



Ecosystem management in the Greater Yellowstone Ecosystem : a coupling of human and natural systems
by Crystal Carleen Stanionis

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Earth Sciences
Montana State University
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Abstract:

The Greater Yellowstone Ecosystem (GYE) is one of the last, relatively intact temperate-zone ecosystems in the world. It is often invoked as a region that is ideal for the application of ecosystem management, yet no single plan or initiative currently exists for the area as a whole. Ecosystem management is seen as an alternative to traditional natural resource policies—those that been carried out within the confines of administrative units and have managed for a single species or a certain natural resource use. Ecosystem management differs from these policies in that it is holistic in its approach: it strives to manage whole ecosystems, which can cross numerous administrative boundaries, with the goal of achieving environmental sustainability.

While there is an established body of literature that reviews the Greater Yellowstone Ecosystem in context of ecosystem management, no studies have explicitly explored the connections between stakeholder recognition of the Greater Yellowstone Ecosystem and ecosystem management. Thus, the two objectives of this study are to 1.) investigate the extent to which the GYE concept is recognized by various GYE stakeholders, and 2.) critically examine this recognition in terms of the prevalence of the ecological and human themes of ecosystem management. The research uses the information contained within management and land use planning documents from a variety of sources and administrations within the GYE. Additionally, a questionnaire survey of residents of Bozeman and Red Lodge, Montana and Jackson, Wyoming is used to assess current knowledge of, and attitudes towards, the GYE and ecosystem management. The results indicate that many GYE stakeholders recognize the Greater Yellowstone ecosystem concept, and they do so in a variety of ways that represent both the ecological and the human themes of ecosystem management. The geographic concept of “place” facilitates interpretation of these results and aids in developing a perspective of the GYE as a coupled human-environment system. This research extends the current definitions of ecosystem management that are largely ecological, to more fully include human systems.

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A thesis submitted in partial fulfillment
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This thesis has been read by each member of the thesis committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

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ABSTRACT

The Greater Yellowstone Ecosystem (GYE) is one of the last, relatively intact temperate-zone ecosystems in the world. It is often invoked as a region that is ideal for the application of ecosystem management, yet no single plan or initiative currently exists for the area as a whole. Ecosystem management is seen as an alternative to traditional natural resource policies—those that been carried out within the confines of administrative units and have managed for a single species or a certain natural resource use. Ecosystem management differs from these policies in that it is holistic in its approach: it strives to manage whole ecosystems, which can cross numerous administrative boundaries, with the goal of achieving environmental sustainability.

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CHAPTER 1

INTRODUCTION

The Greater Yellowstone Ecosystem (GYE) is located in the northwest of Wyoming, south-central Montana, and southeast Idaho. The GYE has been cited as the pre-eminent laboratory for ecosystem management (Primm and Clark 1996), yet currently, no single, area-wide ecosystem management plan exists in the GYE. Additionally, no analyses have been undertaken to determine if and how the GYE concept or facets of ecosystem management have become established in the area. This research will fill this gap through its two objectives: 1.) to investigate the extent to which the GYE concept is recognized by various GYE stakeholders, and 2.) to critically examine this recognition in terms of the prevalence of the ecological and human themes of ecosystem management. The findings that come forth from these enquiries will provide new and critical insights regarding management in the GYE, and do so through conceptual frameworks and methodologies that have not been used to-date for analysis of ecosystem management in the GYE.

The philosophy of ecosystem management will provide the overarching conceptual framework used in this study. The geographic concepts of space and place will be invoked as secondary frameworks, and explicitly in relation to ecosystem management. Although ecosystem management has not been extensively studied in relation to the geographic concepts of space and place, these concepts have great potential to influence the success of ecosystem management initiatives.

Chapter 1 explores ecosystem management and space and place in more detail, and provides a rationale of why the academic discipline of geography is positioned to study ecosystem management. Chapter 2 describes the physical, social, and administrative characteristics of the GYE, and explores the history of the GYE concept and past experience with ecosystem management in the area. Chapter 3 analyzes federal, state, and county GYE land use plans to determine if each plan does, or does not, recognize that particular unit's spatial inclusion in the GYE. These results are then analyzed in the context of ecosystem management themes. Chapter 4 presents two case studies of on-the-ground management in the GYE and then analyzes to what extent this management recognizes the GYE and how this recognition is, or is not, representative of certain ecosystem management themes. Chapter 5 presents the results of a survey conducted among GYE residents. This chapter draws conclusions about resident familiarity with the GYE and ecosystem management, and explores respondents' knowledge of and attitude toward ecosystem management themes. Chapter 6 reviews all of these findings within the context of how ecosystem management in the GYE might move forward.

Ecosystem Management

Ecosystem management is a management philosophy that signifies a shift from commodity-based natural resource management to holistic-based natural resource management (Booth and Kessler 1996, Szaro et al. 1998b). Salwasser (1999, 87) states quite bluntly, "It is not just another name for the way things have always been done." Rather, ecosystem management is an ecologically based approach to management that

addresses whole systems and environmental relationships across varying scales, and while it allows for the management of single ecosystem components, the management is framed within a larger whole (Szaro et al. 1998a).

The emergence of ecosystem management stems in part from current environmental issues that exhibit greater political, economic, social, and cultural complexity than in the past—issues such as the maintenance of habitat corridors, and the protection of fisheries, for example (Haeuber 1996). Its popularity as a management philosophy also stems from a growing awareness and acceptance of environmental values that are seen as conflicting with traditional resource management objectives (Burroughs and Clark 1995, Cortner and Moote 1999, Bengston et al. 2001). Although ecosystem management philosophy is gaining ground in natural resource management, there is not a single, widely accepted definition of ecosystem management (Bengston et al. 2001). In fact, Yaffee (1999) notes that the only agreement about ecosystem management is that the term means different things to different people, and some have noted that the development of ecosystem management is reflective of a paradigm shift in natural resource management (Lackey 1998, Cornter and Moote 1999).

Yaffee (1999) argues that five natural resource management paradigms ultimately frame scientists' and managers' views of ecosystem management: dominant use, multiple use, environmentally sensitive multiple use, an ecosystem approach to resource management, and ecoregional management. According to Yaffee, these paradigms differ in their management goals and principles, their biotic and spatial focus, and their view towards the role of humans in ecosystems. Subsequently, these views have translated into different definitions of and approaches to ecosystem management. Still, Yaffee

notes that within the ecosystem management literature there is a "remarkable degree of consensus about the broad principles of ecosystem management," and notes that most of these principles fall within the paradigm of an ecosystem approach to resource management (Yaffee 1999, 714). Yaffee states that despite academic and philosophical differences over ecosystem management, practitioners are implementing facets of ecosystem management philosophy because many see ecosystem management as a better approach to managing natural resources than the past status quo (Yaffee 1999).

Yaffee (1999) further notes that much consensus about the themes of ecosystem management has emerged. Three seminal works provide insight into this consensus. In 1994, in response to a growing body of ecosystem management literature, Edward Grumbine published a seminal paper in which he summarized what had been written about the topic through 1993 (Grumbine 1994). This summary produced 10 dominant themes common to ecosystem management definitions: 1.) hierarchical context, 2.) ecological boundaries, 3.) ecological integrity, 4.) data collection, 5.) monitoring, 6.) adaptive management, 7.) interagency cooperation, 8.) organizational change, 9.) humans embedded in nature, and 10.) values (Grumbine 1994). Grumbine offered his own definition of ecosystem management, which can be found in Table 1. In 1997, Grumbine revisited these ten themes, and found them to still be sound and applicable (Grumbine 1997).

Claudia Geotz Phillips built on Grumbine's (1994) work by compiling an inventory of recent definitions of ecosystem management (Phillips 1997). Some of these definitions appear in Table 1, and have been augmented by selected definitions that have emerged since 1997.

Table 1. Ecosystem Management Definitions.

