Despite legislation mandating landowners to clear defensible space, less than 1/3 had received advice from each of these organizations, and only 60% of all landowners reported that they clear defensible space. Just below these organizations, in terms of number of people reached, are University of California (UC) Cooperative Extension and private consultants.

Of all the information providers, private consultants received the highest impact ranking (Table 4-2), based on providing land management advice to a comparatively high percentage of landowners and receiving the highest quality of advice scores out of all of the organizations. UC Cooperative Extension and Industry Associations received the next highest impact rankings (Table 4-2). Both received high quality of advice scores, but more landowners had received land management advice from Cooperative Extension, giving it a higher overall impact score. Based on these results, the three organizations were grouped into impact group 1 (Fig. 4-1). These organizations are all non-government agency information providers, with a primary focus on dissemination of natural resource management information. Private consultants, however, charge for advice, while advice from cooperative extension and industry associations is typically free.

Next in ranking (Table 4-2) were local Fire Departments, CalFire, NRCS and Resource Conservation Districts (impact group 2 in Fig. 4-1), all government organizations that provide free advice to landowners. Although the advice was not ranked as highly as group 1, these agencies reached comparatively high numbers of landowners and gave moderately ranked advice.

Impact group 3 (Fig. 4-1) included professional associations, local land trusts, and large conservation organizations. These groups had a low overall impact due to a low percentage of contacts with landowners, despite advice rankings comparable to group 2. These organizations tend to target specific messages to specific types of landowners. For example, professional associations tend to target working landscape owners with information on management practices, and land trusts or conservation organizations

² This question asked specifically if respondents had received information or advice from “county” fire departments, rather than “local” fire departments. Variation exists, however, in how local fire departments are funded and organized, including local fire departments that are county-based, city-based, volunteer-based, or contracted through CalFire. Based on the high percentage of respondents that chose this option in counties that do not have county-based fire departments, we’ve assumed respondents interpreted this question as “local” fire departments.

tend to target landowners with large properties for conservation easements. They also provide information to landowners by request, but typically do not perform active outreach to a broader audience of landowners.

The lowest impact organizations (Table 4-2) were the national and state wildlife and land management agencies. These organizations all have regulatory authorities on public lands and in some situations, such as wildlife or endangered species management, directly on private lands. They consistently had low ratings for quality of advice and little contact with landowners.

In addition to calculating an overall impact metric, organizations were also graphed based on the percent of landowners that received advice compared to the quality of advice metric. Fig. 4-1 shows the distribution of organizations based on these parameters and delineation of the overall impact groups. Groups 1 and 2 both reached comparatively high numbers of respondents, but group 1 received higher quality of advice scores. Groups 3 and 4 also reached similar numbers of respondents, but group 3 received higher quality of advice scores than group 4.

Advice recipients

Primary residents did not differ statistically from non-primary residents in their likelihood of receiving land management advice. Rangeland owners were more likely to receive advice than forest landowners (59% of rangeland owners had received information, compared to 42% of forest landowners, $\chi^2 = 6.65$ $p = 0.01$). Advice recipients were also slightly older than non-advice recipients (Mean age 64 compared to 59, $p = 0.00$), but these differences are not large enough to have meaningful implications. Of the variables examined, the most meaningful and statistically significant results were due to parcel size. When grouped into parcel size categories, these landowners were shown to differ not only by which group received the most land management advice, but also by the organizations they received advice from (Table 4-3).

Small properties (3 to 9 acres)

The majority of landowners from this group received some form of land management advice in the last five years (Table 4-3). These landowners were most likely to get advice from local Fire Departments and represent the largest proportion, almost half, of the landowners that received advice from local Fire Departments. The next most important information provider to small parcel owners was CalFire, however, small property owners represent only a small proportion of the landowners that CalFire provided land management advice to.

Ranchettes (10 to 49 acres)

Of all the parcel size categories, this group was the least likely to receive land management advice (Table 4-3). Most advice came from local Fire Departments followed by CalFire. This group was the second largest proportion of the total landowners that received advice from local Fire Departments.

Moderate properties (~50 to 499 acres)

This group was the second least likely to get advice (Table 4-3). Those that did receive advice were most likely to get it from private companies or consultants, followed by CalFire, UC Cooperative Extension, and NRCS or resource conservation districts (respectively), although none of these organizations reached more than 22% of the landowners in this category (Table 4-3). This group accounted for no more than 30% of the landowners that received advice for any single organization.

Large properties (500 or more acres)

Eighty-six percent of landowners in the large property group had received land management advice in the last five years, making them the group receiving the most advice on land management. The organization that reached the highest percentage of landowners from this group was UC Cooperative Extension, closely followed by CalFire, the Natural Resource Conservation Service (NRCS) or resource conservation districts, and industry associations. Private companies and consultants, and California department of Fish and Game also provided information to a high proportion of respondents. The “large property” group represented the highest proportion of advice recipients from most of the outreach organizations.

Information preferences

Almost all landowners indicated that they would like to receive information on at least one land use topic from the survey (Table 4-4). Of the landowners that would like to receive some type of land use information, almost two-thirds would like information on laws affecting their land (the most popular choice), and almost half would like information on taxes related to their property (fifth most popular choice). Other frequently chosen options included invasive weeds, native plants, fire prevention, and wildlife habitat (Table 4-4). Several topics differed significantly between forest landowners and rangeland landowners (Table 4-4). A significantly higher percentage of forest landowners want information on native plants, taxes related to their property, alternative energy, water quality, conservation easements, timber productions, cost-share programs, biofuels, and forest certification. Conversely, a higher percentage of rangeland owners expressed interest in information on wildlife habitat, pest management, organic farming, and livestock production. Several topics also differed significantly based on property size category (Table 4-4). In general, a higher percentage

of owners of properties 50 or more acres in size were interested in receiving land use information on laws affecting their land, taxes, conservation easements, biofuels, livestock production, timber production, forest certification, and agritourism. In contrast, owners of parcels less than 50 acres in size were more likely to be interested in receiving information on native plants, water quality, and pest management.

