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

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ABSTRACT

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.

1. 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, 1998; Knight, 1999; Kautz and Cox, 2001; Hilty and Merenlender, 2003; Maestas et al., 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 et al., 2005; White et al., 2009; Theobald, 2010). 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 (Butler and Leatherberry, 2004; Hansen and Brown, 2005; Kendra and

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Hull, 2005; Gosnell et al., 2006). 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 paper 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 et al., 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.

1.1. Landowner outreach

Educational outreach can be an effective strategy to influence landowner attitudes toward natural resource management (Marynowski and Jacobson, 1999; Loomis et al., 2001; Rhodes et al., 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 et al., 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 et al., 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; McCaffrey, 2004; Toman et al., 2006; Ryan, 2009; Shindler et al., 2009). 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 paper 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.

2. Methods

2.1. 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 (Fig. 1). 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. The American

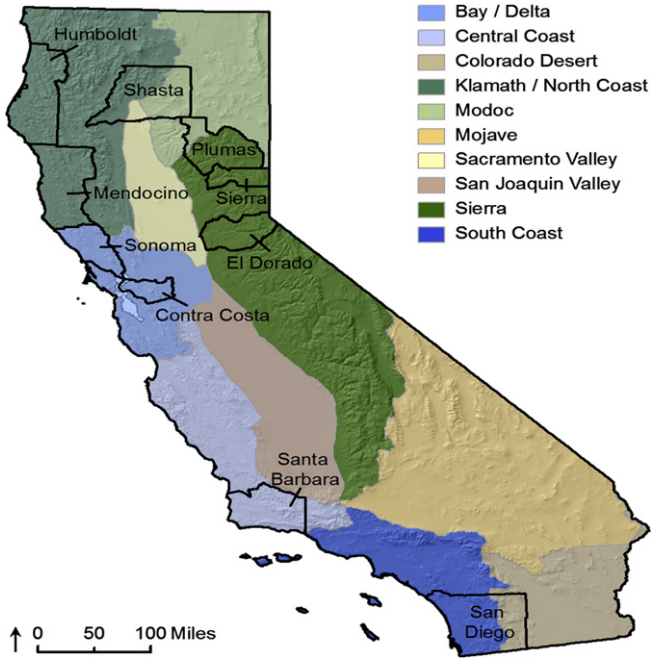

Fig. 1. Study area map with sampled counties and bioregions defined for the California Forest and Range Assessment (California, 2003).

system of measurement (i.e. acres) was used for all sampling and data analysis to maintain consistency with assessor parcel records. Results, however, are reported in the International System of Units and are approximate to the original parcel size groups. The four parcel size groups were 3–9 acres (~1–4 ha), 10–49 acres (~4–20 ha), 50–499 acres (~20–200 ha), and >500 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 et al., 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 et al., 2004; Dillman, 2007). Survey response rates have been gradually declining over the last 30 years (Connelly et al., 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 42.5%.

2.2. Analyses

The stratified sampling design ensured the inclusion of small sized groups, such as owners of large parcels (>200 ha), 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 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 1–4 ha class[1] represents <5%, the 4–20 ha class represents ~15%, the 20–200 ha class represents ~37%, and the >200 ha 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

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

Table 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.
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).

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 2–4 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,

Table 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 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.

	1–4 ha.		4–20 ha.		20–200 ha.		>200 ha.	
	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.

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.

3. Results

3.1. Profile of survey respondents

Forest and rangeland owners from the 10 sample counties average 62 years in age, similar to the national average age of forest owners of 60 years found by Butler Leatherberry (2004), and the average age of California oak woodland owners of 61 found in 2005 by Huntsinger et al. (2010). A majority, 81%, report that they are married or live with a partner, but only 22% have children under 18 years old living at home. Respondents tend 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% attending some college and only 24% with a bachelor's degree or higher (US Department of Commerce, 2002). About 1/3 of respondent are employed in a professional or management position, 1/3 are retired, and 1/3 self-employed. Fifty-nine percent are primary residents and, on average, they have owned their land or the land has been in their family for 31 years. Just over half reported that they have spent most of their life in a city with greater than 5000 people.

3.2. Sources and ratings of land management advice

Fifty-seven percent of landowners have 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 2). The two organizations from which the highest percentage of

Table 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	1–4 ha.	4–20 ha.	20–200 ha.	>200 ha.
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.

landowners have received advice are CalFire, the state resources and fire protection agency, and local Fire Departments[2] (Table 2). Despite legislation mandating landowners to clear defensible space, less than 1/3 have 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 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 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. 2). 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 2) were local Fire Departments, CalFire, NRCS and Resource Conservation Districts (impact group 2 in Fig. 2), 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. 2) includes 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 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 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. 2 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.

[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.

Fig. 2. 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.

3.3. 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 (58.5% of rangeland owners had received information, compared to 41.5% of forest landowners, $\chi^2 = 6.653$ $p = 0.010$). Advice recipients were also slightly older than non-advice recipients (Mean age 64 compared to 59, $p < 0.001$), 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 3).

3.3.1. Small properties (~1–4 ha)

The majority of landowners from this group received some form of land management advice in the last five years (Table 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.

3.3.2. Ranchettes (~4–20 ha)

Of all the parcel size categories, this group was the least likely to receive land management advice (Table 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.

3.3.3. Moderate properties (~20–200 ha)

This group was the second least likely to get advice (Table 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 3). This group accounted for no more than 30% of the landowners that received advice for any single organization.

3.3.4. Large properties (>200 ha)

Eighty-six percent of landowners in the large property group have 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.

3.4. 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). 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). Several topics differed significantly between forest landowners and rangeland landowners (Table 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). In general, a higher percentage of owners of properties greater than 20 ha 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 20 ha 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 5).

Table 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.

4. Discussion

Our results show that although almost all landowners are interested in receiving land management information (Table 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 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 et al., 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. 2).

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 are also significant differences in the kind of land management information that different landowners receive, 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 20 ha 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 20 ha parcel size cutoff. Below this parcel size, landowners are predominately receiving land management advice from local Fire Departments, presumably on defensible space, but most are not receiving information from other providers. Above the 20 ha parcel size, we see landowners still receiving information on fuel management and defensible space (CalFire), and also receiving 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 (>200 ha) are 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 et al., 2002; Kendra and Hull, 2005; Finley and Kittredge, 2006; Gosnell et al., 2006; Salmon et al., 2006; Butler et al., 2007; Emtage et al., 2007; Ross-Davis and Broussard, 2007; Campos et al., 2009; Surendra et al., 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 (Wright and Shindler, 2001; McCaffrey, 2004; Toman et al., 2006; Ryan, 2009; Shindler et al., 2009). 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 et al., 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 et al., 2006; Klingborg and Sams, 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 et al., 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.

5. 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) 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 currently reaches more than 30% of forest and rangeland owners, and these groups as a whole reach 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 20 ha in size (Butler, 2008). Rural development, however, is projected to continue throughout the United States in the coming decades (Theobald, 2005; White et al., 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.

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