Ecosystem management integrates scientific knowledge of ecological relationships within a complex sociopolitical and values framework toward the general goal of protecting native ecosystem integrity over the long term. *Grumbine 1994, 31*

Ecosystem management is the optimum integration of societal values and expectations, ecological potentials, and economic plus technological considerations. The philosophy of ecosystem management is to sustain the patterns and processes of ecosystems for the benefit of future generations, while providing goods and services for each generation. *Everett et al. 1994:7-8*

Ecosystem management implies a process humans cannot avoid decisions about natural resources, and . . . those decisions should be supported with knowledge of the physical, biological, and social relationships that define ecosystems. *Lucier 1994, 21*

Ecosystem management is a system of making, implementing, and evaluating decisions based on the ecosystem approach, which recognizes that ecosystems and society are inexorably linked and always changing. *Maser 1994, 307*

Ecosystem management emphasizes the integration of ecological, social, and economic factors at different temporal and spatial scales to maintain a diversity of life forms, ecological processes, and human cultures. *Salwasser and Pfister 1994, 151*

Ecosystem management represents shifts in the way we do business, indeed in the way we view and interpret society. . . . Ecosystem management is not a static program with a beginning and ending date, but rather involves concepts and principles that evolve and adapt along with changes in science, economics, and demographics. *Staebler 1994, 5*

Ecosystem management is generally viewed as management that promotes ecological, economic, and social sustainability. *U.S. House of Representatives, Committee on Natural Resources 1994, xi*

Ecosystem management is the integration of ecological, economic, and social principles to manage biological and physical systems in the manner that safeguards the ecological sustainability, natural diversity, and productivity of the landscape. *Wood 1994, 9*

Ecosystem management is management driven by explicit goals, executed by policies, protocols, and practices, and made adaptable by monitoring and research based on our best understanding of the ecological interactions and processes necessary to sustain ecosystem composition, structure and function. *Christensen et al. (Ecological Society of America Committee on the Scientific Basis for Ecosystem Management) 1996, 665*

Ecosystem management is managing areas at various scales in such a way that ecosystem services and biological resources are preserved while appropriate human uses and options for livelihood are sustained. *Brussard et al. 1998, 9*

Ecosystem management is the process of managing and understanding the interaction of the biophysical and socioeconomic environments within a self-similar, self-maintaining regional or larger system. *Slocombe 1998b, 31*

Ecosystem management can be thought of as the minimum set of tools a land manager should have available in attempting to define sustainable alternatives for the interactions of people and the environment. *Sexton 1998, 103*

Ecosystem management is an approach that attempts to involve all stakeholders in defining sustainable alternatives for the interactions of people and the environments in which they live. *Szaro et al. 1998b, 1*

Phillips also composed her own definition of ecosystem management:

Ecosystem management is an integrative, interdisciplinary, and adaptive approach to policymaking, planning, and management, at all levels, that is grounded on the best available scientific information, recognizes the uncertainties of science and the dynamic nature of ecosystems, and acknowledges that humans and ecosystems are inexorably linked. The primary goal of ecosystem management is to sustain and/or restore ecosystem integrity, which includes biological diversity and the ecological patterns and processes that support that diversity at all spatial and temporal scales. (Phillips 1997, 63)

In relation to those presented in Table 1, Phillips' definition is very inclusive in that it touches on several themes that Grumbine (1994) lists as major ecosystem management themes, including hierarchical context, adaptive management, interagency cooperation and humans embedded in nature. In common with Grumbine's definition in Table 1, Phillips also places significant emphasis on the importance of ecological integrity. Ecosystems with high ecological integrity exhibit a historical structure, species composition, and disturbance regime because of natural processes that occur in the environment (Brussard et al. 1998).

In support of her definition, and as a result of a thorough literature review, Phillips also developed a list of ten goals for ecosystem management initiatives. These goals are provided in Table 2.

Another seminal work in the field of ecosystem management appeared in 1996, when the Ecological Society of America published the final report of its appointed Special Committee on the Scientific Basis of Ecosystem Management. The Committee's own definition of ecosystem management appears in Table 1. In addition to this

Table 2. Goals of Ecosystem Management. Source: Phillips 1997, 64.

-
1. Maintain ecosystem integrity—protect total native diversity and ecological patterns and processes.
 2. Manage based on natural processes—manage with regard to ecosystem constraints and ecological principles.
 3. Sustain ecosystems for the long-term—maintain and/or restore ecosystem diversity, health, and productivity.
 4. Manage within the context of an ecological hierarchical organization—study ecosystem patterns and processes at varied geographic and time scales or within ecological time frames; give priority to ecosystem boundaries over political boundaries.
 5. Develop and adopt an interdisciplinary approach—manage using interdisciplinary teams of researchers, managers, educators, and citizens.
 6. Facilitate public involvement—directly involve the public in the decision-making process; encourage collective decision-making or consensus building.
 7. Integrate scientific research, policy, and management—develop a strong scientific basis for management decisions; promote stronger teamwork among scientists, managers, and policymakers.
 8. Incorporate adaptive management procedures—develop site-specific monitoring and evaluation schemes to assess ecosystem changes over time.
 9. Develop educational programs and provide for informational exchange—promote awareness and understanding of ecosystem processes and constraints; facilitate the transfer of information within and across disciplines and agencies.
 10. Accommodate human use and occupancy—operate with people in mind; determine and incorporate human desires and requirements in the planning and decision-making process.
-

definition, the Committee listed eight essential elements of ecosystem management: 1.) long-term sustainability, 2.) clear, operational goals, 3.) sound ecological models and understanding, 4.) understanding complexity and connectedness, 5.) recognition of the

dynamic character of ecosystems, 6.) attention to context and scale, 7.) acknowledgement of humans as ecosystem components, and 8.) commitment to adaptability and accountability (Christensen et al. 1996, 669). Additionally, the Committee noted four steps and actions that could facilitate moving ecosystem management from concepts, to practice: 1.) defining sustainable goals and objectives, 2.) reconciling spatial scales, 3.) reconciling temporal scales, and 4.) making the system adaptable and accountable (Christensen et al. 1996, 666).

Many commonalities can be found amongst the themes and goals of ecosystem management as described by Grumbine (1994), Phillips (1997), and Christensen et al. (1996). For example, the need for adaptive management and the need to give attention to hierarchical scales appear in the work of all three authors. Four commonalities, however, will frame most discussions within the research in this thesis—1.) the importance of ecological integrity, 2.) the need to work across administrative boundaries, 3.) the need for interagency cooperation, and 4.) the recognition of humans as ecosystem components. Each of these ecosystem management themes will be briefly discussed here, and later expanded upon as particular research warrants.

Ecological Integrity

The maintenance of ecological integrity is explicitly noted by Grumbine (1994) and Phillips (1997) as necessary to ecosystem management. Ecosystem integrity, in a management context, entails protecting native diversity and the ecological patterns and processes that maintain diversity (Grumbine 1994). Christensen et al. (1996) do not specifically mention ecological integrity as an essential ecosystem management

component, but the notion is embraced through two components that they do list: sound ecological models and understanding, and complexity and connectedness. Christensen et al. note that ecosystem management based on sound ecological principles emphasizes the role of ecological processes and interconnectedness. Additionally, they note the importance of biological diversity in their discussion of complexity and connectedness.

Ecological Boundaries

The need to work within an ecological boundary, as opposed to only within single administrative or political boundaries, is another common theme of ecosystem management that emerges from the work of Grumbine (1994), Christensen et al. (1996), and Phillips (1997). Boundaries imposed by humans on the landscape rarely coincide with ecological processes, and this can often result in piecemeal decision making that can be ecologically harmful (Christensen et al. 1996). Citing the work of Freyfogle (1996), Grumbine (1997) notes that boundaries are not influential because they can distinguish between public and private lands, but because they can constrain thinking. Grumbine (1997) also notes that managers are realizing through ecosystem management that responsibilities begin at boundaries, rather than end.

Interagency Cooperation

To achieve management across ecological boundaries, there is a need for interagency cooperation, another dominant theme in ecosystem management. An ecosystem management approach necessitates a broad view, and traditional boundaries used in management and planning must be transcended. Inherent in this is the need for multiple stakeholders to collaborate in planning and management (Phillips 1997).