Landowners were also asked in what format they prefer to get information about land management. Of the provided options, the highest percentage of landowners chose written newsletters (43%), followed by pamphlets (32%), websites (26%), e-mail newsletters (26%), books (7%) and CD-ROM (5%). Respondents were given the option to write their own answer, however, most respondents (96%) chose one of the provided options. When combined together, 89% of landowners chose written newsletter, website, pamphlet, or e-mail newsletter (top 4 choices), and 42% of landowners chose either website or e-mail newsletter (Internet-based choices). Primary residents did not differ significantly from non-primary residents for any of the provided media choices.

To assess the potential efficacy of using the Internet for outreach, landowners were also asked about their current Internet usage. Sixty percent of landowners use the Internet one or more times per week, 13% use the Internet less than once per week, 4% use the Internet only for e-mail, and 23% never use the Internet. Primary residents were more likely to report that they never use the Internet than non-primary residents (Table 4-5).

Discussion

Our results show that although almost all landowners are interested in receiving land management information (Table 4-3), only 57% have received land management advice in the last five years. Further, the perceived quality of the advice varied substantially based on the source. The most highly valued advice came from private consultants, industry associations, and advisory organizations such as Cooperative Extension (Table 4-2). Landowners rated advice lower when it came from organizations that have regulatory authority or control over access to and use of natural resources. The lowest quality of advice ratings went to the U.S. Fish and Wildlife Service and the California Department of Fish and Game. These agencies both have authority on private lands through federal and state endangered species regulations. California has a disproportionately high percentage of threatened or endangered species compared to other states and the majority of these occur on private lands (Scott, Standiford, and Pratini 1995; Dobson et al. 1997). As a consequence, enforcement of endangered species regulation on private lands has often been in the spotlight in California (Editors 1995). Compliance with these regulations can be expensive and limit potentially lucrative development opportunities. In general, agencies that reached a higher proportion of landowners tended to receive higher quality ratings for their advice, perhaps because they have more extensive outreach programs. However, relative to the proportion of landowners reached, advice from impact groups 2 and 4 was rated lower than advice from the respective groups that reached a similar proportion of landowners (groups 1 and 3) (Fig. 4-1).

Unlike findings by Wright and Shindler (2001) and Shindler et al. (2009) that environmental groups were considered both untrustworthy and unhelpful by landowners in Oregon and the Great Lakes Region, conservation organizations and land trusts were given relatively high ratings in this study. This may reflect the differing goals and strategies between the broad category of “environmental groups” compared to more targeted land conservation organizations, and the fact that prominent conservation groups have begun to take a more collaborative approach in California. In addition, landowners and industry groups have formed their own conservation organizations, seeking to promote stewardship and production of ecosystem services. This includes the California Rangeland Trust, Pacific Forest Trust, and the California Rangeland Conservation Coalition. Each is a conservation organization or land trust developed by landowners to promote the stewardship of the land by production-oriented landowners, and to create partnerships between landowners, agencies and environmental groups.

There were also significant differences in the kind of land management information that different landowners received, with those in the smallest property size categories most exposed to information from organizations related to wildfire prevention and defensible space regulations. Local Fire Departments gave a disproportionately high percentage of advice to small parcel owners – almost three-fourths of the landowners that received advice from local Fire Departments were from parcels less than 50 acres in size. Indeed, even owners of residential lots are subject to regulatory pressure to remove weeds and clear defensible space. Several heavy wildfire seasons led to 2005 California legislation increasing defensible space requirements around homes from 30 feet to 100 feet (California Public Resources Code 4291). Wildfire risk has brought fire hazard into the public eye, particularly in the wildland urban interface, and many landowners appear to be getting advice on how to make their property more resilient to wildfires.

There is an important switch in the type of information received around the 50 acre property size cutoff. Below this property size, landowners predominately received land management advice from local Fire Departments, presumably on defensible space, but most did not receive information from other providers. Above the 50 acre property size, landowners still received information on fuel management and defensible space (CalFire), and also received information from organizations that cover a larger array of topics including wildlife, soils, water quality, conservation easements, and more.

In general, owners of larger properties (500 or more acres) were the most likely to get land management advice from any source, and particularly from land management advisory organizations, industry, and professional organizations. Owners of larger properties are more likely to be involved in production than owners of smaller properties (Huntsinger et al. 2010; Ferranto et al. 2011), bringing them into contact with agricultural or forestry services. Owners of forest and rangeland parcels across the United States are increasingly moving away from a primary focus on production, and toward amenity-based ownership values (Kluender and Walkingstick 2000; Erickson, Ryan, and Young 2002; Kendra and Hull 2005; Finley and Kittredge 2006; Gosnell, Haggerty, and Travis 2006; Salmon, Brunson, and Kuhns 2006; Butler et al. 2007; Emtage, Herbohn, and Harrison 2007; Ross-Davis and Broussard 2007; Campos et al. 2009; Surendra, Mehmood, and Schelhas 2009; Huntsinger et al. 2010). Salmon et al. (2006) found that amenity landowners are less likely to use local forestry information

sources than are multiple-benefit landowners, and are less likely to actively manage their land. Although our analysis did not focus on differences between amenity versus production-focused landowners, it is possible that the differences in both the quantity and types of land management advice between property size categories is related to differences between production and amenity-oriented management goals.

Previous studies have shown that the method of communication can substantially influence outreach effectiveness (Toman, Shindler, and Brunson 2006; Ryan 2009; Wright and Shindler 2001; Shindler, Toman, and McCaffrey 2009; McCaffrey 2004). Our results show that land management information needs to come in multiple formats in order to reach the most people, as no one particular method appealed to majority of respondents. Similar to southern forest owners studied by Measells et al. (2005), newsletters and pamphlets were popular choices, however, unlike their study, e-mail newsletters and websites were also quite popular. Further, options here only included passive and unidirectional forms of media (Toman, Shindler, and Brunson 2006). It is possible that more interactive forms of outreach, such as seminars or community meetings may have been chosen as preferences if provided as an option.

