Dissertation

EXURBAN LAND USE AND LANDOWNER PERCEPTIONS OF ECOSYSTEM MANAGEMENT CONCEPTS

Submitted by

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WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY MATTHEW SHINDERMAN ENTITLED EXURBAN LAND USE AND LANDOWNER PERCEPTIONS OF ECOSYSTEM MANAGEMENT CONCEPTS BE ACCEPTED AS FULLFILLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

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ABSTRACT OF DISSERTATION

EXURBAN LAND USE AND LANDOWNER PERCEPTIONS
OF ECOSYSTEM MANAGEMENT CONCEPTS

The Rocky Mountain West, USA, is currently experiencing dramatic population growth. The region has consistently grown at a greater rate than the nation as a whole, especially in counties containing federal recreation lands. Of particular concern is increasing growth in exurban areas adjacent to public lands. Information concerning land uses associated with these demographic changes is becoming more available, but little is known about the potential impacts these changes will have on regional conservation efforts.

Mail surveys were sent to large lot (25-50 acres) landowners from six counties within the southern Rocky Mountain region. Surveys were designed to document land uses and landowner perspectives of ecosystem management concepts. Based on the results, guidelines for incorporating exurban landowners into ecosystem management plans were proposed.

The study presented here is divided into three distinct sections. For this dissertation, each section is treated independently as a separate study, each with its own chapters. As a result there is some repetition in the reporting of methods and background material among the three papers.

In the first paper, salient exurban land uses and landowner demographics are summarized. Exurban landowners practice several land uses that have the potential to

significantly influence ecosystem management, including grazing, weed management, timber management, and private access to public lands.

The second paper addresses the degree to which exurban landowners would be willing to participate in ecosystem management as measured by landowner attitudes and willingness to vote for hypothetical management activities. The majority of landowners surveyed expressed support for ecosystem management under the condition that managers address property rights and privacy concerns.

Finally, the third paper presents a summary of studies conducted on private landowner support for ecosystem management. Based on this information, several guidelines are proposed that will better enable managers to include exurban landowners in ecosystem management plans.

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Sincerely,

Matthew J. Shinderman
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EXURBAN LAND USE AND LANDOWNER DEMOGRAPHICS IN THE SOUTHERN ROCKY MOUNTAINS

Introduction

The changing landscapes and human communities of the Rocky Mountain West continue to receive widespread attention in both the popular and academic literature (Riebsame, 1997; Maestas et al., 2001; Hansen et al., 2002, Norgaard, 2003). While the information base is growing, little is known about the impact a growing population will ultimately have on regional ecosystems, including the public lands and protected areas that help to define the Rocky Mountain landscape.

Of particular concern is the rapid increase in rural development at the boundary of public and private lands. Few studies have addressed the ecological and social impacts of development at the private/public land interface, and to date no studies have investigated the management implications of exurban development for public land management in the Rocky Mountains. As land management agencies and organizations struggle to define and implement new management strategies, information about adjacent private landowners and their perspectives on land use becomes critical.

The study described here was designed to develop an information base about exurban landowners whose properties are adjacent to public lands. We sent mail surveys to exurban landowners to address the following information needs: 1) private land uses; 2) landowner demographics; 3) general perceptions of the environment; 4) attitudes towards

management concepts; and 5) support for management concepts, as measured by intentions to vote for hypothetical management activities. This paper focuses on land uses and demographics, and provides a foundation on which further research may be based. Companion papers will address the remaining elements of the study, in addition to management recommendations based on the results.

Background: Western Migration

The landscapes and lifestyles of the western United States have long drawn new residents to the region. Although the general population trend for most western states has been characterized by steady growth, the Interior West grew faster than the nation as a whole during the three decades since the 1970's (Baron et al., 2000; Riebsame, 1997). While much of the growth has occurred in major western cities and associated suburban areas, the region has also experienced population expansion into rural areas. Prior to the 1970's, non-metropolitan county population growth was characterized by either losses or rates below the national average (Rudzitis and Johansen, 1989). The next decade, however, began with a reverse migration trend with population growth in rural areas two to three times faster than the national average (Loomis, 1982; Cromartie and Wardwell, 1999).

Growth in the rural west has resulted in wide-scale conversion of agricultural lands, particularly ranches, to exurban development, defined as low-density development outside incorporated city limits (Nelson and Dueker, 1990). The dispersed pattern characteristic of exurban development is land intensive because it consumes more land per housing unit than suburban or urban growth. Additionally, because exurban development typically occurs in areas with limited regulations, rural subdivisions tend to stress local resources for public

services, infrastructure, facilities, and transportation systems that are costly to provide in rural environments (Stroud, 1983; Davis, 1994).

Motivations for Migration

In response to unprecedented growth in the Rocky Mountain region, research efforts began to focus on the principle motivations for migration. Vias (1999) analyzed migration patterns in non-metropolitan areas of Arizona, Colorado, Idaho, Montana, New Mexico, Nevada, Utah, and Wyoming for the period 1970-1995. Results indicated that population growth induced employment growth instead of the reverse. Additionally, nearly half of all counties with a history of natural resource extraction based economies had changed their primary economic activities during this period. Finally, the dominant migration pattern was characterized by population growth in counties with lower wages and higher rents, supporting the notion that values other than economics were driving migration.

Migration to the mountain West is largely driven by the prevalent amenity values in the region. Unlike values driven by economics, amenity values primarily focus on factors that influence quality of life, including opportunities for recreation, scenic beauty, and temperate climate. Studies support the amenity value/migration relationship. For example, Rudzitis and Johansen (1989) sent mail surveys to residents in six western wilderness counties in California, Colorado, Idaho, Montana, and Wyoming. Out of 1518 respondents, the largest group of migrants fell into the 21-35 and 35-50 age groups, and was highly educated. Amenities and quality of life were the most frequently cited motivating factors for migration. As an example, 72 percent of the respondents indicated that wilderness was an important factor in their move. The majority of respondents also reported that life had become less stressful, more enjoyable, and more healthful.

In a similar study, Rudzitis and Streatfield (1992) sent mail surveys to 398 residents in San Juan County, Washington, a high growth, amenity-rich location in the Pacific Northwest. Residents indicated that non-economic factors (landscape/scenery, environmental quality, pace of life, climate) were the most important factors for migration to this area. Differences in motivation by age group were also present. Older residents cited environmental quality and amenity factors more frequently, while younger residents cited employment opportunities as being important. The majority of residents in all age groups used adjacent public lands more than once a year, and expressed concern that ongoing high growth rates might endanger the very qualities that attracted them to the area.

Although amenities have been identified as important causal factors for migration to western states, several studies, including those cited above, revealed differences in motivation according to demographic variables. In support of earlier work, a mail survey of 1,800 residents in high amenity areas indicated that migrants were more likely to be young, highly educated (college education or advanced degree) professionals (Rudzitis, 1999). Additionally, results suggested that migrants from metro areas were more likely to cite amenities as motivating factors, while migrants from non-metro areas cited job opportunities as important.

The type of location to which individuals migrate adds another layer of complexity. The studies described above focused primarily on motivations contributing to growth in general in western states. Motivations for migration may differ depending on whether the final destination is rural or urban. Davis et al. (1994) sent mail surveys to new home purchasers in an area defined as exurban by the Portland metropolitan urban growth boundary. In addition to typical amenity values, respondents cited the attractiveness of rural living, home ownership, and the opportunity to escape the urban environment as importing

motivating factors for their move. These values represent a deviation from traditional amenity values because they emphasize the importance individuals place on the home property itself, in addition to the surrounding landscape.

Theorists have argued that individuals form complex affective bonds, or attachments, to places as a function of their experiences and the meanings they assign to those places. Tuan (1977), a human geographer, suggests that spaces become places when humans experience them and imbue them with meaning. The meanings themselves are often a function of experiences, such that place meanings may be the result of physical/environmental characteristics, associations with friends/family gatherings, recreational experiences, or occupational/consumptive uses. These meanings, and the bonds that result from their creation, may play a key role in determining how people use land.

Clearly, population growth in the western United States is the result of several factors, including economic development, abundant amenity resources, and the attractiveness of the western lifestyle. Rapidly changing technologies and concomitant economic growth, coupled with a growing demand for recreation opportunities, serve as the latest boom for western states. What is less clear, however, are the impacts population growth has on the land from which amenity values are derived and the culture that defines the lifestyle.

Impacts on Culture

In many areas, the rural character of the west is changing. Rural counties in high amenity areas have experienced tremendous growth as they are often targeted for exurban development. Rural growth and subdivision of rural landscapes often leads to socio-cultural

change in local communities. Theobald et al. (1996) report decreasing public land access, erosion of communities based on traditional agricultural land uses, and a lack of affordable housing as land prices begin to reflect residential rather than agricultural land value. Conflicts between old and new residents are common as traditional values clash with new values. For example, in the East River Valley, Colorado, ranchers reported increasing conflicts with ranchette owners over odor, traffic, and trespass problems associated with livestock operations (Theobald et al., 1996).

Mountain 'gateway' communities have experienced some of the most dramatic socio-economic and demographic changes as new residents bring wealth and alternative values (Riebsame, 1997). Increased costs of living and community economic transition from resource extraction to service-based economies have often forced older residents to leave (Riebsame, 1997). Additionally, during the 1990's migrants flush with stock market earnings and increased residential mobility converged *en masse* on ski towns throughout the west, creating exclusive communities like Aspen, Colorado, where only the wealthy elite can afford to reside. Much of the available real estate in these towns is procured for second homes, resulting in part-year communities (Riebsame, 1997).

Additionally, the agricultural backbone of the western experience is steadily eroding. In Colorado alone, 110,000 hectares of agricultural land were lost to commercial and residential development between 1992 and 1997 (Obermann et al., 2000). Faced with estate taxes, increasing development pressure, rising land values, and a declining ranching community, many ranchers decide to sell their land. In a vicious cycle of decay, decreased demand for agricultural supplies and services forces suppliers to relocate farther from rural communities, making it more difficult and costly for producers to continue operations. In many cases, failed ranching operations are replaced by subdivisions.

Impacts on the Land

In addition to socio-cultural and socio-economic changes, population growth in rural areas directly impacts the landscape. Theobald et al (1996) analyzed the landscape level impacts of large-lot ranchette development in the East River valley of central Colorado. Using geographic information systems (GIS), the authors documented land cover, land ownership parcels, buildings, roads, political boundaries, public land survey system grids, and watersheds. The number of habitat patches, patch size, patch shape, and patch distribution were used as quantitative landscape measures. The number of patches increased steadily from 1964 to 1994 with the most prominent fragmentation of aspen, meadow, and sagebrush cover types. Traditional high-density subdivisions were located in ecologically critical riparian areas along valley bottoms, while low-density subdivisions extended from the valley bottoms up into aspen and conifer covers, important cover types for wildlife habitat.

Fragmentation of rural landscapes by exurban development can influence biodiversity, locally and regionally. Maestas et al. (2001) compared songbird and carnivore populations and plant communities in public protected areas, private ranchland, and exurban developments in northern Colorado (lot size = 14-20 hectares). Exurban developments contained more non-native plant species than either ranches or protected areas, and they supported more non-native and generalist wildlife species. Of the three land-use types, ranches supported the greatest diversity of species of high conservation value. Because non-native species, both plants and animals, tend to displace native species and result in decreased biodiversity, containing the spread of non-natives is a top priority on the agenda of most land management agencies (Mack et al. 2000). As a potential point of spread of non-native species from private to public lands, exurban developments play an important role in regional land-use planning.

As shown above, much of the growth in rural areas of the west has occurred adjacent to public lands. Land-use change along the public/private land boundary from large ranch ownership to low-density exurban development often results in cross-boundary impacts. For example, Chase and Hoff (1974) surveyed national forest managers from the Mogollon Rim in north central Arizona, a region that continues to experience rapid population growth and recreational subdivision development. Managers reported increased management costs associated with trespass, special use permits, facility use, insects and disease, timber, watershed maintenance, and natural beauty.

Similarly, forest managers from high growth counties in Utah, Wyoming, Colorado, California, and Oregon associated adjacent private land development with increased management costs for recreation, water (both quality and quantity), special use permits, and land administration (Johnson, 1983). When private lands adjacent to national forest are subdivided, managers are forced to spend more money on public education and participation efforts, special use permits, and cooperative efforts with state and local agencies.

Private landowners are also concerned about land use at the private/public land boundary. In many cases, landowners complain about management practices that occur on public lands adjacent to their properties. For example, forest managers in Michigan reported increasing conflicts with adjacent private landowners over timber harvesting techniques at the private/public land boundary (Blahna, 1990). Additionally, private landowners adjacent to national forests in Colorado, Utah, Oregon, California, and Wyoming expressed concerns about national forest management practices, including timber harvesting, trespass, motorized recreation, and mining (Johnson, 1983).

Several important themes in landowner concerns are evident. First, many private landowners express a "not in my backyard" attitude, whereby they acknowledge the

importance of forest management practices, such as timber harvesting, but are reluctant to accept these practices within sight of their properties (Blahna, 1990). Second, it is possible that many landowners are unaware of existing management practices on adjacent public lands prior to purchasing their land, increasing the potential for conflict when management activities do occur. Many landowners purchase land adjacent to protected areas for the privacy and natural setting afforded, and are understandably dismayed when forest management practices impact their private 'viewsheds' (Blahna, 1990).

While it is clear that land uses at the private/public land boundary influence conditions on both sides of the interface, communication across boundaries is not always evident in areas where private and public lands meet. Furthermore, information regarding private land use at the boundary is severely lacking, even though this information is crucial for predicting impacts on public land management and developing effective outreach programs (Landres et al., 1998). Given that population growth at the private/public land boundary is widespread and on the rise, reliable information regarding important land uses is needed.