Christensen et al. (1996) similarly note that a productive way to reconcile conflicting spatial scales that are created through the presence of administrative boundaries is to identify stakeholders and coordinate activities. Although Grumbine, Phillips, and Christensen et al. do not specifically address planning at regional scales, other authors such as Reichman and Pulliam (1996), Sportza (1999), and Brunckhorst (2000) stress that regional planning is important in the context of ecosystem management. These arguments will be elaborated on in Chapter 3.

Humans as Ecosystem Components

The final theme that will be used in this research is the notion that humans are ecosystem components, and thus there is a human element to ecosystem management. Grumbine (1994), Phillips (1997), and Christensen et al. (1996) each recognize humans as part of ecosystems, and encourage public involvement in ecosystem management initiatives. While Grumbine (1994) and Phillips (1997) both explicitly mention humans in their definitions of ecosystem management, Christensen et al. (1996) do not. However, Christensen et al. (1996) do address the human component of ecosystem management outside of the context of an ecosystem management definition: "Ecosystem management is at least as much about managing human activities as it is about managing lands and waters. A major promise of ecosystem management is its potential to integrate human activities and conservation of nature" (Christensen et al. 1996, 676).

How to integrate human activities and the conservation nature is not a topic that has been extensively discussed within the ecosystem management literature, even though authors such as Szaro et al. (1998) and Yaffee (1999) argue that human activities are

often at the center of debates concerning ecosystem management. Many of the dominant themes of ecosystem management have been developed in the context of conserving nature (i.e. ecological integrity, ecological boundaries, ecosystem sustainability), and although Field (1996, 249) notes that "humans are back in the ecosystem" in twenty-first century natural resource management, it is not clear how humans fit into the ecosystem management equation. The definitions of ecosystem management that exist, and the discussions that occur throughout the ecosystem management literature, bring to the forefront the fact that there is no agreement on how humans should interact with ecosystems. As a result, there are competing visions of how ecosystem management might play out on the landscape.

For instance, several authors have called for human societies to live sustainably within their environments in order to achieve other ecosystem management goals such as ecosystem integrity (Slocombe 1993b, Grumbine 1994, Wood 1994, Galindo-Leal and Bunnell 1995, Brussard et al. 1998, Sexton 1998, Szaro et al. 1998b, Brunckhorst and Rollings 1999, Salwasser 1999). This argument suggests that societies may have to change their present way of interacting with the environment to ensure the success of other ecosystem management goals. On the other hand, other authors have argued that ecosystem management strategies must develop from and be based on local, cultural understandings of the ecosystem in question (Booth and Kessler 1996, Driver et al. 1996). This argument suggests that some ecological goals of ecosystem management may have to take on lesser importance in order to preserve or ensure the continuation of local culture.

Of course not all members of a particular society or culture view the ecosystem in which they live in the same manner. Within any society or culture there will be a diverse array of stakeholders who affect and are affected by natural resource management decisions. Including all of these stakeholders in ecosystem management initiatives has been noted as necessary for success, especially in terms of collaborative goal and decision making (i.e. Galindo-Leal and Bunnell 1995, Cortner 1996, Driver et al. 1996, Szaro et al. 1998b, and Bengston et al. 2001). Shindler and Cheek (1999) specifically note that broad public involvement is integral to environmental planning and management, because without it, very little public ownership of environmental plans will develop. As Booth and Kessler (1996) note, however:

People have complex cultural, economic, and spiritual linkages with the forests and rangelands, whether they actually reside there or are visitors. Human relationships to ecosystems include people's subsistence and recreational activities, their lifestyle choices and means of livelihood, their historical roots, their cultural identities, their family and community traditions, their environmental ethics (Booth and Kessler 1996, 235).

Thus, the challenge inherent in ecosystem management is how to reconcile the views of a potentially diverse set of stakeholders, and to do so while trying to promote the ecological goals of ecosystem management. This can be a difficult task. Cortner (1996) has noted that the inclusion of a value-diverse public can result in environmentally damaging decisions. Along the same lines, Slocombe (1993b) notes that local stakeholder involvement can lead to varying standards of ecosystem management.

Consequently, difficult questions arise when considering the human dimension of ecosystem management: To what extent should value-diverse stakeholders influence the outcome of ecosystem management goals such as ecological integrity? To what extent

should local stakeholder needs and wants be met first, and ecological needs met second? To what extent should current human cultures change to meet the various goals of ecosystem management?

There are no straightforward answers to these questions, which is perhaps why questions such as these are not readily addressed in the ecosystem management literature. Moreover, the academic interest in ecosystem management has been centered in the ecological sciences, and not the social sciences. As is presented in the following section, however, several concepts stemming from the social sciences could aid in the understanding and implementation of ecosystem management. The concepts will not answer the aforementioned questions, but they bring a fresh and important perspective to ecosystem management discussions.

Space, Place, and Ecosystem Management

Many of the dominant themes of ecosystem management are grounded in the ecological sciences, but ecosystem management has a large social component as well. After all, ecosystems are social constructions (Wallace et al. 1996). Greider and Garkovich (1994) note that cultures transform natural environments into culturally meaningful phenomena [i.e. ecosystems] as cultures struggle with the meaning of nature and the environment.

Cronon (1996) provides additional insight into various cultural meanings of nature, noting that all meanings of "nature" are human constructions that are entangled with human values and assumptions. Thus, "nature" is a reflection of people, rather than the things labeled as "nature." He specifically notes that the commonly held view that

“nature” is “not of our own making” is problematic. Cronon describes this view as “nature as naïve reality” and criticizes it because “nature as naïve reality wants us to see nature as if it had no cultural context, as if it were everywhere and always the same. And so the very word we use to label this phenomenon encourages us to ignore the context that defines it” (Cronon 1996, 35).

Cronon brings to the forefront that nature is both a cultural construction and that it occurs within a cultural context. Because ecosystems are one way to describe nature, it follows that ecosystems, too, are cultural constructs and occur within a cultural context. Such a context relates to the geographic concepts of space and place. Agnew (2002, 5) explains both terms:

Space signifies a field of practice or area in which a group or organization (such as a state) operates, held together in popular consciousness by a map-image and a narrative or story that represents it as a meaningful whole. Place represents the encounter of people with other people and things in space. It refers to how everyday life is inscribed in space and takes on meaning for specified groups of people and organizations.

The notion of place has been explored by a variety of academics. Caragata (1998) notes that “place” brings to mind not only physical and spatial meanings, but social meanings as well. Tuan states, “What begins as undifferentiated space becomes place as we get to know it better and endow it with value” (Tuan 1977, 6). Sack notes that places are “fundamental means by which we make sense of the world and through which we act” (Sack 1992, 1). As cited in Smith et al. (1998, 4), Carter (1988) argues that, “by the act of place-naming, space is transformed symbolically into place, that is, a space with a history.” Foster (1995) notes that although one space can contain many different

meanings of place, all places have three primary characteristics: a landscape setting, a set of associated activities, and significance to people.

While places can be named and described, place boundaries are rarely concretely defined. Norton and Hannon (1998) note that physical geographers and ecologists usually employ place boundaries based on physical characteristics while planners and social scientists from geography and anthropology employ boundaries based on perception and cultural factors.

In relation to ecosystem management, the notions of space and place are relevant because currently, ecosystem management philosophy has the tendency to treat ecosystems as spaces, or "nature as naïve reality." From an ecology perspective, ecosystems are often spaces on a map that can be delineated with a line and spoken of in ecological terms, without cultural context. For instance, Christensen et al. (1996) state, that ecosystem management is about managing human activities within ecosystems — as if human activities are separate from and inconsequential to the ecosystem. ✓

Ecosystems are much more, though: they are places. More often than not, people will live within an ecosystem that an ecologist delineates for the application of ecosystem management, or at a minimum, people will visit it or otherwise have some kind of personal affinity to it. Ecosystems, no matter their size, have meaning to people, to organizations, to institutions. Ecosystems can be symbols—to some perhaps a symbol of naturalness, perhaps to others a symbol of wildness that should be tamed. Thus, ecosystems are not only ecologically complex, they are socially complex because of the multiple meanings of place that people ascribe to an ecosystem. Additionally, multiple meanings of ecosystems as places can also stem from spatial variability on the landscape

itself, when for example, administrative units within an ecosystem have particular management strategies that result in different meanings of place.