In a time of limited budgets and resources coinciding with rapid advancements in Internet technologies, many organizations are increasingly leaning toward Internet outreach (Driskell and Lyon 2002; Kallioranta, Vlosky, and Leavengood 2006; Klingborg 2010). Landowners and Internet users both tend to be relatively affluent and well-educated, causing speculation that Internet-based outreach may be an effective strategy to reach such groups (Kittredge 2004). Internet outreach may also more effectively reach absentee landowners (Salmon, Brunson, and Kuhns 2006), which account for over 40% of the landowners in our sample. When asked how they prefer to receive land management information, 43% of landowners in this study chose websites or e-mail newsletters as a preferred media format and 60% of landowners indicated that they use the Internet more than once per week. Primary residents, however, did not differ significantly from absentee landowners in preference for Internet resources, although they were more likely to respond that they never use the Internet. Based on our results, a combined method that includes Internet-based outreach (websites and e-mail newsletters) and written materials (newsletters and pamphlets) will effectively reach the most landowners.

Conclusions

Landowners play a vital role in shaping the future of forests and rangelands. It is important that research findings and information about how to adapt to environmental change reach these landowners in a timely fashion. Further, the changing goals of landowners influence the kinds of information they need. Information, however, cannot be separated from its source. Wildlife agencies, such the US Fish and Wildlife Service and California Dept. of Fish and Game, have enforcement responsibilities on private lands, in an area where the financial stakes are relatively high, and they received the lowest overall quality of advice ratings. The fact that almost half of all landowners (Table 4-4) expressed interest in receiving information on management of wildlife habitat

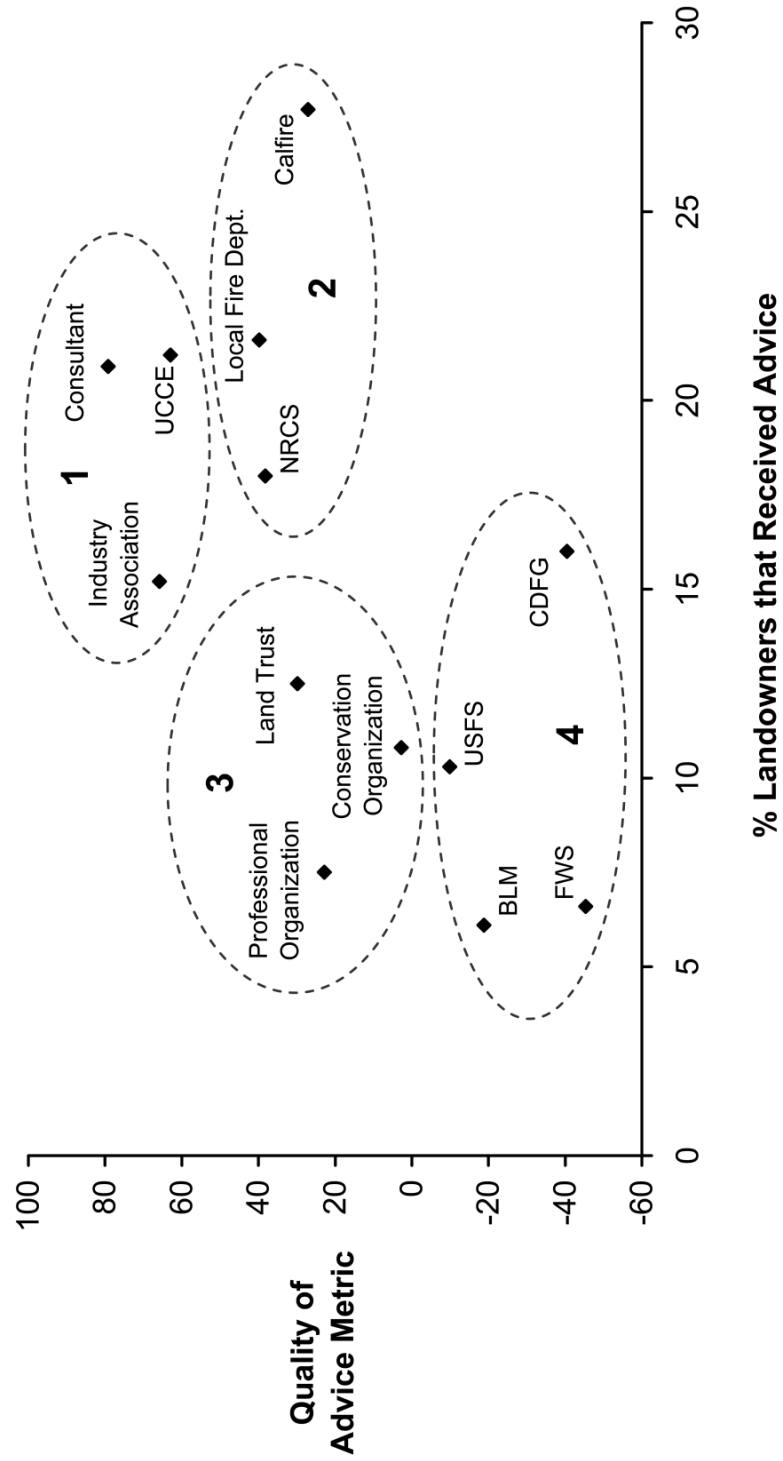
indicates that these low quality ratings are not based on a lack of interest in wildlife-related topics. Land management agencies, including the US Forest Service and the BLM were given slightly higher, but still overall low quality ratings for the advice they provide. Although these organizations do not have authority on privately owned lands, their policies and management actions on the public lands that make up nearly half of the state can have significant impacts on neighboring privately owned properties, by affecting local timber industries, grazing, and firewood gathering, and by controlling recreation. Consultants and advisory organizations, in contrast, are not directly associated with enforcement of regulation or management decisions that can influence neighboring private lands and were consistently given higher quality of advice ratings. It is not a stretch to assume that landowners will be more likely to implement land management advice on their own accord if they believe the advice is of high quality. Based on our results, advisory organizations are thus in a better position to influence private land management than agencies that are best known for enforcement or management responsibilities.