Management Context

Natural resource management in the United States has been influenced by a steady evolution in social values, ranging from the early progressive conservation and preservation movements to contemporary environmentalism. The concept of ecosystem management emerged in the mid-1980's in response to growing mistrust of federal leadership, increasing conflict between local communities and management agencies, and a more holistic understanding of ecosystems. Widespread acceptance of ecosystem management as the

dominant management paradigm for public lands poses unique problems for management at the private/public land interface (Sedgo, 1995).

At the conceptual level, ecosystem management requires an implicit understanding that landscapes are composed of multiple, interrelated and interdependent ecosystems. In contrast to traditional multiple-use management, ecosystem processes, including disturbance, wildlife movement, and nutrient cycling are viewed as principal management concerns. Whereas the multiple-use philosophy is almost solely focused on resources within public land boundaries, ecosystem processes transcend administrative boundaries. As such, ecosystem management activities on public lands cannot be separated from adjacent private lands, and vice-versa (Yaffee and Wondolleck, 1997). Adopting an ecosystem management approach requires a degree of collaboration between private landowners and managers for which there is no precedent in the history of natural resource management in the United States.

Although ecosystem management requires collaboration between landowners, as the number of individual landowners adjacent to federal lands increases, it becomes more difficult for managers to maintain working relationships with residents (Chase and Hoff, 1974). As a result, maintaining consistency of management activities across administrative boundaries is problematic. Subdivision of private lands has important ecological and management impacts on rural landscapes, but little is known about the landowners themselves or the land-uses they practice. Ecosystem management continues to gain momentum within the management community while growth trends and concomitant encroachment of residential development on public lands are increasing. As such, boundary lands will play an increasingly important role in the maintenance of critical ecosystem processes.

CHAPTER 2. METHODS

Study Area and Site Selection

Six counties in the southern Rocky Mountain region were selected for distribution of a mail survey. The region includes southeastern Wyoming (Casper south), Colorado, and northern New Mexico (to Santa Fe), and contains several of the fastest growing counties in the United States. To focus on exurban residents adjacent to national forests, counties containing National Forest were identified. From the initial county list, counties with high population growth rates were randomly selected. High growth was defined as county growth rates exceeding the upper quartile growth rate for each state, based on the 2000 Census. The final list of counties included five Colorado counties and one county in New Mexico (Table 1).

Within each county, exurban residents were identified through a search of county tax records. Exurban status was conferred upon the following requirements: 1) residents lived outside incorporated city limits; 2) properties fell within a range of 20-50 acres; and 3) properties were within five miles of a National Forest boundary. Limitations on property size and proximity to National Forests were designed to capture properties within the immediate zone of National Forest influence and where residence was the primary land use.

Table 1. Growth rates between 1990 and 2000 for selected counties in the southern Rocky Mountains.

County	State	Growth Rate (%)
Delta	CO	29.6
Grand	CO	31.5
La Plata	CO	27.5
Routt	CO	27.3
Summit	CO	52.2
Santa Fe	NM	25.6

ArcView GIS software was used to analyze county data files and determine eligible landowners. Due to the relatively small populations of eligible landowners in all selected counties (ranging from 60-400), all eligible landowners were included in the sampling frame. A total of 1,256 landowners were identified for the survey.

County Descriptions

Grand County, Colorado

Located west of the continental divide in north central Colorado, Grand County has long attracted new residents and tourists alike. The county contains the western portion of Rocky Mountain National Park, parts of two National Forests (Arapahoe and Routt), two Wilderness areas (Never Summer and Indian Peaks), two downhill ski areas (Winter Park and Silver Creek), numerous cross-country ski areas, and world-renowned fishing on the Colorado and Williams Fork rivers. Public lands in Grand County account for over 70 percent of the land area.

Although the county contains six incorporated towns, a significant number of the county's 12,000 residents live outside incorporated city limits, within easy reach of public

lands. Its proximity to major population areas along the Front Range and relative affordability continue to draw population growth.

Delta County, Colorado

Situated in the high desert landscape of west central Colorado, Delta County retains some of the ranching character of the old west. The county is predominantly agricultural, but tourism and the attendant service economies are beginning to play a more important economic role. The county contains portions of two national forests (Grand Mesa and Gunnison), and is a popular base for visits to nearby Black Canyon of the Gunnison National Park, Colorado National Monument, and Powderhorn Ski area.

La Plata County, Colorado

Durango, the La Plata County seat, is one of the fastest growing cities in the state. Located in the scenic four corners region, the county beckons to visitors and new residents alike with a wide variety of recreation opportunities, a small liberal-arts college (Fort Lewis College), and a lively arts scene. Roughly 40 percent of the acreage encompassed by La Plata County is public land, predominantly in the San Juan National Forest. Another 30 percent is held in the Southern Ute Indian Reservation, resulting in concentrated residential and commercial development in incorporated towns and cities. As the available private land base within developed areas has dwindled, development in exurban areas adjacent to public lands has increased.

Routt County, Colorado

With the exception of Steamboat Springs, home to the world-famous Steamboat Ski and Summer Resort, Routt County is a typical Northern Colorado county. The economy of most of the region is driven largely by agriculture and the extractive industries, although tourism plays a significant role, especially in Steamboat Springs. The area has high natural resource amenity value, boasting two federal wilderness areas (Mt. Zirkel and Sarvis Creek), the Medicine Bow-Routt National Forest, excellent skiing, and world-class fishing opportunities. Routt County residents are proud of their ranching heritage, and significant efforts have been made to preserve the ranching lifestyle, favoring open space over residential development. That fact notwithstanding, of the counties selected for this study Routt County had the greatest population of residents living in exurban areas.

Summit County, Colorado

Summit County has earned a reputation as Colorado's playground. It is a mountain county, ranging in elevation from 7,900 to 14,000 feet in elevation. Justly famous for its five ski areas (Arapaho Basin, Breckenridge, Keystone, Loveland Pass, and Copper Mountain), the area is also popular for summer recreation opportunities including mountaineering, hiking, fishing, and mountain biking. A full 73 percent of the county's land area is under public ownership, and 25 percent of the remaining land area is in unincorporated private land, leading to a widely dispersed pattern of settlement. Economically, over 70 percent of the county's annual income is derived from retail and service-based economies, particularly those related to outdoor recreation. Abundant recreation opportunities combined with easy access to a major metropolitan area (Denver) continue to make Summit County a premier destination in Colorado.

Santa Fe County, New Mexico

North Central New Mexico is a landscape of contrasts, including the alpine summits of the southernmost Rocky Mountains and the plateau and canyon geography of the southwestern high desert. Santa Fe County is no exception. Blessed with a sunny climate, a vibrant cultural scene, significant historical interests, and ubiquitous recreation opportunities, Santa Fe County continues to attract the highest growth of any county in northern New Mexico. Although much of the growth in the county is concentrated in urban areas, encroachment of residential development on rural areas is significant.

Data Collection

Data were collected via mail surveys following a modified Total Design Method (Dillman, 2000). In August 2002, all eligible landowners were mailed a survey packet including a cover letter explaining the purpose and scope of the survey (Appendix), a copy of the survey itself, and a postage paid return envelope. Approximately four weeks after the first mailing, reminder postcards were sent to landowners from whom returned surveys had not yet been received. A second survey packet containing a new cover letter, survey, and return envelope was sent to remaining landowners four weeks after the postcard mailing.

Questions in the mail survey were designed to elicit responses in five information categories: 1) private property land use; 2) demographics; 3) general environmental value orientations; 4) attitudes toward ecosystem management concepts; and 5) behavioral intentions with respect to ecosystem management concepts. The data presented in this report represent responses to land use and demography questions only.

Questions pertaining to land use were developed in a variety of ways. First, items were developed as a result of consultation with USDA Forest Service personnel. Forest

Service experts on private land use were asked to provide a list of adjacent private land uses that would be relevant to forest management. Second, an elicitation survey of a small sample of exurban landowners was conducted prior to development of the mail survey. Among other things, landowners were asked to describe how they used their properties. Responses to these questions were used to develop additional land use items for the mail survey.

CHAPTER 3. RESULTS

Response

Out of 1,256 surveys mailed, 452 completed surveys were returned. Seventy-four surveys could not be delivered because of incorrect addresses or changes of address with no forwarding information. An additional 35 surveys were not used in the analysis because the properties were greater than 50 acres. After discarding ineligible surveys, the overall response rate was 39 percent. Although this response rate is acceptable, two major issues may have prevented a higher response rate.

First, the 35 properties that exceeded the specified range represent inaccuracies in the county landowner data from which the population was drawn. Many landowners own multiple adjacent parcels that are treated as separate units in landowner databases. While the total land owned by a single owner may be in the hundreds of acres, one parcel may have fallen in the acceptable range, leading to overestimation of small acreage owners. It is possible that additional landowners originally identified as eligible were in fact not eligible based on property size, and they chose not to return the survey.

Second, private land use is a sensitive issue for many landowners. Although all possible efforts were taken to design a secure, anonymous, and value-neutral survey, it is possible that some landowners refused to participate based on anxiety about privacy, the anonymity of their responses, and loss of property rights that might result from misuse of the data. As evidence of these concerns, several landowners wrote comments to this effect on their returned surveys.

A non-response survey was conducted to determine if there were significant differences between respondents and non-respondents in the survey population. After a preliminary analysis of the mail survey data, six survey items were selected for use in a follow-up telephone survey of 31 non-respondents. Independent samples t-test showed no significant (P>.05) differences between the respondent and non-respondent demographics.

General Population Structure

Landowners who participated in the survey represent a relatively narrow subset of American society. The vast majority of respondents were caucasian males age 50 or greater (Table 2). Although female respondents were the minority, this is more a reflection of who chose to fill out the survey than true gender differences in exurban landownership. The population is also well educated, with over 60 percent of respondents reporting a minimum of a four-year college degree. Finally, survey participants represent a relatively wealthy population, with an annual income exceeding $60,000 for more than half of all respondents (Table 2).

Exurban landowners in the survey population are generally long-time residents with urban backgrounds. The majority of the respondents have been county residents for greater

Table 2. Demographic characteristics of exurban landowners in the southern Rocky Mountains.

Race		Gender		Age Class		Highest Education Level Achieved		Annual Household Income	
	%		%		%		%		%
White	97	Male	67	<18	<1	Grade School	2	<15000	4
Asian Pacific	<1	Female	33	19-30	<1	High School	10	15001-35000	13
Mexican-American	<1			31-40	6	Some College	24	35001-60000	25
				41-50	26	4-Year College	33	60001-100000	26
American-Indian	<1			51-60	35	Post-Graduate	32	>100000	32
				>61	32				
Other Hispanic	<1								
Other	1								

than 11 years, although a significant number (30 percent) have been residents for 10 or fewer years (Table 3). Across all counties, more than half of the respondents reported having moved to their current residence from urban environments. Approximately one fourth of the respondents migrated from rural environments, with small/medium towns comprising the remaining prior residence locations (Table 3). Similarly, more than 50 percent of the respondents reported having grown up in an urban setting, with the remaining residents split between rural and small/medium town environments.

Due to the variation in response by county, direct comparison of respondent information between counties will generally be avoided; however, there were several notable demographic differences. Although the entire population was relatively well educated, more than 60 percent of the residents in Grand, La Plata, Routt, Santa Fe, and Summit counties reported four-year degrees or post-graduate work (Table 4). Income levels were also different between the counties, with more than 50 percent of residents in Grand and Summit counties reporting annual incomes greater than $100,000 (Table 4). These differences can be partially explained by the fact that renowned ski resorts dominate the economies of Grand, Routt, and Summit counties.

Table 3. Length of residence in the state where currently residing and prior residence distributions for exurban residents in the southern Rocky Mountains.

Length of Residence		Prior Residence		Where Grew Up
Non-resident	4	Ranch/farm	18	26
<5 years	12	Ranchette	7	<1
6-10	15	Small Town	12	16
11-20	14	Medium Town	7	6
>20	53	Small City	10	11
		Medium City	14	14
		Large City	32	26

Values represent percentage of respondents in each category.

Table 4. Differences in exurban landowner demographics according to County of residence.

	Delta	Grand	La Plata	Routt	Santa Fe	Summit
Education	n=93	n=52	n=104	n=135	n=17	n=44
4-year college	22	32	25	43	29	45
Post-graduate	24	34	36	28	47	31
Income levels	n=85	n=49	n=94	n=121	n=15	n=35
60001-100000	22	20	27	27	46	28
>100000	10	51	29	36	13	54
Residence Length	n=93	n=52	n=104	n=136	n=17	n=43
Non-resident	2	5	1	9	0	2
<5 years	5	6	23	13	6	12
6-10 years	18	10	20	15	12	9
11-20 years	12	12	20	11	35	7
>20 years	62	67	35	52	47	70
Prior Residence	n=92	n=50	n=101	n=131	n=15	n=43
Ranch/farm	34	20	11	15	27	2
Small town	12	6	14	8	7	28
Small city	15	8	6	11	13	7
Medium city	13	18	12	15	13	16
Large City	15	42	42	33	33	37

Values represent percentages of respondents for each category.

Ski resort towns have long attracted wealthy individuals seeking quick access to the slopes and the chic lifestyle offered by prominent resorts. As a result, counties within which ski resorts are concentrated tend to have a higher proportion of high-income, part year residents.

Length of residence also differed by county (Table 4). Exurban landowners in Grand, Summit, and Delta counties reported the longest history of residence, with greater than 60 percent having lived in their current locations for greater than 20 years. These three counties all lack prominent towns or cities that serve as major population centers on the level of Steamboat Springs (Routt), Durango (La Plata), and Santa Fe (Santa Fe), all of which

continue to attract rapid growth. It is possible that counties with growing urban areas have accommodated more recent growth as economic opportunities have expanded, changing the balance of newcomers to longer-term residents in these areas.