Thus, when ecosystem management is proposed for managing particular ecosystems, recognizing these ecosystems as places can help in visualizing and understanding the complex cultural environment in which this management will potentially take place. This in turn allows a more comprehensive discussion of ecosystem management to emerge. Thus, in addition to discussing the ecological principles of ecosystem management, recognizing ecosystems as places can promote a discussion of human-environment interactions and bring forth a realization that ecosystem management will occur within a human-valued area. Ecosystem management has a better chance of success with such a realization, because the reality on today's landscape is one of coupled human-natural systems.

Additionally, recognizing ecosystems as places can aid in the implementation of ecosystem management itself. When ecosystem management is proposed as a way to manage an area in which people live, fostering a common place identity can be the beginnings of successful ecosystem management. Caragata (1998) notes that when there is a common understanding of place, this understanding can act as a social unifier, and can be helpful in forging public identification and ownership of an area. Similar arguments have been made by Graham and Healey (1999). Such identification and ownership (or connectedness) have been noted as important factors in environmental protection, which is arguably what ecosystem management strives to achieve. For instance, Foster (1995, 3) notes that "place connectedness" is important to environmental pursuits. He postulates that where similar meanings of place are found across a

landscape, a common environmental awareness will arise, which can subsequently be a powerful force for ecosystem-wide action. Similarly, Hough (1990, 179) stresses that connections between regional place identity and the sustainability of an ecosystem are "essential and fundamental." He also notes that a regional environmental literacy is needed for a regional place identity, and stresses that for people to have a regional place awareness, the place in question must be a part of people's everyday lives. Simonson (1989) notes that to know a place is to know its context. In speaking of the importance of human connections to place he adds, "We vandalize, pollute, plunder and ravage what is separate from us; we revere, protect and cherish what we belong to" (Simonson 1989, 145).

These authors demonstrate the important connection between place identity and environmental protection. Foster and Hough specifically note the connection between regional place identity and regional environmental protection. Because ecosystem management commonly strives to sustain whole ecosystems, which are often found at a regional scale, these authors' findings are appropriately extrapolated to ecosystem management. In other words, an important link exists between regional place connectedness (or identity) and the potential success of ecosystem management.

The challenge in fostering a common place identity is that a particular area can have several place-meanings. The key, then, is to find commonalities amongst a diverse public. Cheng et al. (2003) note that it is possible to find such commonalities even among traditional adversaries such as "environmentalists" and "loggers" and that it is important to do so in order to inspire collective action.

SEE RACIOPS
AND TREE-HUGGERS
AGREEMENT
ON MANAGEMENT
IS NOT

The Role of the Geography

Of the many themes within the academic discipline of geography, the human-environment theme, or perspective, has particular relevance to the study of ecosystem management. The human-environment perspective emphasizes the relationships between societies and their biophysical environments, and considers how the two interact to form the particularities of place. Because ecosystem management philosophy currently is based in the ecological sciences, and the ecosystem management literature is weighted towards ecological dialogue, a human-environment perspective would add to a growing academic literature that examines the human dimensions of ecosystem management. Such a perspective could foster a more comprehensive understanding of the nature of ecosystem management because ecosystem management is not just a study in ecology, but a study in human-environment interactions.

The human-environment perspective has a long and rich history within geography, and its development and importance have been explored by various authors including Kates (1987), Pattison (1990), Knight (1992), NRC (1997), Hanson (1999), and Turner (2002). The National Research Council (NRC 1997) notes that the study of human-environment interactions is not only a core element of the discipline's past, but that it has great relevance today for other disciplines, decision makers, and the public. One reason for its relevance is that geographers studying human-environment dynamics "often attempt to transcend the boundaries traditionally separating the various natural sciences, social sciences, and humanities disciplines in order to provide a broad-ranging

analysis of selected phenomena” (NRC 1997, 29). Such study brings together into “one analysis ideas that are often treated separately in other disciplines” (NRC 1997, 29). This research is an illustration of the Council’s assertions: through the human-environment perspective, the concept of ecosystem management is reviewed from both an ecologic and geographic point of view, bringing together both areas of study more fully to analyze ecosystem management in the GYE.

Turner (2002) specifically notes that the human-environment perspective lends itself to synthesis, which is a natural fit for geographers who bridge physical and human geography to produce holistic analyses (Knight 1992). Hanson (1999) argues that geographers should make the most of their ability to synthesize — to bring attention to particular places and the connections between nature and society — by working to bring the messages of the human-environment perspective to non-geographers and society at-large. Through studying ecosystem management with a human-environment perspective, geographers would be poised to do just this.

Although the human-environment theme in geography is now tackled by a variety of disciplines, there remains, according to Kates (1987, 526), a need for geographers who can “sit astride the natural and social science boundary to provide analysis, integration, and leadership.” Other authors, including Crofts (1999), Slocombe (2000), and Cooke (1992), call for a continued and strengthened role for geographers in environmental management issues. This research answers these calls.

Summary

Ecosystem management is a relatively new approach to natural resource management that is viewed as a sustainable alternative to traditional natural resource management. Several dominant themes of ecosystem management have emerged, including the importance of ecological integrity, the need to work within an ecological boundary and across administrative boundaries, the need for interagency cooperation, and the recognition of humans as ecosystem components. Although ecosystem management tends to be grounded in the ecological sciences, the social sciences have much to offer to ecosystem management discussions. Specifically, the geographic notion of place reminds ecologists and other physical scientists that ecosystems are not only about ecology, but about people and their connection to these ecosystems, as well.

The GYE is often evoked as an area that is ideal for the application of ecosystem management, but no area-wide ecosystem management plan exists. Additionally, although the GYE concept has been around for almost 100 years, it is unknown to what extent this concept has taken hold in the area. If the GYE concept has taken hold, there is the possibility that ecosystem management principles are being applied in the area—even without an official ecosystem management plan or initiative. After describing the GYE in the next chapter, the following three chapters, through four specific areas of analysis, will explore if and how local stakeholders recognize the GYE concept and draw conclusions as to the prevalence of the ecological and human themes of ecosystem management in the GYE.

CHAPTER 2

THE GREATER YELLOWSTONE ECOSYSTEM

Physical Setting

The Greater Yellowstone Ecosystem (GYE) is approximately an 18 million-acre area that includes portions of Montana, Idaho, and Wyoming (Figure 1) and represents one of the last, relatively intact temperate zone ecosystems on the earth today (Little 1987, Barbee et al. 1991, Patten 1991, Johnson and Snepenger 1993). Several spatial representations of the GYE exist, however, each bounding the GYE at differing locations. These various spatial depictions are evidence of an ongoing discussion regarding the spatial extent of the GYE, what criteria should be used to define it, and if a boundary should be placed on maps at all (see Clark and Harvey 1988, Glick et al. 1991).

The GYE as spatially defined in Figure 1 will guide discussion of the GYE in this research. This is a relatively recent spatial rendering, used by Noss et al. (2001) as part of their assessment of biological conservation in the GYE. This map is comparable to those that have appeared in Clark and Minta (1994), Harting and Glick (1994), Schullery (1997), and Rasker and Hansen (2000).