Landowner perceptions on quality of advice, however, are overshadowed by the finding that many landowners are not receiving land management advice. No individual information provider reached more than 30% of forest and rangeland owners, and these groups as a whole reached less than 60% of landowners. In addition, most organizations gave advice primarily to large property owners (>200 ha). This group is clearly the most efficient target to influence ecosystems as these landowners control approximately 43% of California's private forest and rangelands (Butler 2008). Small parcel owners manage a more fragmented landscape, requiring more resources and energy to influence a smaller percentage of the total land area – only 20% of private forest and rangelands in California are in properties from 1 to 50 acres in size (Butler 2008). Rural development, however, is projected to continue throughout the United States in the coming decades (Theobald 2005; White, Morzillo, and Alig 2009). If historic trends continue approximately 1.1 million ha of private forests and rangelands in California will become parcelized over the next 40 years (CDFFP 2003). As California's forest and rangelands become increasingly fragmented, smaller-sized parcels will become more important to attaining broader land management goals. Natural resource organizations will need to consider ways to more effectively target outreach to these landowners.

Although active forms of communication have been consistently shown to be most effective for landowner outreach, these methods may not be practical or realistic for reaching such a diverse and numerous audience. Our results indicate that most landowners have access to the Internet, and many prefer this method of outreach over other passive forms of communication. As Internet technologies become increasingly less expensive and more pervasive, these numbers are likely to increase. The Internet may never be a suitable replacement for interactive outreach to critical groups of landowners, such as large property owners. It may, however, play a key role in providing information to the many owners of smaller landholdings. Improving the quality, accessibility, ease of use, and overall reliability of Internet outreach, to be used in combination with other more traditional forms of information sharing, should be an important goal for land management outreach providers in the upcoming decade.

CHAPTER FOUR - FIGURES

Fig. 4-1. The percent of landowners that reported they have received land management advice in the last five years compared to the quality of advice metric for each information provider. The quality of advice metric was calculated for each organization by summing the weighted percentage of respondents that chose each of the five rating categories. The weights used for each category were: Very Low: -2, Low: -1, Neutral: 0, High: +1, Very High: +2.



CHAPTER FOUR – TABLES

Table 4-1. Information providers included in the landowner survey.

Information Provider	General Description
University of California Cooperative Extension (UCCE)	UCCE is a university education and outreach program that provides a broad range of information and technical advice to landowners, and education programs like 4-H to youth.
California Department of Forest and Fire Protection (CalFire)	CalFire is the state of California’s forestry and fire protection agency. CalFire is responsible for both information dissemination and enforcement of defensible space regulations but costly compliance measures or fines are rare. CalFire is best known for protecting homes and property from wildfire.
Natural Resource Conservation Service (NRCS) or Resource Conservation District (RCD)	NRCS (a federal agency in the U.S. Department of Agriculture) and RCDs (locally governed resource agencies in California) both provide technical assistance and in some cases financial assistance to private landowners. Historically they have focused on soil conservation and water quality improvement, although they can provide assistance for a broader range of topics, and in fact implement cost share programs for habitat improvement.
California Department of Fish and Game (CDFG)	CDFG is California’s state wildlife agency and is responsible for the protection and use of the state’s fish, wildlife, and plant resources. They provide information and outreach related to these topics. They also enforce hunting and state endangered species regulations.
U.S. Forest Service (USFS)	The USFS is a federal agency in the U.S. Department of Agriculture responsible for managing the U.S. National Forests and controlling their use for recreation, grazing, and timber, among others. The State and Private Forestry division of the USFS provides technical assistance on forestry to private landowners, and in cooperation with CalFire, the USFS also suppresses wildfires on forested lands.
U.S. Fish and Wildlife Service (FWS)	The FWS is a federal agency in the U.S. Department of Interior responsible for management of fish, wildlife, and habitat protection. They provide information related to these topics, including information on endangered species, invasive species, and habitat conservation. In addition, FWS is responsible for enforcement of federal endangered species regulations.
Bureau of Land Management (BLM)	The BLM is a federal agency in the U.S. Department of Interior that manages and controls the use of public lands for recreation, grazing, and timber, among others.

Table 4-1 (continued). Information providers included in the landowner survey.

Information Provider	General Description
Local Fire Departments	In addition to fire protection services, local fire departments provide information to landowners on reducing fire risk on their property. Like CalFire, fire departments are responsible for both information dissemination and regulatory enforcement of defensible space regulations but compliance measures or fines are rare.
Private Company or Consultant	Private consultants are typically hired by landowners, and can provide information on any land management topic.
Professional Organization	Professional organizations provide information and services that are relevant to the organization's mission. Examples include the Society of American Foresters or the Society for Range Management.
Land Conservation Organization	Regional and national level land trusts, such as the Nature Conservancy, or the Pacific Forest Trust, often have reserve lands and hold title or components of title, like development rights, associated with conservation easements. They may provide information to landowners on a broad variety of conservation related topics, particularly if they are seeking participants in conservation programs in an area. They may also provide funds for easements and restoration activities.
Local Land Trust	Local land trusts are similar to national land trusts, but tend to have goals more related to the local environment or the desires of the local community, for example, provision of recreation or local scenery.
Industry Association	Industry association activities include providing information on industry related topics of concern and political lobbying to represent industry interests. Examples include the California Cattlemen's Association (CCA), and the Forest Landowners of California (FLC).

Table 4-2. The extent, quality, and impact of land management advice for each natural resource organization.