Finally, landowner prior residence and residential background differed by county (Table 4). In marked contrast to residents in the other five counties, less than half of Delta County landowners migrated from urban settings. In fact, 40 percent of respondents from Delta County grew up in rural areas. While Delta County continues to grow faster than state and national averages, migrants may be drawn by different qualities than those offered by the other counties surveyed. As described previously, Delta County has largely retained its' agricultural heritage, and while located in close proximity to recreational areas, the county itself does not contain any prominent recreation destinations. As a result, growth in this area may be determined by quality of life factors, relative affordability, and the ranching lifestyle, which may appeal to a completely different demographic pool.

Land Uses

One of the goals of the land use survey was to identify dominant land use concerns and concomitant uses. When asked how landowners would describe how they maintain their property, weed and fire control were listed as the dominant maintenance-related activities. Less than 40 percent of all respondents indicated that maintaining the natural character of the land or maintaining native species were maintenance priorities. Although weed control and maintenance of native species are ecologically interdependent land uses, exurban landowners apparently view them as independent concepts.

Rural landowners enjoy a broad range of land use options, both on their own property and on adjacent public lands (Table 5). Roughly 40 percent of landowners

Table 5. Exurban landowner uses of private land and privately accessed public land in the southern Rocky Mountains.

Land Uses	Public Land	Private Land
Hiking	88	48
Hunting/Fishing	44	0
Ride Horse	35	26
Nature Study	27	23
Camping	16	0
Shooting	10	22
ORV Use	11	6
Other	4.1	0
Enjoy Beauty		82
Rural Living		82
Building Trails		7
Gardening		40
Landscaping		31
Provide a Home for Livestock		48

Values represent percentages of respondents for each variable.

surveyed reported having private access to public lands, an increasing problem for land managers because it results in dispersed use that is difficult to monitor (Johnson 1983). Landowners in this survey primarily use this access for hiking, riding horses, and hunting, but the list of potential uses is not limited to these activities.

On their own properties, activities associated with rural lifestyles were the most prevalent. More than 80 percent of respondents indicated that enjoying the natural beauty and rural lifestyle were important uses. Rural lifestyles are often associated with land use options not available to urban dwellers. As evidence, over 40 percent of landowners in this survey use their property to provide a home for livestock.

An important aspect of land use in the semi-arid west is experience with western landscapes. Climates of the Interior West differ dramatically from conditions elsewhere in the United States, particularly with respect to average annual precipitation and humidity, which influence appropriate land uses for the region (Kittel et al., 2002). Less than a third of

the landowners in this survey had previous experience owning land in the west (Table 6). Similarly, less than 25 percent of landowners reported experience farming or ranching in the west. In contrast, experience with urban and suburban environments was reported by more than 40 percent of respondents. Although previous experience may play an important role in determining current land uses, that relationship was not tested in this study.

Several natural resource management agencies offer consultation services and information to landowners who lack prior land use experience in western landscapes. Of the residents surveyed, 59 percent reported having consulted with an agency about private land use at least once (Table 6). The majority of contacts were made with County Extension agents, and nearly a third of respondents had contacted State agencies such as the Colorado State Forest Service. Although most of the landowners surveyed live immediately adjacent to national forest, less than a third of respondents had ever consulted with the U.S. Forest Service.

An important objective of land use consultation is development of a property wide management plan. Private landowners in exurban areas may or may not be aware of the many management issues with which they are faced, including fire protection, weed

Table 6. Previous experience and land use consultation for exurban landowners in the southern Rocky Mountains.

Previous Land Use Experience	%	Agencies Consulted	%
No previous experience	5	US Forest Service	27
Eastern Farming	14	National Park Service	<1
Western Farming	17	State Agencies	29
Suburban/Urban	47	Private Organizations	7
Ranching	24	Bureau of Land Mgmt	9
Acreage East	14	County Extension	59
Acreage West	31	Natural Resource Conservation Service	9

management, and wildlife habitat issues. As a component of ecosystem management, management plans help to identify and prioritize landowner concerns, goals, and objectives. Only 30 percent of the landowners surveyed had developed management plans for their property. Of those who had a plan, 67 percent consulted with natural resource professionals about their plan, and 59 percent discussed their plans with neighboring private landowners.

Landowners were asked several questions concerning specific land management activities applied to their property (Table 7). Fifty-six percent of respondents grazed animals on their property, with horses (76 percent) and cattle (51 percent) listed as the dominant grazing animals. Discussions with both landowners and adjacent land managers during the development of the survey identified overgrazing as an important concern in exurban developments. As indicated earlier, many landowners have little experience with western landscapes and may not be aware of appropriate stocking rates for their particular location. Managed grazing, wherein pastures are fenced in order to manipulate the timing, intensity, and duration of grazing, is an option for some small acreage landowners, depending upon the size of available pastures and productivity of the site (Barnhill et al., 1999). In this population, less than half of the landowners who graze animals employ a system of managed grazing.

Landowners were also asked about vegetation management practices. Several different aspects of weed management were examined (Table 7). Over 70 percent of respondents participate in some form of weed control. To accomplish this, 41 percent use spot/selective application of herbicides and 23 percent are actively involved in non-native species removal. Although an indirect form of weed management, establishment of native species can prevent large-scale invasion by weedy species. Forty-three percent of respondents actively plant native species on their property.

Table 7. Land uses practiced by exurban landowners in the southern Rocky Mountains.

Land Use	%	Land Use	%
Grazing	56	Timber mgmt (total)	66
Use Grazing System	47	For fuel reduction	48
Weed Control	73	For wildlife habitat	17
Remove non-natives	23	For views	19
Herbicide application	41	For water yield	5
Planting native species	42	For firewood	46
Mowing	67	Vegetation mgmt (total)	46
Sensitive habitat ID	18	For wildlife habitat	29
		For livestock forage	32

Exurban residents use timber on their property in several ways (Table 7). The fires of 2000 sensitized many landowners in Colorado and New Mexico to the threat of fire and subsequent property loss. A result of this awareness has been increased landowner attention to fuel management on private property. In this study, 48 percent of respondents engage in fuel reduction efforts on their property. Additionally, 46 percent manage their timber resources for firewood.

These figures may be misleading because many exurban properties do not have significant timber resources. When compared to the number of landowners who reported any form of timber management, 72 percent engaged in fuel reduction efforts and 69 percent harvested timber for firewood. Timber management for wildlife habitat, view enhancement, and increased water yield does occur in exurban developments, but a minority of respondents practice these activities.

Exurban landowners often introduce domestic pets to the wildland/urban interface. If allowed to roam free, domestic pets have been shown to impact native bird and rodent populations (Hawkins, 1998). Of the landowners surveyed, 75 percent own either a cat or a dog; of those who have pets, 73 percent allow their pets to roam free on the property. Many

of these properties (70 percent of all properties) are fenced, but the dominant type of fencing (barbed or barbed/smooth combo) used for these properties does not prevent most domestic pets from straying beyond property boundaries.

Fencing represents a difficult issue for exurban landowners because it usually involves several tradeoffs. Pet owners may opt to build fences that prevent straying, but these fences can be unsightly and may act as barriers to wildlife movement. As suggested above, fencing that allows wildlife movement also allows straying by domestic pets. To address this issue, about 12 percent of landowners chose to construct small fenced areas for pets while leaving the remainder of the property unfenced.

Ecological Knowledge

Landowner familiarity with the environment in which they live can have an important influence on land use. This survey evaluated landowner knowledge about ecosystem properties and general concepts in three ways. First, landowners were asked to describe the extent to which they had been exposed to ecological concepts, either formally (e.g. academic training) or informally (seminars, etc). Second, landowners were asked to identify native plants and wildlife common to their region. Finally, landowners were asked to evaluate true/false questions regarding several basic ecosystem management concepts.

In general, exurban landowners in this population have had little formal or academic exposure to ecological concepts. As designed, this item does not in itself provide a fair representation of a landowner's knowledge base with respect to local ecosystems. It is not our intent to suggest that academic training in ecology is the only valuable source of ecological information, nor to discount the value of knowledge gained through experience with the land. As suggested by the data that follow, the population is relatively aware of

basic ecological concepts, even though less than a third of the respondents have had exposure to ecology in an academic setting.

Landowner knowledge about local flora and fauna was mixed. Only a third of respondents correctly identified three or more (out of six) native plant species. The desire for landowners to undertake weed control activities is incongruent with their inability to identify non-native plants. In contrast, 81 percent were able to identify 50 percent or more wildlife species common to the region. These results are understandable given the press attention wildlife receive, the popularity of the region for its' wildlife, and the lack of attention given to plant species in general.

The results for landowner knowledge about basic ecological concepts were more encouraging. Ninety-two percent of landowners correctly answered 5 or more questions (out of seven) about topics including the role of disturbance, change in ecosystems, and ecosystem boundaries (Table 8). While landowners were relatively knowledgeable about the concepts described, this analysis does not illustrate the degree to which landowners understand the connections between ecological concepts and specific land uses.

Landowners may be unaware of ecological degradation that results from certain land uses (e.g. overgrazing) and how those uses affect adjacent properties. Furthermore, understanding how disturbance regimes, nutrient cycles, and energy flow relate to specific land uses is not intuitive. Landowner understanding of the connections between ecological concepts and land uses warrants further investigation.

Table 8. Exurban landowner knowledge about selected ecosystem concepts.

Question	% answered correctly
Disturbance events, such as fire and floods, are natural and important elements of ecosystem structure and function	95
Rocks and soil are not included in the notion of an ecosystem	97
A healthy ecosystem is characterized by equilibrium and the absence of change	83
All plants and animals are of equal importance to an ecosystem's maintenance and functioning	33
Ecosystems are isolated units that are completely self-contained	89
Impacts or events that occur in one ecosystem do not impact other systems	95
Under ecosystem management, mining, grazing, and logging are not permitted on national forests	87

CHAPTER 4. DISCUSSION

There are little data concerning the demographics, land uses, and values of exurban residents in the Rocky Mountain west. At the same time, however, exurban development is becoming more widespread and has the potential to significantly impact ecosystems in the region. Preventing further exurban development in sensitive areas is currently a major focus of many conservation organizations, resulting in the creation of numerous land trusts in nearly every western state. While this is a worthy goal, there is little effort being taken to establish dialogue and conservation partnerships with existing exurban landowners. This paper, in conjunction with two subsequent reports, provides a basis for better understanding these landowners.

Within this survey population, communication and collaboration between exurban landowners and adjacent national forest managers is not common. As a result, private landowners may be unaware of forest management goals and strategies that may influence their properties. Concomitantly, as the population of adjacent residents grows it becomes more difficult for forest managers to keep track of adjacent private land uses that may impact the forest. Several land uses practiced by exurban landowners have important implications for adjacent properties, whether they are public or private lands.

First, relatively widespread use of grazing animals in exurban developments can have an important influence on local vegetation. With less than half of all respondents employing managed grazing, it is likely that some of these properties are overgrazed. Shifts in species

dominance as a result of overgrazing can provide an opportunity for non-native species invasion, the spread of which is not limited to property boundaries. As many of the landowners in this survey are unable to distinguish between common native and non-native plants, populations of non-native species may increase to the point where they become serious management problems. Dialogue among adjacent land managers, county weed districts, and private landowners about vegetation management can help to prevent problem weed infestations.

Dispersed recreation resulting from private access to public lands also represents a serious concern for ecosystem managers. Unofficial trails and roads extending from private property into previously inaccessible areas can influence wildlife behavior and provide an avenue for the spread of invasive species. Additionally, monitoring of acceptable or unacceptable uses of public land becomes very difficult when adjacent landowners avoid established access points in favor of private access. Here again, open communication between adjacent landowners and public land managers can address these issues and prevent small-scale concerns from becoming large-scale resource conflicts.

Widespread introduction of domestic pets into exurban environments, the majority of which in this population are allowed to roam free, has the potential to impact resident and migratory wildlife. Even if direct predation by domestic pets is not a factor, harassment caused by barking, chasing, or stalking is certainly an issue (Miller et al., 2001; Hawkins, 1998). There is no ecological distinction between private property boundaries and wildlife habitat distribution, so the influence private land uses have on adjacent properties requires discussion. If resident and migratory wildlife are a valuable resource to private landowners, public land managers, and state wildlife agencies, increased collaboration with exurban landowners is warranted.

Finally, the concept of ecosystem management requires a scale that transcends administrative and property boundaries. In order for this to occur, management of public and adjacent private land needs to reach some degree of compatibility, requiring collaborative planning between adjacent landowners. A minority of landowners in this survey had a management plan for their property, representing a potential barrier to landscape scale management. As the growing exurban population continues to encroach upon buffer lands surrounding protected areas, the need for cooperation and collaborative land planning between landowners and land managers increases.

In summary, ecosystem management in the southern Rocky Mountains will require more communication between land managers, be they public or private, and private landowners. It is unlikely that landowners will initiate this dialogue, suggesting that managers will need to increase outreach efforts aimed at establishing relationships with adjacent exurban landowners. To do so, land managers will need to understand the demographics, land uses, values, and concerns of adjacent landowners.

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EXURBAN LANDOWNER PERCEPTIONS OF AND SUPPORT FOR ECOSYSTEM MANAGEMENT IN THE SOUTHERN ROCKY MOUNTAINS

Introduction

Ecosystem Management (EM) has been broadly accepted as the contemporary management paradigm for public lands in the United States, and has received significant attention in the natural resource literature (Grumbine, 1994; Yaffee and Wondoleck, 1997; Yaffee, 1999; Bengston et al., 2001). Although the majority of land management agencies have adjusted their approaches to incorporate evolving EM ideas, there is still no consensus about the application of EM on the ground.

As land management agencies struggle to define and implement EM, the social context within which collaboration must occur is ever changing. The southern Rocky Mountains in particular have experienced explosive population growth, much of which has occurred in exurban areas adjacent to public lands (Theobald et al., 1996; Baron et al., 2000). As the population base on adjacent private land increases, management at the boundary between public and private land becomes much more complex.