First and foremost, the GYE has been spatially defined in ecological terms, as a scientific construct (Johnson and Snepenger 1993). Clark and Harvey (1988) note that the ecosystem has often been delineated according to the habitat requirements of various wildlife species that occur within the region, and suggest that besides wildlife, the "logical boundaries" of the GYE should also include geology, climate, vegetation, and

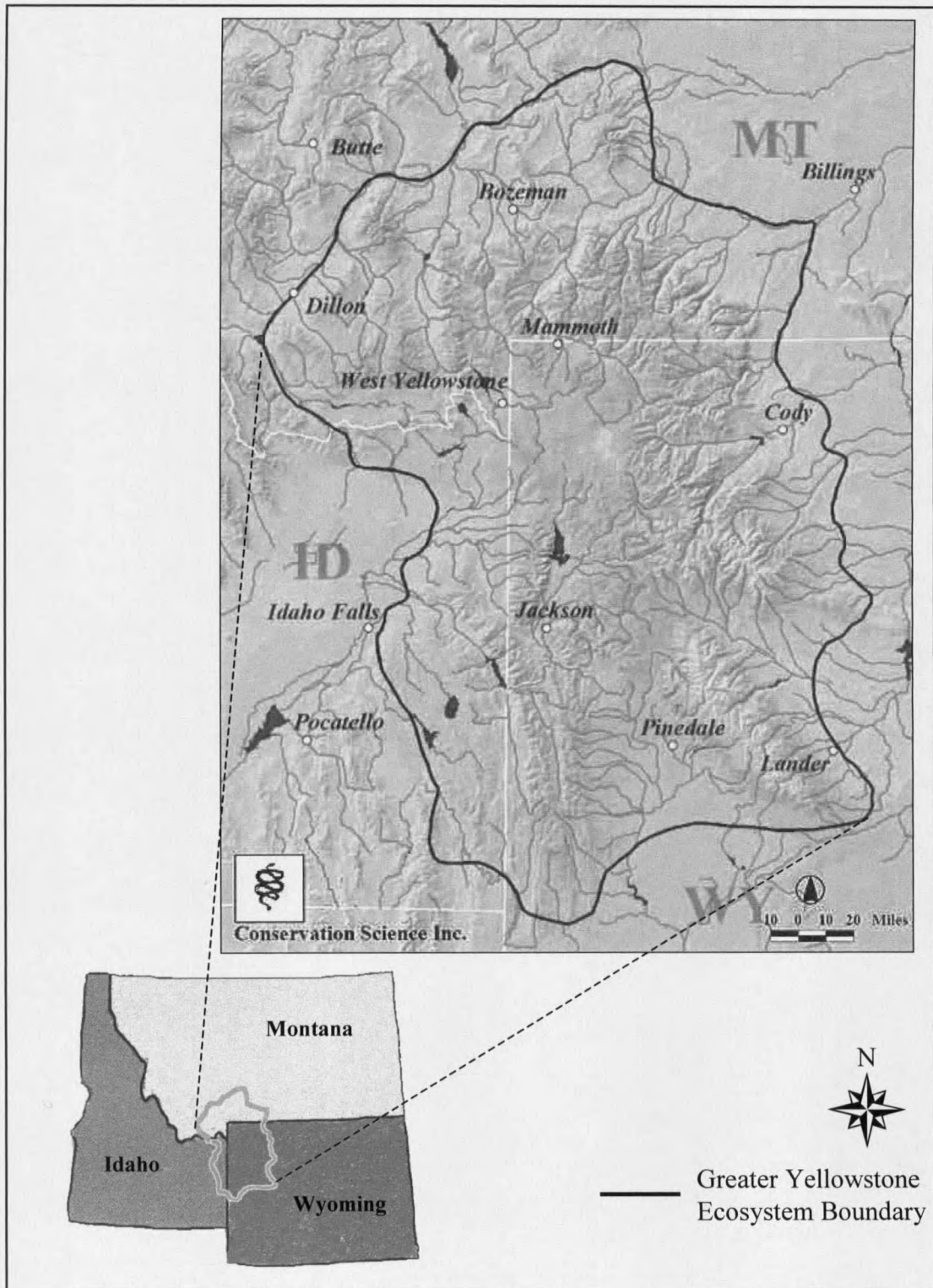


Figure 1. The Greater Yellowstone Ecosystem. Inset Map by Aaron Jones, Montana State University. Greater Yellowstone Ecosystem Map by Conservation Science, Inc.

topography. Patten (1991) similarly notes that although the GYE has no definite boundary, the area exhibits unifying ecological characteristics that bound it as an ecosystem. Marston and Anderson (1991) specifically use watersheds and vegetation to define the GYE, arguing that the two characteristics are dominant controls of GYE structure and function.

The GYE has a unique physical geography. The Yellowstone Plateau, at 2,438 meters in elevation, is a dominant landscape feature at the core of the ecosystem and serves as a reminder of the area's volcanic history. The rest of the GYE is characterized by several mountain chains, with several wide river valleys dissecting them. The headwaters of three major river systems begin within the GYE: the Missouri-Mississippi, the Snake-Columbia, and the Green-Colorado (Marston and Anderson 1991). The Wind River, Teton, Absaroka, Washburn, Beartooth, Gros Ventre, Centennial, Madison, Gallatin, and Bridger mountain ranges encircle the Yellowstone Plateau, and feed the GYE's river systems every spring when the winter snowpack begins to melt. The GYE is also home to the largest functioning geothermal basin in the world. This basin produces most of the world-famous geysers and hot springs found throughout the area.

In comparison to the environments that surround it, the GYE's biogeography is unique as well. Approximately 60 percent of the GYE is forested, and of that, 60 percent of the forest is composed of lodgepole pine (*Pinus contorta*) (Glick et al. 1991). Other conifer tree species that comprise the forested environment include Douglas fir (*Pseudotsuga menziesii*), Engelmann spruce (*Picea engelmannii*), subalpine fir (*Abies lasiocarpa*), whitebark pine (*Pinus albicaulis*), and juniper (*Juniperus scopulorum* and *Juniperus communis*). Ponderosa pine (*Pinus ponderosa*), a dominant conifer tree species

found throughout the West, is absent in the GYE due to climatic influences which produce comparatively cool and moist conditions within the ecosystem. Conifer distribution, overall, closely correlates with mountain distribution (Wyckoff and Dilsaver 1995). Deciduous tree species are not nearly as widespread in the GYE, but do include cottonwood (*Populus* spp.), aspen (*Populus tremuloides*), and willow (*Salix* spp.). These species are often found along rivers and floodplains. Grasslands and shrub steppes characterize the lower, valley areas of the GYE. Common shrub species include sagebrush (*Artemisia tridentata*), Rocky Mountain maple (*Acer glabrum*), grouse whortleberry (*Vaccinium scoparium* leib), antelope bitterbrush (*Purshia tridentata*), and serviceberry (*Amelanchier arborea*) (Glick et al. 1991).

Several mammal species exist within the GYE including elk, pronghorn antelope, bighorn sheep, mule deer, black bear, mountain lions, and wolverines. The GYE also provides habitat for the endangered grizzly bear, the last free-ranging herds of bison in the United States, and the recently reintroduced (in 1995) gray wolf. In addition to mammals there are ten fish, 24 amphibian and reptile, and 300 bird species occupying the ecosystem (Clark and Minta 1994).