Source	Percent landowners that received advice	Quality of advice Metric	Impact Metric
Private Company or Consultant	21	79	1655
UCCE	21	63	1334
Industry Association	15	66	1000
Local Fire Dept.	22	40	860
CalFire	28	27	751
NRCS or RCD	18	38	688
Local Land Trust	13	30	373
Professional Organization	8	23	171
Land Conservation Organization	11	3	29
USFS	10	-10	-102
BLM	6	-19	-115
FWS	7	-45	-299
CDFG	16	-41	-648
Any Source	57		

Table 4-3. Sources of landowner information by property size. For each parcel size category, the left column shows the percent landowners from that parcel size category that have received advice in the last five years. The right column shows what proportion of the advice received from each organization goes to landowners in each parcel size category. For each organization, differences by property size are significant at $p < 0.05$ (Chi-square), except for the BLM, where there is no significant difference by property size.

	<u>3 to 9 acres</u>		<u>10 to 49 acres</u>		<u>50 to 499 acres</u>		<u>≥ 500 acres</u>	
	Percent landowners	Percent advice	Percent landowners	Percent advice	Percent landowners	Percent advice	Percent landowners	Percent advice
Any Organization	58	24	44	22	48	24	86	31
UCCE	6	7	5	8	18	24	63	62
CalFire	21	17	15	16	21	21	61	46
NRCS or RCD	2	3	2	3	16	24	61	70
CDFG	6	9	8	15	12	20	42	56
USFS	14	32	5	16	5	14	20	39
FWS	2	9	1	6	6	27	18	59
BLM ^a	7	29	2	10	7	32	8	29
Local Fire Dept.	39	43	23	31	9	11	15	15
Private Company or Consultant	12	14	6	9	22	30	45	46
Professional Organization	1	2	1	2	7	24	25	71
Land Conservation Organization	10	22	2	5	10	26	23	47
Local Land Trust	5	9	5	12	7	16	39	63
Industry Association	0	0	1	2	8	14	60	83

^a Results not significant

Table 4-4. Landowner interest in land use information. Results show the percentage of landowners that reported they would like to receive information on each topic, out of the total number of landowners that responded to the question.

Land Use Information	Total	Forest	Rangeland	3 to 9 acres	10 to 49 acres	50 to 499 acres	≥ 500 acres
Any type	92	94	91	91	93	92	96
Laws affecting my land ^b	65	69	62	50	66	64	80
Invasive weeds	56	54	57	53	61	61	48
Native plants ^{a, b}	55	61	51	63	60	47	53
Fire prevention ^{a, b}	50	41	55	43	33	60	66
Taxes (related to property uses) ^{a, b}	47	60	39	31	49	50	62
Wildlife habitat ^{a, b}	45	39	49	39	59	35	49
Alternative energy ^a	43	49	39	45	45	35	48
Roads ^b	38	45	34	23	43	45	37
Water quality ^{a, b}	36	42	32	38	43	33	27
Erosion control	35	37	33	28	33	42	37
Pest management ^{a, b}	32	27	36	42	39	28	17
Conservation easements ^{a, b}	30	42	24	16	23	38	49
Organic farming ^{a, b}	24	19	27	23	36	23	11
Timber production ^{a, b}	24	43	12	8	14	26	53
Cost-share ^{a, b}	24	32	19	38	43	33	27
Biofuels ^{a, b}	16	25	11	11	12	12	33
Livestock production ^{a, b}	14	5	19	5	12	13	27
Forest certification ^{a, b}	10	17	5	4	5	12	20
Agri-tourism ^b	8	8	8	4	4	10	14

^a Results significant < 0.05 for differences between forest and rangeland landowners

^b Results significant < 0.05 for differences between property size categories

Table 4-5. Frequency of internet usage for all landowners, and frequency of internet usage based on residency status.

	Total^a (%)	Primary Residents (%)	Non-Primary Residents (%)
Often	60	61	64
Sometimes	13	11	18
E-mail Only	4	3	6
Never	23	25	12

^a Includes landowners that responded to internet usage question, but did not respond to residency question

CHAPTER FIVE

Conclusion and directions for future research

Rural communities are changing, and these changes have important implications for environmental sustainability. California, like other rural areas, has experienced extensive urban and exurban development in recent decades, resulting in land fragmentation, growth of the wildland urban interface, and changes in landowner populations. Considerable attention has been paid to the ecological effects of exurban development, as well as the social change associated with amenity migration and the rural rebound, but the implications of this social change are still not well understood. As the primary decision-makers on their land, rural landowners influence a substantive land area and play a critical role in either achieving environmental goals or facilitating future problems.

In this dissertation, I presented the results from a statewide survey of California forest and rangeland owners in order to improve our understanding of the landowner population and thereby improve future collaborations with landowners. The environmental challenges that threaten sustainability in California are complex and operate at scales larger than single properties. These problems must be addressed across jurisdictional boundaries engaging diverse groups of landowners and often public land managers as well. Although the landowner population is diverse in many ways, several themes emerged that can be used to guide and inform future cooperative partnerships. Below, I outline these themes as key findings from this dissertation.

Summary of Key Findings

1. Amenities and financial investment are important reasons for owning land.

Although a small percentage of the surveyed landowners earned income from their land, the majority earned little to no income; they predominantly benefited from its amenity and investment value. Even those that earned income from the land still considered amenities as important reasons for land ownership. When segmented by ownership motivations, all four groups considered financial gain through land appreciation as an important reason for owning their land, and three of the four landowner groups considered living near natural beauty as the most important or second most important reason for owning their land (based on mean scores). This finding is consistent with other studies in California (Campos et al. 2009; Huntsinger et al. 2010) and implies an overall shift from production-oriented owners to amenity and investor ownership in California forests and rangelands. This trend has been observed in rural areas throughout the United States and in other parts of the world indicating that this phenomenon is widespread (Gosnell and Abrams 2011; Mendham and Curtis 2010).

2. Landowner characteristics and activities change with decreasing property size.

For several questions, property size proved to be an important explanatory variable. Owners of large properties were significantly more likely to consider ownership objectives such as “family tradition or business” and “income source” as important reasons for owning their land and report income-generating land uses. Owners of large properties were also more likely than owners of small properties to implement environmental management or improvement practices on their land, and to receive advice about land management. These results suggest that in addition to the known ecological effects of fragmentation, land parcelization may also affect environmental health by facilitating an in-migration of landowners less likely to implement environmental practices or receive help with managing their land.