This study focused on exurban landowner attitudes towards and support for four themes of ecosystem management in application: Adaptive management; collaboration with land or wildlife managers; a science-based approach; and the use of private land for wildlife habitat. Specific dimensions of implementation were evaluated for each of the themes, with the goal of elucidating ecosystem management approaches in which landowners would be most likely to participate.

Background

At the conceptual level, ecosystem management requires an implicit understanding that landscapes are composed of multiple, interrelated and interdependent ecosystems. In contrast to traditional multiple-use management, ecosystem processes, including disturbance, wildlife movement, and nutrient cycling, are viewed as principal management concerns. Additionally, EM recognizes that ecological processes transcend administrative boundaries. As such, ecosystem management activities on public lands cannot be separated from adjacent private lands, and vice-versa (Yaffee and Wondolleck, 1997).

The EM approach requires a degree of collaboration between private landowners and managers for which there is no precedent in the history of natural resource management in the United States. Existing regulations (National Environmental Policy Act, National Forest Management Act) regarding public involvement in federal land management planning are designed to allow for public comment and review of proposed actions, rather than facilitating collaborative efforts. As a result, federal agencies have little experience with the degree of cross-boundary collaboration inherent in the ecosystem management concept.

Furthermore, policy and social barriers to collaboration between federal land managers and private landowners exist. Stipulations of the Federal Advisory Committee Act (1972) are often viewed by federal managers as restrictive of their ability to participate in collaborative groups, particularly with respect to management of public lands (Cortner and Moote, 1999). Additionally, long-standing citizen distrust of land managers, misconceptions about what ecosystem management entails, and concerns

about property rights have resulted in an atmosphere of skepticism surrounding collaboration (Reading et al., 1994; Raedeke et al., 2001; Hurley et al., 2002).

Public land management directives aimed at biodiversity preservation and reintroduction of disturbance regimes are unlikely to succeed without the inclusion of private lands. In some cases, adjacent private lands provide critical seasonal habitat for migratory species (Hansen et al., 2002). Furthermore, over half of all federally listed threatened and endangered species can be found only on private land (Irland, 1994). As such, adjacent private lands provide a critical link in the ecosystem management chain.

Information regarding private landowner perceptions of and willingness to participate in ecosystem management is crucial for development of collaborative approaches. Numerous studies have shown that the general public expresses favorable attitudes toward ecosystem management concepts (Reading et al., 1994; Shindler et al., 1996; Jacobson and Marynowski, 1997; Manning et al., 1999), but relatively few studies have focused on specific perceptions of private landowners. Studies conducted on non-industrial private forest (NIPF) owners have shown that landowners are generally supportive of ecosystem management concepts, although these views are moderated by concern for privacy, property rights, and the tradeoffs between conservation and other values (Egan and Jones, 1993; Brunson et al., 1996, Rickenbach et al., 1998).

Although ecosystem management is complex, researchers have taken several approaches to simplify the concept for landowner surveys. Brunson et al. (1996) asked NIPF owners to define ecosystem management, and then had respondents evaluate a researcher-provided definition. Even with clearly worded definitions, landowners may not understand the full range of ecological concepts inherent in ecosystem management, or how ecosystem management translates into actions and impacts.

Rather than focus on terminology, some researchers have focused on landowner perceptions of ecosystem management concepts. For example, Rickenbach et al. (1998) asked landowners about ecosystem management themes rather than the concept as a whole. Questions were designed around the themes of landscape perspectives, small-scale sensitivity, and the temporal dimensions of ecosystem management. Although an original and useful approach, the items measured focused primarily on attitudes towards ecosystem management concepts rather than actions.

The Mountain West differs from the landscapes where studies of NIPF owners have predominantly occurred. In the Rocky Mountains, private lands often abut or intermingle with public lands, creating a land-use context where private interests operate within the rubric of public land management. While it is clear that the private/public land interface is an important area of concern for ecosystem management, little information about private landowner perceptions of collaboration with adjacent land managers exists.

Here, we present the results from a mail survey of exurban landowners whose properties are adjacent to national forests. Landowners were asked about their attitudes and support for ecosystem management themes, with the goal of determining management recommendations with the greatest chance of success and landowner participation. We used cognitive hierarchy theory to explain relationships between landowner cognitions about ecosystem management.

An individual's perception of the environment can be described as a cognitive hierarchy consisting of values, value orientations, attitudes/norms, behavioral intentions, and behaviors (Homer and Kahle, 1988, Fulton et al., 1996; Vaske and Donnelly, 1999). Individual items in the hierarchy build upon each other towards the end of predicting

actual behaviors. This study applied several aspects of the cognitive hierarchy, specifically value orientations, attitudes, and behavioral intentions, to the land use context.

Value orientations are patterns of basic beliefs, or clusters of interrelated fundamental values (Homer and Kahle, 1988; Fulton et al., 1996). Values, the basis for value orientations, are enduring beliefs about appropriate conduct or end states of existence that transcend objects, situations, and issues (Rokeach, 1973). Value orientations toward natural resources can be represented along several continuums ranging from anthropocentric to biocentric, protection to use, and benefits to existence (Steel et al., 1994; Fulton et al., 1996; Manning et al., 1997; Vaske and Donnelly, 1999).

Although numerous definitions for attitudes can be found in the social psychology literature, all agree that an attitude is an individual's tendency to respond favorably or unfavorably towards a particular object or behavior (Vaske and Donnelly, 1999). Attitudes can be highly correlated with behavior, especially when attitudes concerning specific behaviors are used as predictors (Ajzen and Fishbein, 1980). In many cases, the influence of attitudes is measured with respect to behavioral intentions, or an individual's intent to enact a particular behavior.

CHAPTER 2. METHODS

Study Area and Population

Exurban development is widespread in the southern Rocky Mountains, particularly in counties containing National Forest land, providing a natural laboratory for this type of research. Six counties in the region were randomly selected for analysis based on Census 2000 growth rates and the occurrence of National Forest land within their boundaries (Table 1).

Within each county, exurban residents were identified through a search of county tax records. Exurban status was conferred upon the following requirements: 1) Residents lived outside incorporated city limits; 2) properties size was between 20-50 acres; and 3) properties were within five miles of a National Forest boundary. Limitations on property size and proximity to National Forests were designed to capture properties within the immediate zone of National Forest influence and where residence was the primary land use.

ArcView GIS software was used to analyze property ownership and property tax data to determine eligible landowners. Due to the relatively small populations of eligible landowners in all selected counties (ranging from 60-400), all eligible landowners were included in the sampling frame. A total of 1,256 landowners were identified for the survey.

Table 1. Counties selected for analysis of exurban landowners in the southern Rocky Mountains.

County	State	Growth Rate
Delta	Colorado	29.6%
Grand	Colorado	31.5%
La Plata	Colorado	27.5%
Routt	Colorado	27.3%
Santa Fe	New Mexico	25.6%
Summit	Colorado	52.2%

Growth rates based on 2000 census data, U.S. Census Bureau.

Data Collection

Data were collected via mail surveys following a modified Total Design Method (Dillman 2000). All eligible landowners were mailed a survey packet including a cover letter explaining the purpose and scope of the survey, a copy of the survey itself, and a postage paid return envelope. Approximately four weeks after the first mailing, reminder postcards were sent to landowners from whom returned surveys had not yet been received. A second survey packet containing a new cover letter, survey, and return envelope was sent to remaining landowners four weeks after the postcard mailing.

Questions in the mail survey were designed to elicit responses in a variety of categories, but the discussion here is focused on questions pertaining to: 1) General environmental value orientations; 2) attitudes toward ecosystem management concepts; and 3) behavioral intentions with respect to ecosystem management concepts.

Elements of several widely used scales were used to assess general landowner value orientations with respect to land, wildlife, and ecosystems. Items were selected to reflect a dichotomy of values, providing a measure of the degree to which landowner

Table 2. Value orientation items for a mail survey of exurban landowners in the southern Rocky Mountains

Scale items
Plants and animals exist primarily to be used by humans[1]
Humans have the right to modify the natural environment to suit their needs[1]
Ecosystems should only be preserved for their potential benefit to humans[1]
I prefer wildlife reserves to zoos
Forests are important only because humans need lumber[1]
It's only important to keep rivers and lakes clean to provide[1] clean water for humans
Nature is important because of what it can contribute to human welfare and pleasure
Nature is valuable in its own sake[1]
We need to preserve resources to maintain a high quality of life
It is important to preserve natural ecosystems[1]
Maintaining healthy ecosystems is important for all life, not just humans[1]
Economic growth is more important than ecological sustainability[1]
Economic growth is compatible with ecological sustainability

[1]These items were combined into a single scale for structural equation modeling.

values were biocentric (biologically centered) or anthropocentric (human centered) in nature (Table 2). After reliability analysis, nine of the original 13 basic belief items were combined into a single value orientation scale representing a continuum of anthropocentric to biocentric beliefs.

Questions about landowner attitudes were based on a comprehensive literature review and an elicitation survey administered to 30 exurban landowners in Larimer County, Colorado. For the elicitation survey, landowners were asked to evaluate the

four ecosystem management concepts described above (collaboration, adaptive management, science based land-use, and private property habitat value). Responses to the elicitation survey were used to develop Likert scale items for each attitude theme.

Landowner attitudes were measured using five-point Likert scale items to construct scales for each ecosystem management concept. Likert scales typically measure the degree of agreement with a particular statement, where the values indicate how strongly an individual agrees or disagrees (Dawes, 1972). In this study, attitude items measured landowner evaluations (positive or negative) of belief statements for each ecosystem management theme. Attitude scales were composed of several attitude items that represented the same underlying construct, in this case one of the four concepts of ecosystem management mentioned above.

Value orientation and attitude scales were tested for reliability using Cronbach's alpha (Borhnstedt, 1983). Reliability analysis provides a measure of the degree to which a set of variables represents the same latent construct. Specifically, Cronbach's alpha is a function of the number of items in a scale and the inter-item correlations (SPSS, 1992). Cronbach's alpha values range from 0 to 1, with values closer to 1 indicating greater reliability.

There are several reasons why measurement of landowner behaviors that directly relate to ecosystem management concepts is not always practical. First, while ecosystem management has come of age at the conceptual level, it is not widely practiced, particularly by private landowners. Second, gaining access to private land for land use assessment is difficult, especially in the Rocky Mountain West. For this study, landowner intentions to participate in ecosystem management related behaviors were

measured by their likelihood to vote for hypothetical management prescriptions. The Likert scale used for attitudes was also applied to voting intentions.

Several analysis techniques were used to evaluate the relationships between value orientations, attitudes, and voting intentions. First, multiple regression analysis was applied to value orientation, attitude, and voting scales to identify the variables with the strongest influence on voting intentions. Second, structural equation modeling (SEM), using Lisrel 8.5 (Joreskog and Sorbom, 1994), was used to further test the relationships between variables. SEM combines confirmatory factor analysis with path analysis to explain relationships among observed variables relative to latent underlying constructs.

There are several advantages to the SEM approach, among them the ability to account for measurement error and provide a test for both direct and indirect relationships between variables. Although use of SEM to evaluate elements of the cognitive hierarchy is not new, application to the land use context has not been widespread.

SEM analysis was performed using maximum likelihood estimation and the sample correlation matrix of the items measuring value orientations, attitudes, and voting intentions. Basic beliefs items (from the value orientation scale) were treated as observed variables measuring underlying anthropocentric and biocentric latent value orientations. Similarly, three attitude scales (described in results) were treated as observed variables measuring an underlying latent attitude towards ecosystem management. Voting intentions served as the dependent, or criterion variable in the model. Model fit was assessed using several indices, including chi-square, chi-square/degrees of freedom, Goodness of Fit Index (GFI), Normed Fit Index (NFI), Normed Noncentrality Fit Index (CFI), and Root-Mean-Square-Residual (RMR).

CHAPTER 2. RESULTS

Response

Of the 1,256 surveys mailed, 452 fully completed surveys were returned. Seventy-four surveys were returned undeliverable, due to either incorrect address or change of address with no forwarding information. An additional 35 surveys were not used in the analysis because the properties were greater than 50 acres. Accounting for ineligible surveys, the overall response rate was 39 percent. Although this response rate is acceptable, three major issues explain why more surveys were not returned.

First, the 35 properties that exceeded the specified lot size range represent inaccuracies in the county landowner data from which the population was drawn. Many landowners own multiple adjacent parcels that are treated as separate units in landowner databases. While the total land owned by a single owner may be in the hundreds of acres, one parcel may have fallen in the acceptable range, leading to overestimation of small acreage owners. It is possible that additional landowners were not eligible based on property size, and they chose not to return the survey.

Second, private land use is a sensitive issue for many landowners. Although all possible efforts were taken to design an anonymous and value-neutral survey, it is possible that some landowners felt that the survey was too invasive of their privacy. Several respondents commented specifically about concern for the anonymity of their

responses and that the data might be used as justification to restrict or reduce property rights.

Finally, many homes in exurban areas are second homes or vacation properties. Irregularities in county databases regarding landowner contact information were prevalent, such that many records did not include permanent mailing addresses. Furthermore, part-year residents often maintain post-office boxes that are checked infrequently, and it is possible that the time frame during which the survey was conducted (August-December) did not coincide with occupancy. Although it is impossible to give precise estimates for the number of landowners who could not be reached as a result of these issues, they likely contributed to the low return rate.

A non-response survey was conducted to determine if there were significant differences between respondents and non-respondents in the survey population. After a preliminary analysis of the mail survey data, six survey items were selected for use in a follow-up telephone survey of 31 non-respondents. Independent samples t-test showed no significant (0.05) differences between the respondent and non-respondent demographics, but significant (0.05) differences were found on the six attitude items (Table 3).