Administrative Setting

In context of the GYE's administrative setting, Glick and Clark (1998, 237) appropriately call the GYE "a landscape of boundaries." Figure 2 reveals the federal units and subsequent boundaries that exist at the core of the GYE. Clark and Minta (1994) trace the history of these boundaries, noting that with the establishment of Yellowstone National Park in 1872, the GYE was quickly subdivided into federal

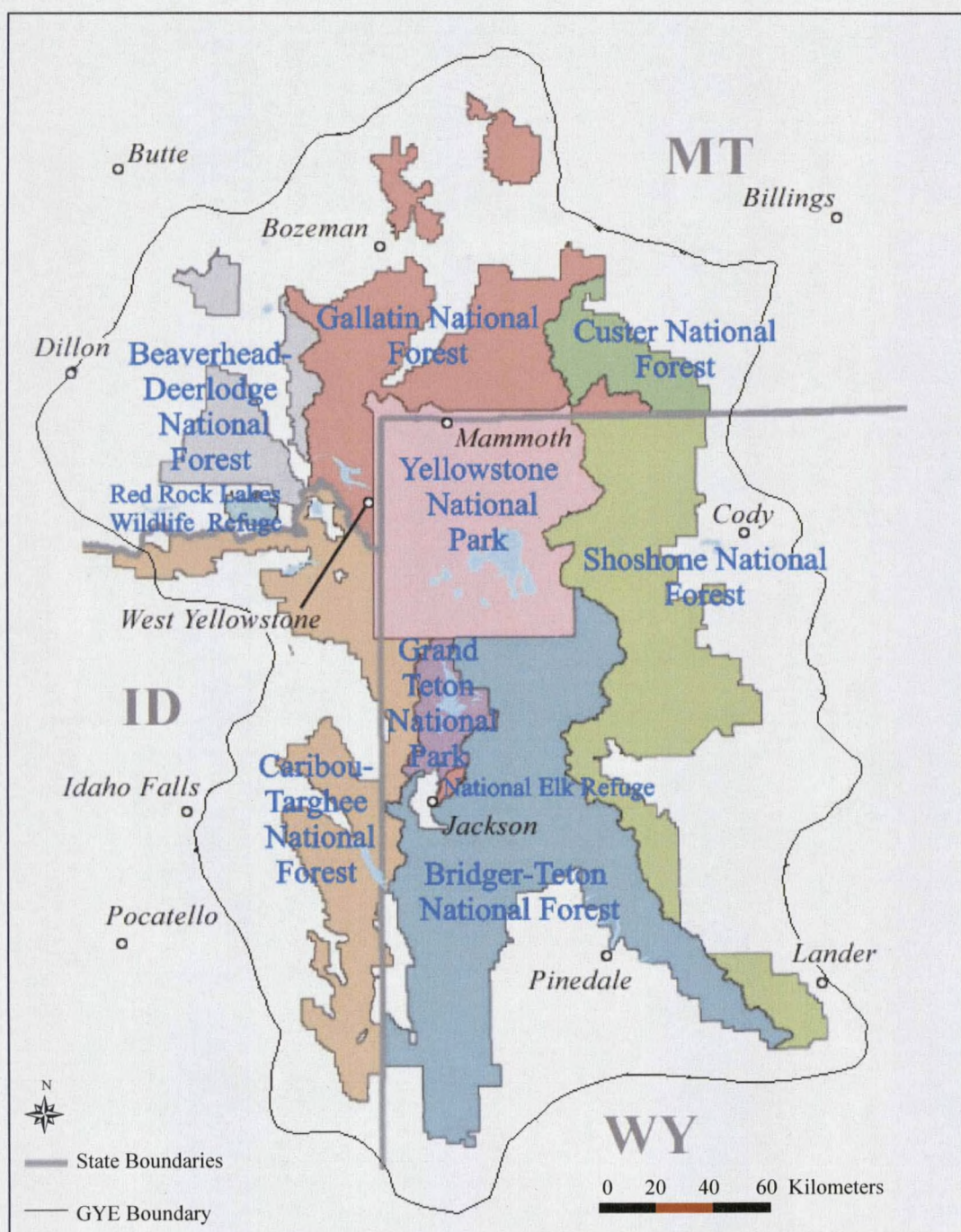


Figure 2. Federal Administrative Units at the Core of the Greater Yellowstone Ecosystem. Source: Henry Shovic, Gallatin National Forest.

administrative units, which they relate to carving up the ecosystem. Today, these administrative units persist.

Within in the GYE are several administrative units which include, but are not limited to, Yellowstone and Grand Teton National Parks, the Beaverhead-Deerlodge, Bridger-Teton, Caribou-Targhee, Custer, Gallatin, and Shoshone National Forests, the Red Rocks Lake National Wildlife Refuge, the National Elk Refuge, Grays Lake National Wildlife Refuge, various parcels of Bureau of Land Management and state land, and 20 counties. The management of these units is delegated to varying government agencies. Glick et al. (1991) report that the Department of the Interior manages approximately 17 percent of GYE land through the National Park Service (NPS), the Bureau of Land Management (BLM), and the U.S. Fish and Wildlife Service (USFWS), and that the Department of Agriculture manages approximately 62 percent of GYE land through the United States Forest Service (USFS). States, counties, and private landowners manage between seven and 30 percent of GYE lands, depending where the GYE boundary is drawn (Goldstein 1992a).

The core of the GYE is considered to be the relatively mountainous, roadless wildlands managed by the NPS and USFS (Harting and Glick 1994). These lands are considered to be the source of ecological vitality within the GYE (Harting and Glick 1994). Increasingly, however, private lands in the GYE, which are commonly found in river valleys and mountain foothills, are also noted for their critical ecological role in the ecosystem (Goldstein 1992a). Harting and Glick (1994) note, for example, that in Teton County, Wyoming, private lands provide 50 percent of all bald eagle nests, and provide winter range habitat for 90 percent of the mule deer that forage in Grand Teton National

Park in the summer. Observations such as these are important to note because whereas federal GYE land managers are mandated by law to protect certain species and habitat, private land owners are not governed under all of these same mandates. Thus, from an ecological perspective, there is concern over the extent to which private lands in the GYE are being subdivided or otherwise developed. As a result of such development, it has been noted that critical wildlife habitat is being fragmented, there are increases in noxious weeds and water pollution, and there are increasing calls for suppression of ecological processes such as wildfire (Glick and Clark 1998).

Lichtman and Clark (1994, 460) have called the GYE administrative landscape a “complex patchwork of management domains and ownership” that has resulted in piecemeal decision-making. A major reason for such decision-making stems from conflicting management philosophies and mandates of GYE land managing agencies (Lichtman and Clark 1994). For example, the NPS and USFS, which manage the majority of GYE federal lands, have different management philosophies and goals. These differing philosophies and management goals have caused Berger (1991) to argue that protecting the GYE may require the placement of the whole ecosystem under a single agency. The topic of the differing GYE federal agency management philosophies will be explored further in Chapter 3.

Social Setting

There is no debate in the academic literature that the boundary of the GYE is based on biogeographical, topographical, and/or hydrological characteristics, as opposed to social or administrative characteristics. Still, the GYE is a social construction—one

that happens to be based on similar physical characteristics rather than similar social or cultural characteristics. Although the GYE boundary is predicated on physical attributes, attempts have been made to describe and synthesize the region's social characteristics.

Jobes (1991) describes the social geography of the GYE in terms of the relationship between GYE residents and their environment. He expresses the social ecology of the area in terms of zones, zones that could be drawn as concentric circles within and around the ecosystem. Descriptions of these zones can be found in Table 3.

Table 3. Social Ecology of the GYE. Modified from Jobes 1991.

Zone	Population	Social Organization	Relationship w/ Nature
I	Small, sparse, very transient, isolated	Rural and small towns. Very informal and personal. Limited organized participation.	Volatile; some want to exploit, others want to lock it up; involved with GYE issues.
II	Small, sparse, very transient	Rural, small and large towns. Informal with rules. Strong environment and development organizations.	Influences the GYE most strongly, romantic interest in GYE, some polarity of views.
III	Small, sparse, some transience	Small cities, towns, and rural. Informal with rules.	States differ in environmental philosophies affecting the GYE, nature needs to be subdued is prevalent.
IV and V	Mass society, varied transience	Metropolitan, urban. Impersonal with formal rules.	Symbolically interested in the GYE, detached, occasional supporters of preservation, development, or both.

Jobes' Zone I comprises Yellowstone and Grand Teton National Parks and areas within a few miles of the boundaries. Zone II encompasses all of the GYE counties.

Zone III encompasses Wyoming, Montana, and Idaho. Finally, Zones IV and V represent the United States and the world, respectively. Clark and Minta (1994) offer similar observations.

Jobs table can be construed as broadly capturing different GYE senses of place among geographically distinct populations. Additionally, his depiction of GYE social ecology recognizes that social involvement in the GYE reaches beyond GYE boundaries. Zone IV and V residents, for example, can exert great political influence in the GYE. Jobs notes that because the GYE is a "mecca of wilderness, environmental protection, and natural recreation" for Zone IV and V residents, it is often found that these residents can exert great political influence in the GYE (1991, 392).