3. Landowners support the idea of cross-boundary cooperation.

Landowners, in general, supported the idea of cooperative land management and many landowners already implement active management on their land. Landowner groups derived from land ownership motivations proved to be important for predicting both management activities and support for cooperation. Landowners that owned their land for natural amenities were the most supportive of cross-boundary cooperation, followed by working landscape owners, rural lifestyle owners, and finally financial investment owners. All groups, however, expressed neutral to high support for cooperation. Working landscape owners were significantly more likely than all other groups to already implement active land management for environmental improvement. This information is valuable to guide future cross-boundary ecosystem management initiatives. The landowner groups identified roughly match those from other studies suggesting these results can be generalized beyond California.

4. Landowners prefer to cooperate with neighbors and local organizations over federal agencies, and on issues that are relevant to them.

Landowner support for cooperation also varied with potential partners in cooperation. For each topic, all landowner groups showed most support for cooperating with neighbors and least with federal agencies. There was a general trend where support for cooperation decreased moving from the local level (i.e. neighbors and local agencies) up to the state and finally federal level. These results are consistent with other studies (Bergmann and Bliss 2004) and suggest that cooperative efforts might be more successful if implemented at a local level and with local partners. Landowners were most supportive of cooperation to reduce fire hazard risk. Of the environmental problems asked about, wildfire has the most direct and potentially devastating impact to landowners throughout the fire-prone west. This suggests that problems with obvious high benefits will be more likely to engender cooperation from landowners.

5. *Landowners prefer to receive land management advice from advisory organizations over regulatory or land management agencies.*

There are many organizations that provide management advice to landowners. The perceived quality of this advice, however, varied substantially based on the source of the information. The most highly ranked land management advice came from private consultants, industry associations, and advisory organizations such as Cooperative Extension. Landowners rated advice lower when it came from organizations that have regulatory authority or control over access to and use of natural resources. The lowest quality of advice ratings went to the U.S. Fish and Wildlife Service and the California Department of Fish and Game. These agencies both have authority on private lands through federal and state endangered species regulations. Assuming that landowners will be more likely to implement land management advice on their own accord if they believe the advice is of high quality, then our results suggest that advisory organizations are in a better position to influence private land management than agencies that are best known for enforcement or management responsibilities.

Directions for future research

The survey research method provides an opportunity to study social phenomena at a broad scale. This methodology lends itself well to large sample sizes and is used to identify statistically significant trends across a population. What is gained in breadth, however, must be sacrificed in depth of understanding. Although significant relationships can be identified, causality is often outside the realm of possibility with a survey. In this dissertation, I successfully identified several important and statistically significant relationships about California landowners. The underlying mechanisms driving these relationships, however, are still inadequately explained and will require use of additional methodologies, such as in-depth interviews and/or focus groups. Here, I outline several areas that warrant further in-depth research.

First, why do working landscape owners implement more active management on their land than other groups of landowners? These landowners presumably have more experience in managing their land for production, and this could make them pre-inclined to manage their land for environmental improvement, or environmental management may be a side-effect of practicing sustainable land production. It is also possible that working landscape owners have more resources available to implement environmental management through incentive programs designed to target production-oriented landscapes. Alternatively, it is possible that working landscape owners have a land ethic that is more amenable to active management than that of other landowners, such as a “stewardship” land ethic as opposed to a “let nature be” ethic. Identifying the specific factors or suite of factors that promote environmental management will help outreach organizations more effectively encourage desired management behaviors.

Second, what characteristics or preconditions must be present for landowners to engage in cooperative management? Although the results of this survey reveal that landowners support the general idea of cross-boundary cooperation and that they prefer to cooperate with local partners on relevant topics, such as wildfire, these data do not tell

us what must be present for a landowner to actually participate in a cooperative project. For example, to what extent do they require financial resources and/or incentives? How much risk to their personal resources or well-being must be present? And how strong must relationships with cooperative partners be before they are willing to participate in a project? These questions could be addressed through interviews with landowners that have either participated or chosen not to participate in a cooperative project involving their land.

Third, why is there a gap in the distribution of land management advice to owners of small properties? It is possible that owners of small properties do not seek information out as readily as owners of large properties; alternatively, it is possible that outreach organizations only target owners of large properties because they influence larger proportions of land per landowner. With on-going land parcelization, small-property owners will become increasingly abundant and increasingly important to environmental sustainability. Understanding why these landowners received less advice about land management will provide insight to improve future outreach distribution.

Finally, why do landowners rate the quality of advice from consultants and advisory organizations higher than the advice from regulatory and land management agencies. I have hypothesized that this is because landowners associate advice from these agencies with the regulations they enforce or the policies and management decisions they implement on public lands, which can have significant impacts on neighboring privately owned properties. This hypothesis, however, remains to be tested.

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APPENDICES

Appendix A. Detailed response rates for sample counties.

Response rates for each county given as the percent of landowners that returned a questionnaire divided by the total number of landowners that received a questionnaire. Results are given for each county overall, by vegetation type, and by property size.

County	All Landowners (%)	Forest (%)	Rangeland (%)	3 to 9 Acres (%)	10 to 49 Acres (%)	50 to 499 Acres (%)	≥ 500 Acres (%)
All Counties	43	41	41	43	41	39	44
Contra Costa	33	25	34	31	42	26	25
El Dorado	40	35	41	31	43	44	0
Humboldt	45	43	47	41	41	47	52
Mendocino	41	33	46	42	36	33	51
Plumas	48	52	42	59	50	32	29
San Diego	35	32	33	38	29	34	0
Santa Barbara	37	30	37	37	29	33	50
Shasta	42	43	39	48	35	43	33
Sierra	49	43	50	50	45	75	38
Sonoma	43	47	35	41	45	26	54

Appendix B. The role of land conservation programs.