Although statistically significant, the differences between respondents and non-respondents are not substantive. For example, a mean score of 3.77 is on the high end of a continuum between a neutral and positive response, whereas a mean score of 4.17 is on the low end of a positive response. The significant difference between the two values is related less to a true difference in the means than to the parsimony of the response scale (5 levels as opposed to 7) and disparity in the size of the two samples (452 versus 31). Because substantive differences (change in direction of response) were not found

Table 3. Comparison of non-respondents to survey respondents on six attitude items from a mail survey of exurban landowners in the southern Rocky Mountains.

Attitude Question	Mean		SE	T-Value	Sig.
	Group 1	Group 2			
Use property for T and E species if privacy respected	4.12	3.45	.158	4.27	.001
Use property for T and E species if property rights protected	4.11	3.35	.175	4.33	.001
Use property for T and E species if advisory approach taken	3.90	3.10	.169	4.78	.001
Monitor conditions on private land if privacy respected	4.28	3.42	.141	6.11	.001
Monitor conditions on private land if participation is voluntary	4.19	3.77	.144	2.87	.004
Monitor conditions on private land if property rights respected	4.31	3.55	.142	5.41	.001

Group 1 are mail survey respondents, Group 2 are non-respondents. Mean values correspond to a Likert scale ranging from 1 to 5, where a value of 1=extremely negative and 5=extremely positive. $P<0.05$.

between the non-response sample and survey respondents, weighting of the data was unnecessary.

Exurban Landowner Value Orientations

Responses from each county were compared using multivariate ANOVA to determine if stratification by county was necessary. No significant differences existed between counties on any of the survey items. Therefore, all respondents were treated as one population for the analysis.

Generally speaking, value orientations expressed by this sample of exurban landowners were primarily biocentric. Greater than 53 percent of the population expressed biocentric value orientations, agreeing with statements like, "nature is valuable

in its own sake" and "healthy ecosystems are important for all life, not just humans". Less than 7 percent of respondents expressed anthropocentric value orientations, and the remaining 40 percent reported neutral orientations.

There are several important considerations for interpreting these data. Although the items used were taken from well-tested scales, several items were added or changed to reflect a more contemporary understanding of ecosystems and economic values (Table 2). As such, the scale as a whole is untested. Reliability analysis of all the items used revealed a Cronbach's alpha of 65 percent, indicating a relatively low degree of consistency between the items. After deletion of several items based on inter-item correlations, the reliability improved to 86 percent. These items were then combined into a single scale for the remaining analyses (Table 2). Although reliability is a useful measure, the validity of the scale warrants further scrutiny.

Additionally, closer examination of the responses revealed inconsistencies in interpretation of scale items in a number of cases. For example, one individual gave a value of 4, indicating agreement, for both of the following statements: "Ecosystems should only be preserved for their potential benefit to humans"; and "Maintaining healthy ecosystems is important for all life, not just humans". These two items were intended to represent different poles on the biocentric/anthropocentric continuum, but this respondent clearly did not interpret them as such. This may be due to the actual presentation of the questions, such that key qualifiers such as 'only' were missed by respondents, or to varying conceptions of key words like 'preservation'. Perhaps the best conclusion to be made is that the scale requires further evaluation to resolve these issues.

Landowner Attitudes

Landowner attitudes were measured by questions concerning adaptive management, collaboration with natural resource managers, science-based management, and the use of private land for wildlife habitat and threatened and endangered species (hereafter TE species). Attitudes varied for each concept, but a majority (greater than 50 percent) of landowners expressed positive attitudes towards 17 of the 26 ecosystem management items. Although these numbers indicate broad support for many of the ecosystem management concepts measured here, closer inspection of the data reveals several important considerations.

First, positive attitudes in each ecosystem management category were often tempered by concerns about landowner privacy and preservation of private property rights (Table 4). For example, landowner attitudes about private land as wildlife habitat were generally negative, except under the conditions that property rights weren't threatened (63 percent). Similarly, positive responses to collaboration with resource managers, TE species management (on private property), and monitoring programs for private property were primarily limited to property rights and privacy related items. In fact, in the four attitude categories that contained these issues, 7 of the 13 items to which landowners responded positively were based on these two concerns.

Second, landowners are concerned about the level of participation and expectations ecosystem management concepts may require of them. This translated into concerns about compatibility with how they currently use their land. These issues served as conditions for positive attitudes towards use of private land for wildlife habitat (54 percent), TE species management (57 percent), and use of scientific information for

Table 4. Responses of exurban landowner attitudes towards ecosystem management topics related to privacy and private property rights.

Attitude Items	Mean	% Support
Private landowners could...		
use private land for wildlife habitat if it doesn't threaten property rights.	3.66	62.7
collaborate with resource managers if privacy is respected.	4.27	92.8
collaborate with resource managers if property rights aren't threatened.	4.22	87.7
use property for endangered species habitat if landowner privacy is respected.	4.12	86.7
use property for endangered species habitat if property rights aren't threatened.	4.11	83.0
allow monitoring programs on private property if landowner privacy respected.	4.28	93.6
allow monitoring programs on private property if property rights are respected.	4.31	93.4

Mean scores are based on a Likert-type scale with values ranging from 1-5, where 1 equals extremely negative and 5 equals extremely positive.

private land use (81 percent). Furthermore, 88 percent of landowners responded positively to collaboration with resource managers if expectations for landowner involvement were reasonable, and 84 percent would use scientific information to guide private land use if it were more available. These statements illustrate that exurban landowners are supportive of the management concepts measured here, but are wary of the level of commitment that may be required.

Third, landowners are concerned about maintaining autonomy and decision authority with respect to how they manage their property. Fifty-one percent of landowners would support collaboration with adjacent resource managers if managers acted in an advisory capacity only, where the landowner ultimately retains decision

power. Additionally, 74 percent of landowners supported using private property for endangered species if managers took an advisory rather than regulatory approach. Finally, 89 percent of landowners would support monitoring programs on private property if participation were voluntary. All of these responses support previous research suggesting that private landowners are extremely wary of government control of private land use. Importantly, these data also suggest that landowners are willing to participate in ecosystem management activities if the approach taken is advisory and they are included in the final decision space.

Finally, in all cases where questions related ecosystem management concepts to land or wildlife health, landowners expressed negative attitudes. For example, 84 percent of landowners reported negative feelings about using private land for wildlife habitat if the land is critical for wildlife. Responses to questions about collaboration with resource managers, use of scientific information on private land, and monitoring programs were similarly negative (Table 5). Although not directly addressed here, the results indicate that positive attitudes towards ecosystem management concepts primarily reflect anthropocentric (privacy, property rights, conditions for participation) concerns rather than biocentric (land health) concerns. This may be related to the ambiguous nature of the term land health, but it may also reflect a lack of understanding and appreciation for the importance private lands play in landscape ecology. This latter concept warrants further investigation.

Landowner Voting Intentions

Behavioral intentions have been described as the most proximate determinant of behaviors, and in many cases they can be measured more easily than behaviors.

Table 5. Responses of exurban landowner attitudes towards ecosystem management topics related to land health.

Attitude Items	Mean	% Support
Private landowners could...		
use private land for wildlife habitat if it is critical for wildlife.	1.83	5.8
collaborate with resource managers if land/wildlife health is the goal.	1.92	5.6
use science to guide private land use if it improves land health.	1.86	5.4
allow monitoring programs on private property to improve land health.	1.93	6.3

Mean scores are based on a Likert-type scale with values ranging from 1-5, where 1 equals extremely negative and 5 equals extremely positive.

Following the format used for attitude assessment, landowners were asked whether or not they would vote for a collaborative agreement with land or wildlife managers.

Landowner voting intentions were pursuant with attitudes, such that majority support (>70 percent) was expressed for collaborative management designed around privacy, property rights, reasonable expectations for participation, and landowner decision authority (Table 6). As with attitudes, the majority (80 percent) of landowners would not vote for ecosystem management activities designed solely to improve land health.

While behavioral intentions can be strong predictors of actual behaviors, there is not always a direct relationship between the two. In this particular case the agreement landowners were asked to evaluate was described very generally and was not explicitly related to any real consequences or specific behavioral changes. As such, the hypothetical context in which landowners expressed voting intentions may not be an

Table 6. Exurban landowner voting intentions for hypothetical ecosystem management activities involving private property.

Voting Items	Mean	% Support
I would vote for collaborative management plans between private landowners and resource managers if they were designed around...		
protecting land health.	2.10	11.3
respect for landowner privacy.	4.14	88.1
reasonable expectations for private landowner participation.	3.90	81.0
respect for property rights.	4.18	90.8
a landowner incentive program.	3.43	46.3
an advisory approach.	3.91	76.6
providing landowners with decision authority on private land.	4.24	87.6

Mean scores are based on a Likert-type scale with values ranging from 1-5, where 1 equals extremely unlikely and 5 equals extremely likely.

accurate representation of the context in which land use decisions are made. It is possible that landowner perception of and support for the concepts described here may change when given more detail about specific management activities.

Tests of the Theoretical Model

Multiple regression analyses of the influence of value orientations and attitudes on voting intentions indicated that not all of the scales influenced voting intentions. In support of cognitive hierarchy theory, value orientations were not significant ($P<0.05$) predictors of voting intentions. Attitudes towards ecosystem management concepts accounted for 42 percent of the variance in voting intentions. Of the attitude variables, attitudes towards TE species, use of science on private land, and monitoring programs

Table 7. Influence of exurban landowner attitudes towards ecosystem management on voting intentions.

Attitude Scale	Beta	Std. Error	T	Sig.
Private land as wildlife habitat	-.016	.059	-.34	.734
Collaboration with resource managers	.071	.067	1.50	.134
Use of science to guide private land use	.187	.089	3.56	.001
Private property as threatened and endangered species habitat	.264	.052	5.64	.001
Monitoring programs on private property	.134	.108	2.45	.015

R^2=.416

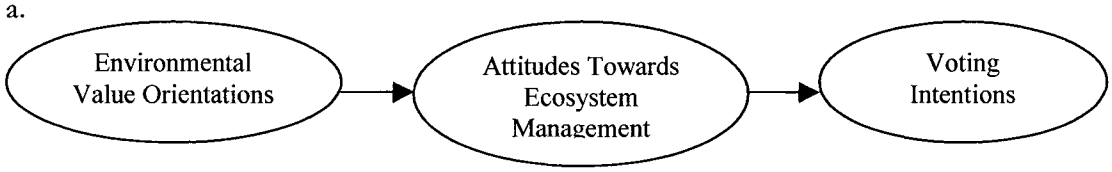
had the greatest influence on voting intentions (Table 7). These three attitude scales were used in further analyses.

Structural equation modeling (SEM) was used to further evaluate the relationships between landowner value orientations, attitudes, and voting intentions. Three different models were used to test full mediation, partial mediation, and direct effects of value orientations and attitudes on voting intentions (Figure 1). Full mediation represents the extent to which value orientations influence attitudes and attitudes influence voting intentions, whereby there is no direct influence of value orientations on voting intentions. In a partial mediation scenario, value orientations influence both attitudes and behavior, in addition to a direct relationship between attitudes and behavior. Finally, a direct effects model measures the degree to which value orientations influence attitudes and voting intentions, but attitudes themselves do not directly influence voting intentions.

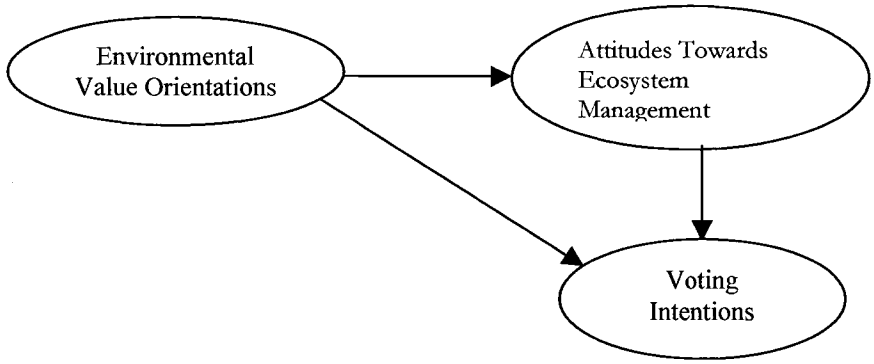
Goodness of fit tests indicated that both the full and partial mediation models provided a reasonably good fit to the data (Table 8). Chi-square to degrees freedom

Figure 1. Full mediation (a), partial mediation (b), and direct effects (c) models for structural equation analysis of exurban landowner value orientations, attitudes, and voting intentions.

a.



b.



c.

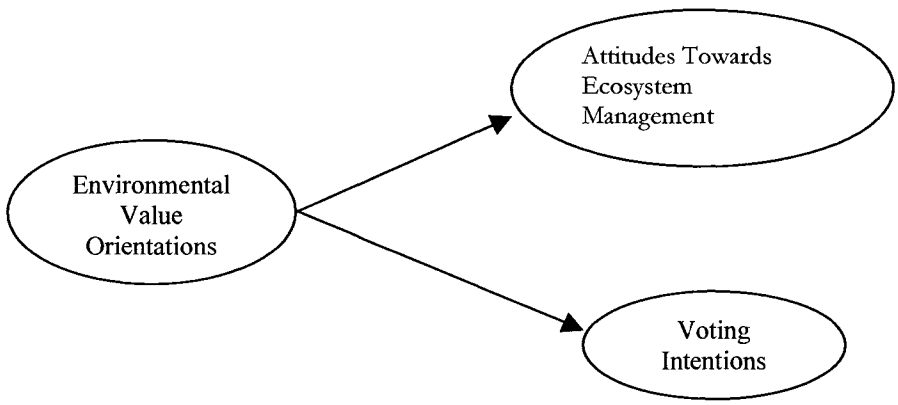


Table 8. Comparison of goodness of fit statistics for structural equation modeling of exurban landowner value orientations, attitudes, and voting intentions.