As demonstrated in Table 3, residents of Zones I and II display a range of views toward the GYE. Schullery (1997) and Clark (1999) note that these GYE residents have complex and shifting environmental perspectives. Schullery (1997) specifically notes that Greater Yellowstone is changing economically and socially as the area experiences significant population growth. Although the GYE was once an area where logging, mining, and ranching dominated the economy, little of the recent population growth has resulted in a boost to these traditional Western industries. Rather, population growth in the GYE has resulted in a growth in the service sector, and has resulted in an influx of residents who place value on preserving landscapes and quality of life (Schullery 1997, Rasker and Hansen 2000). The result has been a mismatch between environmental values that has fueled various resource issue debates within the GYE. Clark and Minta (1994) postulate that the GYE's economy and resident base will continue to follow recent

trends, thus resulting in important implications for the direction of natural resource management in the GYE.

History of the Greater Yellowstone Ecosystem Concept

In 1882 Civil War veteran General Philip Sheridan proposed what we would consider today to be a very forward-thinking idea. He wanted to see Yellowstone National Park's southern and eastern boundaries expanded so that more wildlife range could be protected (Schullery 1997). Forty years later, in 1917, the term "Greater Yellowstone" first appeared in print in the Saturday Evening Post when conservation writer Emerson Hough wrote, "Give her Greater Yellowstone, and she will inevitably become Greater Yellowstone" (Hough 1917 in Schullery 1997). Then, in 1964, the term "Greater Yellowstone" became institutionalized by the creation of the Greater Yellowstone Coordinating Committee (GYCC), a low-key committee originally comprised of GYE national forest supervisors, national park superintendents, and the regional directors of these units (Schullery 1997).

It was in the late 1970s that the phrase "Greater Yellowstone" really came into the public sphere. This development can be traced to Frank and John Craighead—two biologists who pointed out that Yellowstone grizzly bears needed more territory than Yellowstone National Park could offer. Rocky Barker (1992) traced the evolution of the GYE concept through an interview with Frank Craighead in 1992. According to Craighead, the brothers were talking about the notion of a Greater Yellowstone in 1959. The seminal moment, however, came in 1979 (Barker 1992). Although the GYCC had been in existence for 15 years by 1979, it was during this year that Frank Craighead put

the terms "Greater Yellowstone" into the public domain when he referred to the area with this term in his book, Track of the Grizzly (Craighead 1979).

For all of their accomplishments in grizzly research and all of their legacies they left for wildlife research in general, such as the use of radio telemetry, perhaps the Craigheads' greatest legacy is that phrase. For once it left their lips, it took a life of its own (Barker 1992).

Edward Grumbine, who also traces the history of the GYE concept, notes that in the late 1970s Frank Craighead called for the NPS and USFS to formally recognize a "greater ecosystem" so that grizzly bear habitat would be protected, but there was little response from the agencies at that time. Grumbine argues that, "to this day, the federal agencies are uncomfortable with the idea of greater ecosystems," noting that both scientific and political uncertainties make adopting the term risky (Grumbine 1992, 58). He notes that Yellowstone is only one of three areas in the United States where the term is much employed—with The Greater North Cascades and the Southern Appalachian Highlands Ecosystems as the others.

Schullery (1997) also traces the history of the GYE concept, noting that federal agencies within Greater Yellowstone refer to it as both an "ecosystem" and an "area." He notes that throughout the 1980s federal land managers preferred to use "Greater Yellowstone Area" because it appeared less politically loaded than "Greater Yellowstone Ecosystem" (Schullery 1997). By the mid-1980s, however, Schullery notes that the term "Greater Yellowstone Ecosystem" was being used just as much, if not more than, "Greater Yellowstone Area."

As Barker suggests and Grumbine and Schullery confirm, the Greater Yellowstone phrase appears to have taken on a life of its own, and is used with some

regularity. There are on-the-ground studies, groups, books and papers all in the name of a Greater Yellowstone. Moreover, Greater Yellowstone is referred to as many things—a concept, an area, a region, a place, a notion, a movement, and of course, an ecosystem. It is no use to say which of these is the right way to describe Greater Yellowstone, because they are all legitimate descriptors.

I have chosen two ways in which to describe Greater Yellowstone. I will most commonly refer to Greater Yellowstone as an ecosystem, which recognizes the historic development of the concept, which is based in the notion that Greater Yellowstone is an ecological whole. Secondly, I will also refer to Greater Yellowstone as a concept. The Third College Edition of Webster's New World Dictionary of American English defines the word concept as "an idea or thought, especially a generalized idea of a thing or a class of things; abstract notion." Recognizing Greater Yellowstone in this way recognizes the human construction of the terms—Greater Yellowstone is an idea, an abstract notion. It is one that some people have ascribed to, and others have not (see Primm and Clark 1996).

The Greater Yellowstone Ecosystem and Ecosystem Management

The Greater Yellowstone Ecosystem concept is a cultural construction. It does not exist except in relation to our present culture and ways of thinking about our environment. This should not diminish, however, the real impact the concept can have, and has had. The concept has not only been internalized through the formation of groups, and the publications of articles and books, it has been invoked as the reason why land management practices within the area's borders should change.

Schullery concludes that “if there was any doubt about the permanency of the Greater Yellowstone movement, it must have been dispelled in 1985” (Schullery 1997, 203). It was during this year that the U.S. Congress House Subcommittee on National Parks and Recreation held hearings on federal land-management practices in the GYE. These hearings resulted in the GYE agencies submitting various data and management reports to Congress. In 1987 the Congressional Research Service published its analysis of these documents, generally finding that GYE coordinated agency management was severely lacking—as evidenced by the submittal of inconsistent and incomplete data, and non-inclusive membership of the GYCC (Lichtman and Clark 1994, Schullery 1997).

In response to congressional concerns, and the labeling of Yellowstone National Park as both a Biosphere Reserve and a World Heritage Site, GYCC forest supervisors and park superintendents began to publicly advocate ecosystem management in the GYE (Schullery 1997). Jensen (2000) more explicitly states that this interest could have been influenced by a Congress who wanted the GYE managed according to an ecosystem approach. GYCC’s initial attempt at ecosystem management was the 1987 publication of The Greater Yellowstone Area: An Aggregation of National Park and National Forest Management Plans—a compilation of data from all GYE National Forests and National Parks that explored existing resources and use levels. Its objective was to “illustrate the relationship and common goals of National Parks and Forests management” and was meant to serve as a “useful tool for coordination and future interagency planning” (GYCC 1987, v).

The GYCC followed through on its desire for future interagency planning by embarking on what has been called “the Vision exercise.” This process began by

producing, in 1990, a 74-page draft document entitled Vision for the Future: A Framework for Coordination in the Greater Yellowstone Area. The document stated three goals for GYE management: (1) conserve the sense of naturalness and maintain ecosystem integrity, (2) encourage opportunities that are biologically and economically sustainable, and (3) improve coordination [amongst federal, state, and local governments, private landowners, and Greater Yellowstone users] (GYCC 1990). Grumbine (1994) notes that this document was the first attempt at applying ecosystem management to federal lands in the United States.

The document was short-lived. There was fierce opposition to the document from both environmental groups and commodity extraction groups. Private landowners, state governors, and state congressional delegates also voiced their displeasure with the document (Lichtman and Clark 1994). Grumbine summarizes this opposition this way:

A firestorm of controversy exploded at the public hearings on the draft. Agency staff were called communists and Nazis by private landowners who saw 'federal takeover' in the public lands document. ...Representative Ron Marlenee's (R-Montana) statement was typical: The document 'essentially writes a blank check for a few wilderness advocates within federal agencies and radical environmental groups to impose their narrow ideological agenda on 17 million acres of land' (Grumbine 1992, 164-165).

Lichtman and Clark (1994) note:

The Vision exercise was viewed from all sides of the issue as a critical shift in natural resource management to a scale much broader than FS and NPS boundaries and policies had historically encouraged. As such, it had the potential to change management substantively, and it also carried tremendous symbolic significance to both proponents and opponents. It was a high-stakes issue for many interests (Lichtman and Clark 1994, 461).