Land conservation programs can reward landowners for not fragmenting or developing their land, but only a small percentage of landowners participate in these programs (Fig. 2-7), and most are tailored toward production-oriented ownership. We asked about three land conservation programs in the survey.

Williamson Act (California Land Conservation Act) enrollment

The program with the highest participation (19%) was the Williamson Act. This program reduces property taxes on agricultural properties through a rolling 10-year contract between landowners and counties, while the state provides funding to compensate counties for all or a part of the property tax losses. The 45-year-old Williamson Act is widely supported by agricultural groups, landowners, county governments and environmentalists as a method to restrict the conversion of farms and ranches to urban uses, but its fate is tenuous due to recent state budget cuts (Sokolow 2010). The program is also not accessible to all landowners. The specifications for enrolling include having a property large enough for commercial use and located within a county-designated “agricultural preserve,” as well as other requirements set by each county. To change the land use without penalty, a landowner must stop renewing the contract and wait 9 years while property taxes gradually increase to normal levels. About 15 million acres were enrolled in 2010, with 9 million on “nonprime” sites typical of rangelands.

Timberland Production Zone (TPZ) designation

The TPZ program had the second highest participation (16%). County governments initially classified lands as TPZs in the 1970s, but landowners can petition to change the county zoning. Lands zoned as TPZs have larger minimum parcel sizes and limitations on residential uses. Similar to the Williamson Act, TPZs have specific acreage and site requirements that vary by county. The landowner receives a lower tax assessment based on timber production rather than development potential. A successful petition for rezoning and a 10-year period of gradually increasing property taxes are needed to remove land from a TPZ without penalties. About 4.3 million of the 5.6 million acres in TPZ designation in 2010 are owned by forestry businesses, and the rest are owned by families.

Conservation easement establishment

Conservation easements, in contrast, can be implemented on any type of landscape with conservation value. A landowner voluntarily gives up the development rights for a property in return for a monetary payment and/or tax reductions (Gustanski and Squires 2000). The development rights are then held by a land trust or agency and recorded in the property title. The easement may also have other provisions such as limitations on particular practices, but these are individually negotiated for each property. Over the last decade, conservation easements have become an increasingly important conservation tool, but like other conservation programs, they are limited by the level of private donations to land trusts and the availability of public funds. Only 6% of the landowners surveyed had conservation easements on all or part of their property.

Mitigation easements

Mitigation easements are another form of environmentally oriented easement; although they were not asked about in the survey, some respondents may have treated them as conservation easements. Mitigation easements are similar to conservation easements in that they change the property title to restrict certain activities. However, they are funded when a developer has to mitigate, for example, habitat loss for a particular species. The landowner agrees to provide that habitat, and anything that might harm it is permanently restricted from the area.

Limitations of land conservation programs

Limitations in available funding and the high transaction costs per project make these programs inaccessible to the vast majority of landowners (Fig. 2-7). Programs for large properties can preserve the greatest number of acres with the least logistical overhead. Still, with continuing fragmentation in California's forests and rangelands, it will become increasingly important to consider the ecosystem services provided by moderate- to small-sized properties and adopt more comprehensive strategies to preserve these services.

Appendix C. Results of follow-up postcards sent to non-respondents.

Follow-up postcards were sent using certified mail to 139 non-respondents asking them why they chose not to participate in the survey. Of these, 115 were successfully delivered, and 45 were returned completed (39% response rate). This table summarizes the reasons why this sample of non-respondents chose not to participate in the survey.

Reason for not responding	Percent Landowners
I don't have time to participate in surveys.	41%
I don't feel that this survey applies to me or my land	37%
I consider this junk mail, which I already receive too much of	28%
I don't trust University researchers or I am concerned with the confidentiality	24%
The survey was too long	20%
The survey was too complicated	15%
Health issues or recent death of the owner	11%
I never received the questionnaire	4%
I didn't receive the questionnaire because I was away from home	4%

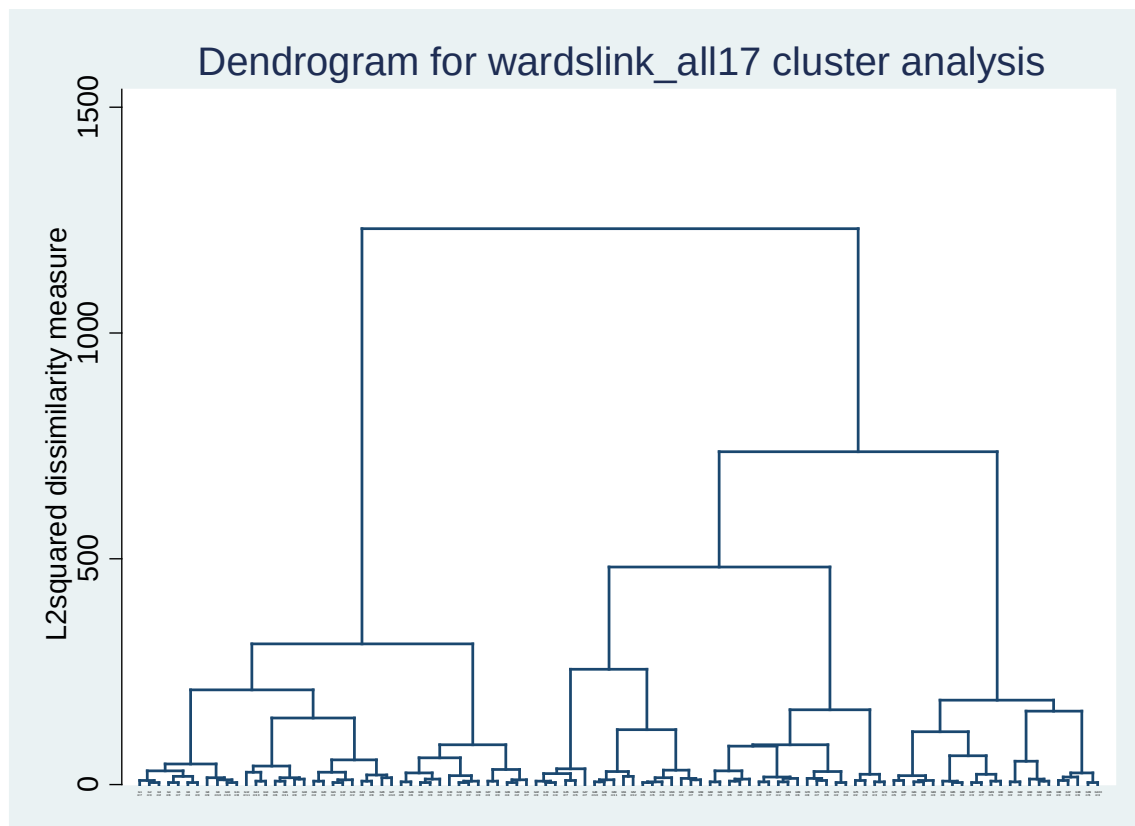
Appendix D. Detailed explanation for the four-cluster solution chosen in chapter three.