Model	X^2/df	GFI	CFI	NFI	RMR
Full mediation	4.06	.91	.91	.88	.058
Partial mediation	4.18	.91	.91	.88	.058
Direct effects	7.10	.87	.82	.80	.10

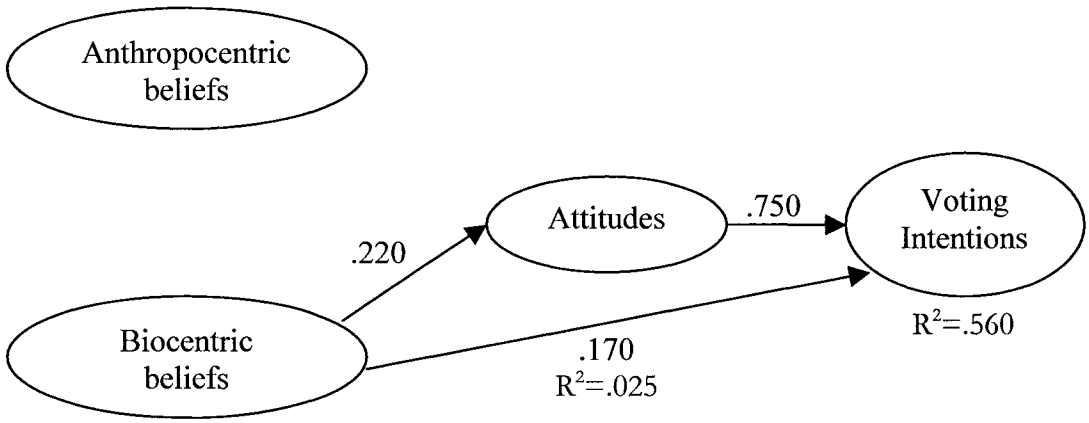
Acceptable fit ranges for each item are as follows: X^2/df = 2-5; Goodness of Fit Index (GFI) = >.90; Comparitive Fit Index (CFI)=>.90; Normed Fit Index (NFI)=>.90; Root Mean Square Residual (RMR)=.05-.10.

ratios were within the 2-5 criteria for good fit in both models, and the models had Goodness of Fit (GFI) index scores greater than .90. The models were also within the acceptable range (>.90) for the Comparative Fit Index (CFI). Values for the Normed Fit Index (NFI) and Root Mean Square Residual (RMR) were slightly below the normal range. By nearly all measures, the direct effects model provided a poor fit to the data.

Value orientations were not strong predictors of attitudes in any of the models (Figure 2). Value orientations accounted for less than 5 percent of the variance in attitudes towards ecosystem management, of which only biocentric orientations were significant (T>2.00). In the test for direct effects, less than 5 percent of the variability in voting intentions was explained by value orientations. The disparity in significance between biocentric and anthropocentric value orientations may be due to a difference in sample size, wherein less than 7 percent of the population indicated this orientation.

Of the three models, full mediation is supported here for two reasons. First, model fit is best for the full mediation model as evidenced by a smaller X^2/df ratio than partial mediation. In general, selection of the partial mediation model occurs when model fit statistics improve from full to partial mediation. Second, the influence of value

Figure 2. Structural equation modeling results for the influence of landowner value orientations and attitudes on voting intentions.



orientations on voting intentions, although significant, is negligible.

Attitudes towards ecosystem management had a strong influence on voting intentions (Table 9). All three attitude variables had a significant (T>2.00) influence on voting intentions, accounting for 56 percent of the variance. Beta coefficients were highest for attitudes towards monitoring programs on private land, in contrast to results from the regression analysis. Beta coefficients were also high (>60 percent) for use of private property to support endangered species and use of science to guide private land use.

Table 9. SEQ results for the influence of exurban landowner attitudes on voting intentions.

Model factors	Target Variable	T	Std. Error	Beta	R^2
Ecosystem Management Attitudes	Voting Intentions	10.88	.069	.750	.560
TE species on private land	Latent Attitude			.610	.370
Science to guide private land use	Latent Attitude	10.72	.064	.690	.480
Monitoring on private land	Latent Attitude	11.57	.071	.830	.680

Data taken from test for full mediation. T values greater than 2.00 are considered significant. $P<0.05$.

CHAPTER 4. CONCLUSIONS

Exurban landowners from this population were generally supportive of several important ecosystem management concepts, although support was heavily tempered by concerns about privacy, property rights, and conditions for participation. Landowner concern for land or ecosystem health was not evident as measured, although this may be more a result of exclusively worded questions than a true lack of concern. Further work on the tradeoffs involved with exurban landowner participation in ecosystem management is needed, but it is clear that efforts to incorporate exurban landowners into landscape-scale management need to address these issues in conjunction with information regarding the ecological significance of private lands in exurban areas.

Landowners were particularly sensitive to management activities related to threatened and endangered species management, use of science on private land, and monitoring programs on private land. These results are not surprising, considering that these activities can result in land use restrictions and invasions of privacy. Landowners were willing to support these activities as long as privacy and property rights are respected. Specific details about how to include these concerns were not addressed here, but this study provides the basis upon which further work should be based.

The results presented here also provide some support for application of the cognitive hierarchy to a land use context. Exurban landowner value orientations were significant (although not strong) predictors of attitudes towards land use concepts,

which in turn were significant predictors of intentions to vote for collaborative planning efforts. It is evident, however, that general environmental value orientations are not the best predictors of attitudes or voting intentions related to ecosystem management concepts.

General environmental value orientations had little influence on attitudes and voting intentions as measured, but these results should not be interpreted as an indication that value orientations are not an important element of land use decisions. It is likely that the value orientation scale used was too general in nature to accurately predict attitudes towards ecosystem management concepts. General environmental values may influence pro-environmental behaviors such as recycling and support of environmental organizations, but the decisions people make regarding how they use their land are infinitely more complex and involve specific consequences for action.

Currently, there are no scales designed specifically to address land use or ecosystem management situations. The basic premise of ecosystem management, management across boundaries, entails activities that may violate property rights in the minds of some landowners. Given the prominence of property rights concerns described here and in other studies, it is clear that future scale development should focus on dimensions of privacy and property rights. Continued work on the perceptions landowners have regarding their property rights, and how exclusive they perceive those rights to be, is needed, especially in the context of land use. Furthermore, a more complete understanding of exurban landowner decisions will require identification of the

specific rights landowners feel are threatened by ecosystem management. Ultimately, the success of ecosystem management strategies at the private/public land boundary may depend on the extent to which managers can address these issues.

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ECOSYSTEM MANAGEMENT AND PRIVATE LANDOWNERS: A SYNTHESIS OF RESEARCH AND SUGGESTIONS FOR MANAGERS

Introduction

Natural resource management in the United States has a long and distinguished history, the focus of which has primarily been protection or regulated use of public lands set aside by federal, state, and local governments (with a few notable exceptions). Beginning with conservation of important commodity-based resources, natural resource management has evolved to provide for non-commodity values including recreation, aesthetics, and spiritual renewal. The evolution continues today. Contemporary resource management paradigms have begun to focus more on the values of biodiversity, management at the landscape scale, and ecosystem health, pursuant with a more sophisticated understanding of ecological systems.

Ecosystem Management (EM) has been broadly accepted as the contemporary management paradigm for public lands and protected areas in the United States, and has received significant attention in the natural resource literature (Grumbine, 1994; Yaffee and Wondoleck, 1997; Yaffee, 1999; Bengston, 2001). Although the majority of land management agencies have adjusted their approaches to incorporate evolving EM ideas, there is still no consensus about the application of EM on the ground. Additionally, an important element of landscape scale management, incorporation of private lands, has received little attention.

At the conceptual level, EM requires an implicit understanding that landscapes are composed of multiple, interrelated and interdependent ecosystems. In contrast to traditional multiple-use management, ecosystem processes, including disturbance, wildlife movement, and nutrient cycling, are viewed as principal management concerns. Additionally, EM recognizes that ecological processes transcend administrative boundaries. Therefore, EM activities on public lands cannot be separated from adjacent private lands, and vice-versa (Yaffee and Wondolleck 1997).

Until recently, private lands have received little attention from federal land managers and researchers concerned with biodiversity and ecosystem health (Knight, 1999). This lack of attention stands in marked contrast to the biological importance of private lands. Over half of all federally listed threatened and endangered species can be found only on private land (Irland, 1994). Furthermore, private lands adjacent to public lands and protected areas often provide critical seasonal habitat for migratory species and animals with large home ranges (Hansen et al., 2002; Craighead, 1995). Land management directives aimed at biodiversity preservation and ecological sustainability at the landscape scale are unlikely to succeed without the inclusion of private lands. As such, adjacent private lands provide a critical link in the EM chain.

The EM approach requires a degree of collaboration among private landowners and managers for which there is no precedent in the history of natural resource management in the United States. Existing legislation (National Environmental Policy Act, National Forest Management Act, etc.) regarding public involvement in federal land management planning are designed to allow for public comment and review of proposed actions, rather than facilitating collaborative efforts. As a result, federal agencies have little experience with the degree of cross-boundary collaboration inherent in the EM concept.

Furthermore, policy and social barriers to collaboration between federal land managers and private landowners exist. Stipulations of the Federal Advisory Committee Act are often viewed by federal managers as restricting their ability to participate in collaborative groups, particularly with respect to management of public lands (Cortner and Moote 1999). Additionally, long-standing citizen distrust of land managers, misconceptions about what EM entails, and concerns about property rights have resulted in an atmosphere of skepticism surrounding collaboration (Reading et al., 1994; Yaffee, 1996; Raedeke et al., 2001; Hurley et al., 2002).

Understanding private landowner perceptions of and willingness to participate in EM is crucial for development of collaborative approaches. Numerous studies have shown that the general public expresses favorable attitudes toward EM concepts (Reading et al., 1994; Shindler et al., 1996; Jacobson and Marynowski, 1997; Manning et al., 1999), but relatively few studies have focused on specific perceptions of private landowners.

The following review of the existing research on landowner perceptions of and attitudes towards EM reveals several important themes. First, landowners are generally supportive of a wide range of EM concepts, but support is tempered by concerns about the tradeoffs private landowners may have to make if they participate in collaborative management. Second, knowledge of what EM means conceptually or in practice is not widespread among private landowners, but many landowners want to know more. Finally, there is no clear direction in terms of the conditions under which private landowners would be most likely to participate in EM. Here, we summarize relevant research and conclude by presenting broad EM guidelines for inclusion of private landowners.

CHAPTER 1. LANDOWNER SUPPORT FOR ECOSYSTEM MANAGEMENT

Research on landowner perceptions of ecosystem management (EM) has primarily focused on non-industrial private forest (NIPF) owners. NIPF studies have shown that landowners are generally supportive of EM concepts, although these views are moderated by concern for privacy, property rights, and the tradeoffs between conservation and other values (Reading et al., 1994; Brunson et al., 1996; Rickenbach et al., 1998; Raedeke et al., 2001). Chief among these concerns is the notion that implementation of EM on private lands would result in greater government control and loss of private property rights (Reading et al., 1994; second paper this dissertation). More than two-thirds of landowners in the Greater Yellowstone Ecosystem (GYE) reported fears that EM in the area, although beneficial for the ecosystem, would result in greater government control (Reading et al., 1994).

Exurban landowners in the southern Rocky Mountains express similar concerns. The majority of landowners in a six county survey expressed a willingness to vote for EM activities under the conditions that privacy and property rights were respected and they retained decision authority (second paper this dissertation). Furthermore, 55 percent of landowners in the Ozarks indicated that they wanted to take care of their own problems rather than share power with land managers (Raedeke et al., 2001).

Property rights are not the only tradeoffs landowners perceive inherent to participation in EM. Concerns about the economic impacts of EM are also evident. The vast majority of landowners in the GYE were unwilling to support EM if local economies were harmed (Reading et al., 1994). These concerns stem from landowner beliefs that EM would restrict logging and oil/gas exploration, activities which still play a major role in some western economies.

Landowner acceptance of EM seems to hinge on other factors as well. Studies have shown that landowners are more accepting of EM applied to public lands than private lands, especially if EM is viewed as part of long-term federal planning (Brunson et al., 1996; Shindler et al., 1996). Additionally, some landowners feel that society should only regulate private land use if demonstrable harm is shown on adjacent lands or resources (Brunson et al., 1996). Although this statement can be interpreted in many ways, a logical assumption is that some landowners will need to see proof of ecological degradation to justify participation in EM activities.

These beliefs illustrate several important issues. First, it is clear that landowners are wary of federal managers and of management programs that might reduce their ability to make land use decisions on their own land. Second, varying support for EM on private and public lands points to an incomplete understanding of the EM concept, particularly the concept of landscape scale. It is apparent that some landowners continue to envision landscapes in terms of property boundaries and separate management units, even though they indicate agreement with stated EM concepts. Finally, landowners may be unaware of the ecological impacts of land use, such as changes in species composition, which are subtle to the untrained eye. As such, the need for EM programs may be unclear for landowners, making participation unlikely.

Landowner Knowledge of EM

Continued misunderstanding of EM by private landowners is not unusual. After all, the concept continues to evolve within the natural resource profession. The majority of studies that have measured landowner understanding of EM indicate that many private landowners are unfamiliar with the concept (Reading et al., 1994; Brunson et al., 1996; Raedeke et al., 2001; Jacobson et al., 2000). For example, landowners in Missouri reported that they did not know enough about EM in general or about specific projects in their watershed (Raedeke et al., 2001). Similarly, landowners in the GYE, Utah, Indiana, and throughout the southeast report little prior knowledge about EM and would like to know more, especially if their participation is desired (Reading et al., 1994; Brunson et al., 1996; Jacobson et al., 2000).

Even with clearly worded definitions, landowners may not understand the full range of ecological concepts inherent in EM, or how EM translates into actions and impacts. As suggested above, many landowners are generally more in favor of EM on public lands than on private lands, illustrating a misinterpretation of the concept. To understand why these misconceptions occur, we need only look to the sources of information from which landowners derive their understanding of EM.

In a study of landowners in Oregon, researchers found that the two most important sources of information about federal forest management were newspapers and television (Shindler et al., 1996). Importantly, only 16 percent felt that natural resource agencies were important sources of information, the lowest support for any of the sources listed. Furthermore, during an elicitation survey conducted on large lot (20-50 acres) landowners in Colorado, the majority of the landowners had never spoken with a Forest Service employee while in residence, even though their properties were directly adjacent to national forest land

(First paper, p. 24). Given these results, it should come as no surprise that a concept as complex and place-specific as EM is often misinterpreted by landowners.

It is clear that adequate communication between land managers and private landowners is lacking. From the perspective of land managers, management at the private/public land boundary has become increasingly complex as rural populations continue to grow. Instead of collaborating with relatively few ranch or farm owners, the adjacent private landowner population may consist of numerous individual landowners. On the other side of the boundary, new exurban landowners are rarely familiar with local ecosystems or management priorities on adjacent lands, and developers assume no responsibility for these issues. Furthermore, the very nature of ecosystems requires that management be flexible depending upon conditions, whereby EM applications that are appropriate or desirable in one area may not be useful in another area. It is consequently self-evident that EM planning benefits from open communications between landowners and land managers; however, that is exactly what is lacking in many cases (First paper, p. 24).

Landowner Conditions for Participation

Landowner willingness to participate in EM activities seems to hinge upon several factors. Since many landowners are relatively unfamiliar with EM and what it means in terms of land use, a common condition for participation among many landowners is more information, some of which can come from observing EM partnerships at work (Brunson et al., 1996; Jacobson et al., 2000). In many cases, landowners are unaware of the opportunities for collaboration with adjacent land managers, or of the need to do so. Providing landowners with accurate information about the role their properties play in the surrounding

landscape and the land use options they have may go a long way towards increasing participation.

Incentives for participation in EM activities may also be important for landowner participation, although the data are mixed. At least one study has suggested that incentives (e.g. tax credits or deductions) for participation in EM are appealing to landowners (Brunson et al., 1996). For example, some states offer tax credits for conservation easements, a tool which can significantly reduce landowner tax burden. In the second paper presented in this dissertation, exurban landowner attitudes towards EM concepts were least favorable when coupled with incentive programs. It is not clear why these landowners were not supportive of incentive programs, but the results suggest that EM plans should not rely on incentives alone as a guarantee for landowner participation.

Studies of landowners have revealed other influences on participation as well, including participation by neighboring landowners, federal agency exclusion, and protection of commodity/extractive uses (Reading et al., 1994; Brunson et al., 1996, Shindler et al., 1996, Jacobson et al., 2000). The point is that landowner participation in EM is not likely to be influenced by any single factor. Just like the ecosystems in which they live, landowners bring a variety of place, culture, and experience specific conditions to the table, all of which need to be considered in outreach efforts. The studies described above point to another important consideration when engaging private landowners in EM: It is important for managers to understand, a priori, the full range of perspectives and concerns held by adjacent landowners with respect to participation in EM. As such, relatively extensive information gathering efforts, including surveys, has the potential to greatly aid EM plan development.

Finally, although the information presented here represents an advance in our knowledge, actual landowner participation in EM has not been reliably measured. This is less a criticism of landowner studies than a caveat to the conclusions reached. The linkage between attitudes and behaviors is not always direct, whereby specific conditions at the time of decision may cause an individual to behave in a manner in opposition to a previously defined attitude. For example, private landowners may express favorable attitudes towards use of private land for endangered species, but may become resistant when faced with restrictions on land use if a species is actually found on their property.

Because of this potential disconnect, managers and EM planners should not expect widespread landowner participation by simply addressing the issues described herein. Nor should they be concerned with trying to get 100 percent participation. Ultimately, conservation goals of EM may largely be achieved if managers can entice *most* landowners to participate. Furthermore, not all private properties have the same ecological importance in any particular landscape. For this reason alone, establishing properties of conservation priority is an important step in the process of developing landowner outreach programs.

CHAPTER 2. GUIDELINES FOR MANAGERS

Although many questions still remain regarding the potential for ecosystem management (EM) that includes private landowners, the research record currently provides useful information for developing EM protocol for land managers and planners. Based on the literature, I developed guidelines for inclusion of private landowners into landscape level management.

Several important caveats to the guidelines presented below warrant discussion. First, in many cases contemporary public land managers are tasked with achieving more while spending less. Budget cuts are an important limiting factor determining what managers can and cannot do with respect to management actions, and particularly research. Second, managers sometimes face political resistance to changing the status quo, both from within and outside the agency for whom they work. EM may be ecologically justified, but it isn't necessarily politically or socially desirable in all locations. Finally, landowner outreach programs compete with other management priorities, some of which may supercede cross-boundary management activities in the minds of funding sources. Public land managers may find the following guidelines useful when considered within the context of these limitations.

1. **Prior to development of an EM plan, an extensive social assessment of adjacent private landowners should be conducted to identify priority concerns and information gaps.**

The flexibility inherent to the EM model is designed to address the variable nature of ecosystems, both temporally and spatially. Social dynamics, like ecosystems, vary from community to community. As such, the management situation in any given location is likely to present social and ecological issues that are unique to that area. If collaboration between managers and landowners is to be successful, managers need to understand landowner perspectives. Assessments should include questions about the following landowner perceptions: (1) how their property relates to the surrounding landscape; (2) what ecological, economic, social, or management problems do they perceive in their area; (3) how willing are landowners to collaborate with adjacent land managers, and under what conditions. Responses to these and other questions will allow managers to design effective outreach programs suited to the needs and knowledge levels of the community with whom they intend to collaborate.

In many cases managers may be unable to undertake social assessments on the scale described above. Current Office of Management and Budget (OMB) requirements restrict federal managers' ability to spend federal dollars on surveys. As a result, managers may have to rely on partnerships with private organizations (such as the National Forest Foundation) to finance these activities. It may also be possible for managers to enlist the support of state and local government agencies and non-profit land management organizations (such as TNC) with similar interests and management objectives.

2. **Before contacting landowners, managers should clearly define and articulate the ecological issues that warrant an EM plan.**

As the research record indicates, landowner skepticism of EM is at least partly due to a lack of awareness about the impacts of land use on ecosystem structure and function. Landowner participation in EM projects is likely to increase if management problems have been clearly identified and described in a manner landowners can understand. Perhaps the single best method for problem identification is to organize field trips to problem areas where landowners can visualize and discuss a particular management issue. Careful selection of problem areas, including areas immediately adjacent to or on private property, will allow managers to maximize the impact of the field trip experience. After all, for many people, seeing truly is believing.

An additional component of this idea is to make the problem relevant to the landowner. For example, how will exotic weed invasions impact private property? How can maintenance of healthy forest stands protect landowners from wildfire and provide better wildlife habitat (and hence viewing opportunities) at the same time? How, specifically, are individual properties linked biologically? Ecological sustainability may be foremost on the minds of ecologists, but landowners often have other concerns. A little forethought with regard to relating ecological issues to private land use may go a long way towards increasing landowner participation in EM.

3. **The terminology used in EM proposals should be clearly defined in terms that landowners can readily understand.**

Many landowners are unclear about the meaning of EM, both conceptually and in practice. Managers and planners need to spend time, prior to contacting landowners, developing definitions and clearly worded management actions that will be meaningful to the

average private landowner. Enlisting the assistance of individual landowners in developing a management vocabulary may be useful here. Collaborative efforts with multiple parties are typically evolutionary processes, but a process that begins with easily understandable terminology may save significant time and prevent conflicts later on.

4. Management actions should be supported with examples from other areas and third party science.

Distrust of federal managers continues to be a common sentiment among private landowners. Although there are several ways to address this issue, the research reviewed above suggests two specific solutions. First, participation in EM may increase if landowners are able to observe similar projects in other areas. If possible, field trips to active EM project sites may help to bolster landowner confidence in proposed actions and the managers themselves. At the very least, comprehensive documentation of success in other areas with similar problems will allow landowners to make more informed judgements about the issues at hand. This type of inclusive approach also reinforces landowner confidence in their ability to share the decision space with managers, an important component of long-term landowner participation.

Second, many landowners feel that science is a credible and appropriate foundation from which to make land use decisions, both on public and private lands. As such, enlisting the support of scientists for development and review of proposed management plans may increase landowner trust in EM projects. If possible, scientists should be included in public outreach efforts, including field trips, to help establish credibility early on the process.

5. When developing management plans and specific projects, landowner property rights and privacy concerns should be considered.

It is evident that landowner concern about loss of property rights and/or privacy is a significant barrier to EM. Where possible, property rights concerns should be addressed, although this is easier said than done. An important step towards addressing property rights concerns is gathering detailed information from landowners about what specific rights they feel are threatened by EM, how those rights are threatened, and which specific EM activities threaten rights. By simply showing a concern for these issues, managers can increase landowner trust in their leadership.

Another important component is to develop management guidelines and suggestions that can be implemented by landowners who are interested in EM. This can be especially important for monitoring programs. Engaging landowners in the implementation of management activities increases landowner feelings of ownership, a key factor for long term participation and trust in cross-boundary management activities. Similarly, it is important to share the decision space, where possible, with private landowners, particularly when management actions will directly impact private land. If landowners are able to retain decision authority for land use on their own property they are more likely to participate in EM projects. This may not be possible for all management prescriptions, especially those that require technical skills or knowledge, so it is important to provide landowners with land use suggestions they will support and can safely accomplish. This may be as simple as regular field trips to project sites where landowners are given the opportunity to evaluate and discuss the results of management activities.

6. **Local human resources and businesses should be utilized for implementation of EM prescriptions. If possible, conduct third-party analysis of economic impacts of management on the community, with emphasis on benefits and potential market outlets for community derived products that result from management activities.**

Landowner concern about the economic impacts of EM on local communities can limit participation and support. Managers can do several things to address these concerns. First, if management prescriptions can be implemented by local people (e.g. private logging companies, weed cooperatives, ranchers, etc), these resources should be utilized. An economic analysis of the impacts management actions may have on the community can also allay landowner concerns. Third-party analysts, particularly those from local universities, can lend credibility to the analysis and increase landowner trust. Economic analysis should market outlets for products derived from management activities (e.g. grass banking, timber, etc.). Concern for local economies and traditional land uses, even at a limited scale, can increase community support for EM projects.

7. **Managers should develop and distribute information packets for new and existing adjacent landowners.**

As described earlier, landowners are often unaware of management priorities on adjacent public lands and of the land use options (i.e. technical support) available to them. This lack of awareness presents a good opportunity for education, wherein ecosystem managers can provide substantial information to landowners about adjacent land use priorities, important local flora and fauna, opportunities for technical assistance, contact information, and management issues. Managers can present this information through local landowner associations, to be distributed to individual landowners on a regular basis.

Furthermore, adjacent landowners should be invited to attend regular 'open house' type meetings with managers where this information can also be disseminated. Whatever the

venue, the point is that managers need to take a proactive approach towards establishing contact with and educating landowners about important management issues. It is unlikely that landowners will seek this information out for themselves. Prepared packets allow for review of the information in the comfort and privacy of their own home, and open meetings allow for discussion and clarification of the information provided. These ideas will also help managers establish a rapport with landowners, an important component of enlisting landowner support in EM.

Managers need not face this task alone. Information regarding natural resource inventories, land use planning, and small acreage land use is available from a variety of sources, including State and local governments, universities, and non-profit organizations. Here again, the key for managers will be to establish partnerships with organizations that have similar interests and objectives.

Conclusions

Successful application of EM on public lands will require inclusion of adjacent private lands. To do so, managers must understand the perspectives private landowners have about land uses on both public and private land, particularly with respect to EM concepts. In this paper I have reviewed a variety of studies that represent the current state of knowledge about private landowners and EM. Several conclusions can be made from this review.

First, while our understanding of landowner concerns regarding EM is improving, more work is needed on actual landowner participation in EM programs. Knowing why landowners do or do not participate in EM and how landowner concerns have been successfully addressed will significantly add to the current literature. Second, landowners in

different regions express similar concerns about EM, including loss of property rights, economic impacts, lack of knowledge, trust in federal managers, and reduced decision authority. This suggests a degree of generality across populations. As a result, we've developed a set of guidelines that may facilitate incorporation of private landowners into ecosystem programs.

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2002 Survey—Land Use in the Southern Rocky Mountains

This survey was developed by Colorado State University to help us learn more about land use on private lands in the southern Rocky Mountains. Surveys are being mailed to private landowners whose properties are between 20 and 50 acres in size and are located within five miles of a national forest. Your responses to this survey will be used to develop comprehensive strategies that allow private landowners greater participation in the planning and management of adjacent national forests.

The southern Rocky Mountain region has experienced explosive growth during the last decade, a significant portion of which has occurred next to public lands. Landowner perspectives of the relationships between their properties and the surrounding landscape are not well understood. To help manage public lands now and in the future, we need to know what you think about the relationship between your property and neighboring properties, whether they are public or private lands.

In this survey we use terms associated with ecological science. For clarity, we define ecology as the study of the interactions between plants and animals and the physical environment in which they live. The questions are all related so we can get an accurate picture of your ideas and opinions, so please answer every question as carefully as you can. The best answer is the response that most accurately represents your views. Survey completion is estimated to take approximately 30-35 minutes.