Cluster analysis is exploratory in nature, with the underlying goal of trying to find the most stable and robust cluster solution. I explored several clustering options and describe here why the chosen solution is more robust than the others:

Alternative 1 (not selected):

Include the four variables with high uniqueness values in the factor analysis. This alternative provided 4 factors that were highly correlated with the four factors from our analysis. The cluster analysis performed on these factors, however, provided less stable clusters than our solution, as indicated by the cluster dendrogram (cluster tree #1)

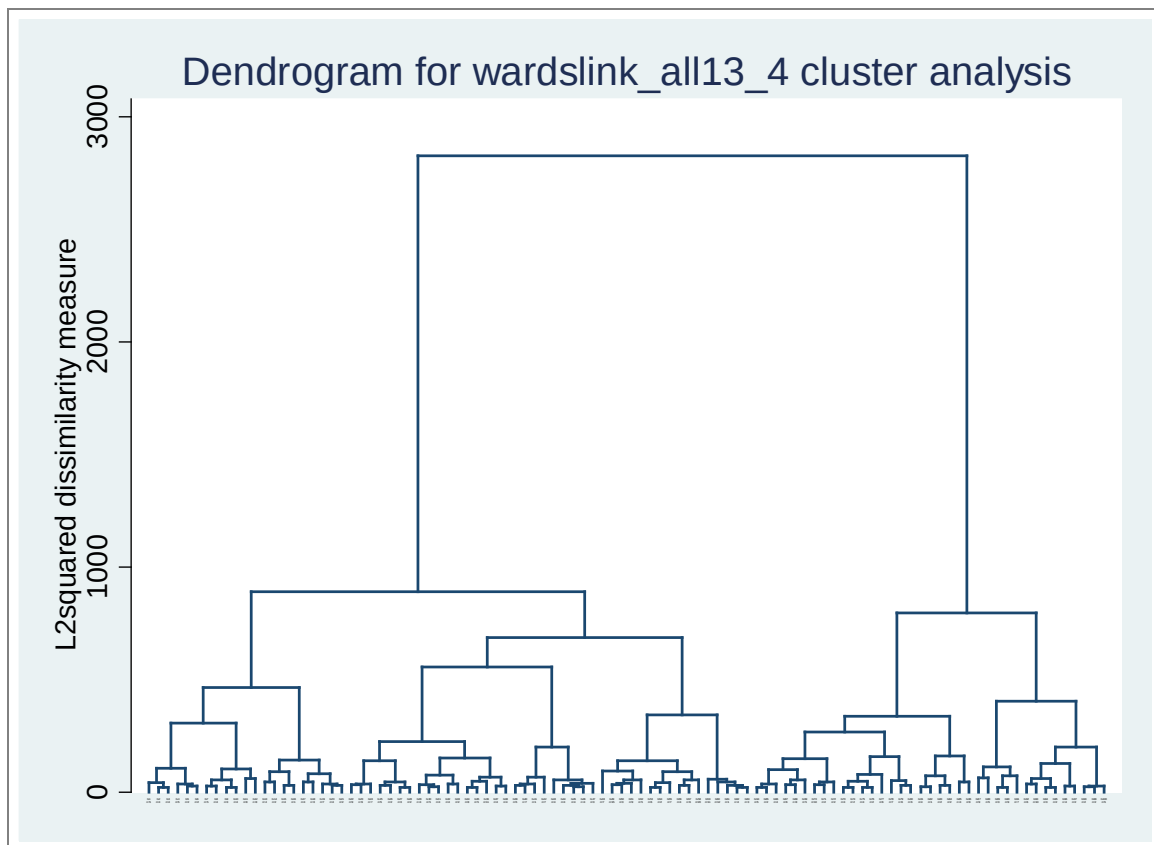
Cluster Tree #1



Alternative 2 (not selected):

Don't include the four variables with low uniqueness values in the factor analysis, but include them as separate variables in the cluster analysis. This alternative provided a 2 cluster solution (see cluster tree #2). Upon further analysis the 2 cluster solution appears to be driven heavily by the four “unique” variables rather than the four factors. It intuitively does not make sense to treat raw variables the same as factor score variables (that are a composite of several variables) in a cluster analysis, and this is likely influencing the results in this alternative. Moreover, the 2 cluster solution did not provide interpretable results or meaningful clusters for hypothesis testing.

Cluster Tree #2



Alternative 3 (chosen cluster solution):

This method provided the most robust clusters as indicated by the four stable groups in the cluster dendrogram (cluster tree #3) that held up in hypothesis testing with other variables. The fact that these clusters were statistically different for many of the variables tested in further analysis provides strong support that these clusters are in fact meaningful segments of the population. The ordered logistic regression analysis described in chapter three shows that these clusters also have strong explanatory power in understanding cooperation.

Cluster Tree #3