Your participation in this survey is voluntary, and there is no penalty for failing to complete or return surveys. Names and addresses will not be associated with your responses, and all information you provide will be kept strictly confidential. It is not possible to identify all potential risks in research procedures, but the researchers have taken reasonable safeguards to minimize any known and potential, but unknown, risks. Should you have questions or comments about this survey, please contact Matt Shinderman at (970)663-0810. If you have questions regarding human subject's rights, please contact Celia Walker at (970)491-1563.

Thank you for your participation in this survey!

In order to create a regional picture of land use in the southern Rocky Mountains, we need some information from you about how you use your land. Please answer all of the following questions so that we have the most accurate information possible.

(1) How would you describe how you maintain the land on your property? (circle all that apply)
- a. leave natural/don't manage
- b. actively try to maintain native species and natural character
- c. occasionally manage vegetation for fire control
- d. occasionally manage vegetation for weed control
- e. planted pasture species for livestock

(2) Does your property give you private access to public lands? (Check one)
- ____Yes. If so, go to question 3.
- ____No. Skip to question 4.

(3) For what activities on public lands do you use your private access: (Circle all that apply)
- a. hiking
- b. fishing
- c. hunting
- d. horseback riding
- e. nature study
- f. camping
- g. shooting/target practice
- h. ORV use
- i. other (describe)

(4) What do you enjoy doing most on your land? (Circle all that apply)
- a. hiking
- b. horseback riding
- c. enjoying beauty
- d. rural living
- f. shooting/target practice
- g. gardening
- h. landscaping
- i. home for animals/livestock
- j. building trails
- k. nature study
- l. ORV use
- m. other _____

(5) What kind of previous experience do you have with land use? (circle all that apply)
- a. none (apartment, etc)
- b. gardening
- c. farming in the east
- d. farming in the west
- e. suburban/urban residential
- f. ranching
- g. land (>5 acres) owned in the east
- h. land (>5 acres) owned in the west

(6) Have you ever consulted with federal, state, county, or private organizations/agencies about managing your land? (check one)
- ____Yes. Proceed to question 7.
- ____No. If no, skip to question 8.

(7) From the list below, place a check mark next to the agency or group with which you have consulted the most frequently:

____US Forest Service ____BLM
____National Park Service ____County/University Extension
____State Agencies ____NRCS/SCS
____Private organizations _____Other (fill in)

(8) Do you graze animals on your property?

____Yes. Go to question 8a.
____No. Please skip to question 9.

a. What kind of animals do you graze on your property? Check all that apply

____Horses ____Sheep
____Cattle ____Goats
Other (please specify)_____.

b. How many acres of pasture are on your property? _____.

c. How many animals do you graze on your pastures/property?____.

d. What time of year do your animals graze your property? (Check all that apply)

____Spring ____Summer
____Fall ____Winter
____Year round

e. Do you use a grazing system (e.g. pasture rotation)?

___Yes. Please specify _____.
___No.

(9) Which of the following practices do you do on your property? (check all that apply)

___Weed control
___Prescribed burning
___Removal of non-native vegetation
___Mowing around house
___Removal of native vegetation
___Planting native species
___Identification and protection of sensitive habitat
___Planting non-native species (e.g. lawn grass, ornamentals, etc.)

___Timber management (e.g. thinning, selective cutting) for: (check all that apply)
- ____ fire fuel reduction
- ____ wildlife habitat enhancement
- ____ view enhancement
- ____ increased water yield
- ____ fire wood

___ Vegetation management for: (check all that apply)
- ____ wildlife habitat enhancement
- ____ livestock forage enhancement

___ Pesticide/herbicide application. If no, skip to question 10

a. Explain how you apply pesticides/herbicides (e.g. spot/selective, property wide)

b. What kind of pesticides/herbicides do you use? Please list.

___ I don't do any of the above activities on my property.
___ Other. Please describe any other land uses not listed above.

10. **Please circle the appropriate response for each of the following questions. Fill in the appropriate blanks.**

Do you have a management/use plan for your property?	Yes	No (skip to pets)
Did you consult with neighboring landowners (public or private) while preparing your property plan?	Yes	No
Did you consult with natural resource professionals while considering your property plan?	Yes	No
With what agencies did you consult?_____.		
Do you own domestic pets?	Yes	No
What kind of pets do you own? (fill in)_____.		
Do you keep your pets loose (unchained) on the property?	Yes	No

Is your property fenced? Yes No

Please describe (e.g. 3-strand. barbed vs. smooth. picket. post and rail) _____.

11. **We'd like to know about your views of land and the environment. For each question, circle the number under the response that best indicates your level of agreement with the statements below.**

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Plants and animals exist primarily to be used by humans	1	2	3	4	5
Humans have the right to modify the natural environment to suit their needs	1	2	3	4	5
Ecosystems should only be preserved for their potential to benefit humans	1	2	3	4	5
I prefer wildlife reserves to zoos	1	2	3	4	5
Forests are important only because humans need lumber	1	2	3	4	5
It's only important to keep rivers and lakes clean to provide clean water for humans	1	2	3	4	5
Nature is important because of what it can contribute to human welfare and pleasure	1	2	3	4	5
Nature is valuable in its own sake	1	2	3	4	5
We need to preserve resources to maintain a high quality of life	1	2	3	4	5
It is important to preserve natural ecosystems	1	2	3	4	5

Maintaining healthy ecosystems is important for all life, not just humans	1	2	3	4	5
Economic growth is more important than ecological sustainability	1	2	3	4	5
Economic growth is compatible with ecological sustainability	1	2	3	4	5

We'd like to know how familiar you are with ecosystems, ecosystem management, and general ecology. Please answer all of the following questions.

(1) Have you taken courses, attended seminars, or received other instruction in ecology or ecosystem management? (Check one)

____Yes. Please describe_____

____No.

(2) From the list below, can you identify which plants are native to Colorado? Check the species you think are native to Colorado. If you're not sure, enter 0 in the space provided.

____Downy brome (cheatgrass)
____Columbine
____Mountain mahogany
____Canada thistle
____Blue flax
____Kentucky bluegrass
____Blue grama grass
____Spotted knapweed
____Tamarisk
____Leafy spurge
____Buffalo grass
____Penstemon

(3) From the list below, place a check next to the animals that currently exist in Colorado.

____Grizzly bear
____Great Horned owl
____White-Tailed deer
____Lynx
____Pronghorn antelope
____Mountain lion
____Timber wolf
____Prairie dog
____Cutthroat trout

(4). Please indicate whether you think the following statements are true or false by circling the appropriate letter.

T F Disturbance events, such as fire, floods, and wind, are natural and important elements of ecosystem structure and function.

T F Rocks and soil are not included in the notion of an ecosystem.

T F A healthy ecosystem is characterized by equilibrium and the absence of change.

T F All plants and animals are of equal importance to an ecosystem's maintenance and functioning.

T F Ecosystems are isolated units that are completely self-contained.

T F Impacts or events that occur in one ecosystem do not impact other ecosystems.

T F Under ecosystem management, mining, grazing, and logging is not permitted on national forests.

5. We'd like to know what kind of relationships you have with your property. Please circle the number that best indicates your level of agreement with the following statements.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
This is my favorite place during my time off	1	2	3	4	5
This area means a lot to me	1	2	3	4	5
I feel attached to this area	1	2	3	4	5
I identify strongly with this area	1	2	3	4	5
This area feels like a part of me	1	2	3	4	5
Being at the house is one of the most pleasant things I can think of	1	2	3	4	5
Much of my life centers around this place.	1	2	3	4	5
My family has a long-lasting attachment to this area.	1	2	3	4	5
This property is an important part of my lifestyle.	1	2	3	4	5

6. **We'd like to understand more about specific things to which you are attached with respect to your property. Please indicate the importance of each statement by circling the response that best describes your feelings.**

	Extremely Unimportant	Unimportant	Neutral	Important	Extremely Important
The natural environment: landscape, wildlife, plants.	1	2	3	4	5
Family life at the house	1	2	3	4	5
Friends and acquaintances in general	1	2	3	4	5
Relatives-family in the area	1	2	3	4	5
Neighbors	1	2	3	4	5
Local cultural history and resource use	1	2	3	4	5
Outdoor life traditions	1	2	3	4	5
Peace and quiet	1	2	3	4	5

7. **Wildlife often use private land adjacent to public land for travel, cover, or forage during the winter months. Indicate how positively or negatively you feel about the following statements.**

Private land could be used for wildlife habitat.....

	Extremely Negative	Negative	Neutral	Positive	Extremely Positive
because private land is critical for wildlife.	1	2	3	4	5
if some predators are controlled	1	2	3	4	5
if landowners are compensated	1	2	3	4	5
if it's compatible with how I currently use my land	1	2	3	4	5

	Extremely Negative	Negative	Neutral	Positive	Extremely Positive
if it doesn't threaten private property rights	1	2	3	4	5

8. Public land and wildlife managers are hoping to work with private landowners to protect wildlife habitat and land health (e.g. soils, vegetation, fire fuels, wildlife) on public lands and neighboring private land. How would you respond to each of the following conditions of collaboration?

Public land or wildlife managers and private landowners could work together to protect wildlife habitat....

	Extremely Negative	Negative	Neutral	Positive	Extremely Positive
if land or wildlife population health is the goal	1	2	3	4	5
as long as landowner privacy and security are respected	1	2	3	4	5
if expectations of landowner participation are reasonable	1	2	3	4	5
as long as property rights aren't threatened	1	2	3	4	5
if there is an incentive program for landowner participation	1	2	3	4	5
if land managers collaborate in an advisory capacity only	1	2	3	4	5

9. **Using private property to protect habitat for sensitive, rare, threatened, or endangered species is a controversial topic. How would you respond to the following statements?**

Private property could be used to protect habitat for sensitive or endangered species....

	Extremely Negative	Negative	Neutral	Positive	Extremely Positive
if sensitive or endangered species are already on the property	1	2	3	4	5
if long as there are no major impacts to my lifestyle	1	2	3	4	5
depending on the species in question	1	2	3	4	5
if landowner privacy is respected	1	2	3	4	5
if property rights aren't threatened	1	2	3	4	5
if an advisory approach is taken	1	2	3	4	5

10. **Public land managers try to use scientific information to guide land management decisions. This often involves observing conditions on landscapes, generating explanations for observed conditions, designing experiments to test their explanations, and using the results to either support of refute the explanations. How would you respond to the following statements.**

Private landowners could use scientific information to guide use of private property.....

	Extremely Negative	Negative	Neutral	Positive	Extremely Positive
if it benefits the landowner	1	2	3	4	5
if land management agencies make information generated by science more available	1	2	3	4	5
if it improves land health	1	2	3	4	5

	Extremely Negative	Negative	Neutral	Positive	Extremely Positive
if the information is relevant to private land use	1	2	3	4	5
if the information comes from a reliable source	1	2	3	4	5

11. **Public land managers are trying to follow a new management approach, called adaptive management, that involves careful monitoring and evaluating impacts of management activities in order to integrate new information into future management plans. This often involves inventorying plants, animals, and soils on public lands. How would your respond to the following statements about monitoring conditions on private lands?**

Private landowners could participate in monitoring conditions on private land.....

	Extremely Negative	Negative	Neutral	Positive	Extremely Positive
if it would improve land health	1	2	3	4	5
if landowner privacy and security were respected	1	2	3	4	5
if participation were voluntary	1	2	3	4	5
if property rights were respected	1	2	3	4	5

12. **We'd like to know your response if you were asked to vote for some of the management guidelines discussed above. Please indicate how likely you would be to vote for each of the following items.**

A collaborative agreement between public land or wildlife managers and private landowners that is...

	Extremely Unlikely	Unlikely	Neutral	Likely	Extremely Likely
designed to protect land health	1	2	3	4	5
designed around respect for landowner privacy and security	1	2	3	4	5

	Extremely Unlikely	Unlikely	Neutral	Likely	Extremely Likely
designed with reasonable expectations for private landowner participation	1	2	3	4	5
designed to respect property rights	1	2	3	4	5
based on a landowner incentive program	1	2	3	4	5
advisory in nature	1	2	3	4	5
designed to give landowners decision authority on their land	1	2	3	4	5

Finally, we'd like to know a little about you. Please answer all of the following questions.

(1) What is your age?

(2) Please indicate your gender (M/F)

(3) Please provide an indication of your race (check one)

___White
___Asian-Pacific Islander, Eskimo, or Aleution
___Puerto Rican
___Black
___Other Spanish or Hispanic
___American Indian
___Mexican American
___Chicano
___Cuban
___Other

(4) What is the highest level of education you have completed? (check one)

___Grade school
___Some College
___Post-graduate
___High School or GED equivalent
___4-year College Degree

If you completed some college education, please describe the focus or major of your education _____.

(5) My current family annual income is best described as (check one)

___less than 15.000 ___between 15.001 and 35.000
___between 35.001 and 60.000 ___between 60.001 and 100.000
___greater than 100.000.

(6) Please indicate the size of your property (in acres). _____

(7) How long have you been a resident of Colorado or New Mexico (whichever applies)?

_____

(8) Please describe your most recent residence. prior to moving to Colorado (check one)

___ranch/farm ___ranchette/exurban
___small town (>5000) ___medium-sized town (>5000)
___small city (15-50.000) ___medium city (50-200.000)
___large metropolitan area (200.000+)

(9) How would you describe the area where you grew up?

___ranch/farm ___ranchette/exurban
___small town (>5000) ___medium-sized town (>5000)
___small city (15-50.000) ___medium city (50-200.000)
___large metropolitan area (500.000+)

(10) Please indicate the type of work you do for a living by selecting from the following list of career types (check one)

___Professional/Technical ___Manager
___Clerical/Sales ___Agent/Broker
___Laborer ___Service/Gov't
___Farm/Ranch ___Student
___Mining, logging ___Natural Resource Conservation.
___Tourism

(11) Are you dependent on federal land to make a living?

___Yes
___No