Because there was vocal, vehement and organized criticism from multiple use interests, all discussions of ecosystem management were squelched (Grumbine 1992). In addition, environmental groups were disapproving because they felt the draft Vision document did not do enough to promote interagency coordination and other facets of ecosystem management (Barbee et al. 1991, Goldstein 1992b).

In response, the GYCC, in 1991, renamed and published the final version of the document: A Framework for Coordination of National Parks and National Forests in the Greater Yellowstone Area. This version was drastically different—it consisted of 11 pages (a cut of 63). The three ecosystem management goals were replaced by “principles,” and the first goal of “conserve the sense of naturalness and maintain ecosystem integrity”, was removed and replaced with the principle of “maintain functional ecosystems” (GYCC 1991). Goals two and three remained intact as principles. Lichtman and Clark (1994, 463) call the final draft a “brochure” and note that most of the major points set forth in the draft Vision document were deleted in the final document. In the end, Lichtman and Clark (1994) state that the Vision exercise failed—because it failed to fundamentally change natural resource management in the GYE, or in other words, failed to implement fundamental principles of ecosystem management.

Grumbine hones in on the fact that the word “Vision” was removed in the final draft, and that all mention of biodiversity was removed, as well. Of special interest to Grumbine was a stated goal in the final version: “This document reinforces the separate missions of the Forest Service and Park Service” (Grumbine 1992, 165).

Why the final Vision document changed so dramatically from the draft document is explored in many publications (e.g. Barbee et al. 1991, Grumbine 1992, Lichtman and

Clark 1994, Freemuth and Cawley 1998, Jensen 2000). However, the lessons learned from the Vision Exercise are informative. Lichtman and Clark (1994) give four explanations for the failure of the Vision exercise: 1.) unclear objectives, 2.) a politicized environment, 3.) miscalculation of public response, and 4.) the sinister agency conspiracy (which Lichtman and Clark define as a deliberate attempt by the federal agencies to use vague language throughout the Vision process).

What the Vision exercise did accomplish was an immediate interest in Greater Yellowstone issues: numerous papers appeared in academic journals during and following the Vision exercise. These articles have since tapered off. The GYE concept is still very much employed, however, as exemplified by current academic literature that address the GYE economy and by the use of the terms by several environmental groups. These examples, among others (such as the existence of the GYCC), make it clear that the GYE remains a recognized geographical and ecological entity. The remainder of this study will determine to what extent the GYE is recognized by selected GYE stakeholders, and per these results, connections will be made concerning the prevalence (or non-prevalence) of certain ecosystem management themes.

CHAPTER 3

FEDERAL, STATE, AND COUNTY LAND USE PLANNING

Introduction

The Greater Yellowstone Ecosystem (GYE) is a patchwork of administrative units, each having its own comprehensive land use or management plan which guides land use and management decisions. This chapter explores each of these plans in relation to whether or not each unit plan specifically mentions that the unit is spatially included in the GYE, and analyzes this information in the context of what it may or may not indicate in terms of ecosystem management. To begin, pertinent ecosystem management concepts are reviewed and specifically discussed in terms of the GYE.

Ecosystem management is a new way of thinking about managing natural resources. Several definitions of ecosystem management exist, as shown in Table 1, Chapter 1, page 5. A common theme of ecosystem management is the need to work within ecological boundaries as opposed to administrative boundaries (Grumbine 1994, Haeuber 1996, Christensen et al. 1996, Phillips 1997, Slocombe 1998a). Although they may follow a river or a mountain ridge, most administrative boundaries in the United States divide ecosystems into arbitrary political units that have no relationship to ecological structures or functions (Cortner et al. 1998), which adds to the complexity of achieving ecosystem management (Clark et al. 1991). Christensen et al. (1996, 678) state:

The mismatch between the spatial and temporal scales at which humans make resource management decisions and the scales at which ecosystem processes operate represent the most significant challenge to ecosystem management. Boundaries between ownerships and jurisdictions rarely match the domain of ecosystem processes.

To address these issues Goldstein (1992a) and Szaro et al. (1998a) state that to move toward ecosystem management, whole ecosystems and the natural resources contained therein must be managed not in a traditional site-specific manner (e.g. within administrative boundaries), but in an ecosystem-wide context.

The GYE, like various other regional ecosystems in the United States, is faced with the difficulty of managing natural resources and ecological processes across numerous jurisdictional boundaries (Glick and Clark 1998). Ecosystem processes such as wildfire, water flow, and wildlife migrations occur independent of administrative boundaries; or in other words, the processes do not stop at the boundaries of particular GYE units such as Yellowstone or Grand Teton National Parks. The bi-annual migration of pronghorn antelope is one example of this (Maffly 2003). Pronghorn antelope residing in the southern reaches of the GYE make the longest overland migration of any animal in the lower 48 states twice a year. The migration begins south of Pinedale, Wyoming in mid-spring. The pronghorn leave this winter range and head north, traversing private and federal lands (mostly Bureau of Land Management and Forest Service lands). Their aim is to reach prime birthing grounds and summer pasture in the higher elevations of Grand Teton and Yellowstone National Parks. When the cold approaches in the fall, the pronghorns use the same migration route to head southward, returning to the drier regions of their winter range (Maffly 2003).

Pronghorn antelope are facing obstacles in their migration, however, as are other wildlife species that migrate within the GYE (see Glick et al. 1991, Goldstein 1992a, Maffly 2003). Resource development occurring on Forest Service, Bureau of Land Management, and state lands, and urban development occurring on private lands threatens to severely alter and even halt wildlife migrations (Harting and Glick 1994). In the case of pronghorn migration, it is the potential of natural gas development in the Green River Valley of Wyoming that poses the greatest threat to migration (Maffly 2003).

While resource development is known to alter ecological processes, and the disruption of ecological processes is contrary to what ecosystem management strives to accomplish, several agencies within the GYE are required to balance environmental protection and economic development. The mission of each GYE federal land management agency is given in Table 4. The National Park Service (NPS) manages Yellowstone and Grand Teton National Parks. The United States Forest Service (USFS) manages the six GYE national forests. The Bureau of Land Management (BLM) manages the thousands of acres under its jurisdiction. And the U.S. Fish and Wildlife Service (USFWS) manages the three National Wildlife Refuges in the GYE.

The differences between the missions of GYE federal land management agencies can be categorized in two ways: those that promote multiple use (USFS and BLM), and those that largely promote preservation (NPS and USFWS). The lands managed by the USFS and the BLM, in addition to the lands managed by the states of Montana, Idaho, and Wyoming, are often highly contested in the GYE because of their multiple use characteristics (see Harting and Glick 1994, and Primm and Clark 1996).

Table 4. Missions of Federal Land Management Agencies.

The following agencies are within the United States Department of Interior.
The missions of each are as follows:

National Park Service:	to preserve unimpaired the natural and cultural resources and values of the national park system for the enjoyment, education, and inspiration of this and future generations. (http://www.doiu.nbc.gov/orientation/nps2.cfm)
Bureau of Land Management:	to sustain the health, diversity and productivity of the public lands for the use and enjoyment of present and future generations. (http://www.doiu.nbc.gov/orientation/blm2.cfm)
U.S. Fish and Wildlife Service:	working with others, to conserve, protect and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people. (http://www.doiu.nbc.gov/orientation/fws2.cfm)

The following agency is within the United States Department of Agriculture.
Its mission is as follows:

United States Forest Service:	to sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations. (http://www.fs.fed.us/aboutus/mission.shtml)
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Disputes on these lands often emerge around issues such as timber cutting, mining, livestock grazing, motorized travel, and wildlife habitat. In the case of migrating pronghorn, the dispute is over the development of energy sources and the protection of wildlife habitat. Land use disputes on private lands are often are similar in that they

usually erupt over issues pertaining to development and its affects on wildlife habitat, water quality, and other ecological characteristics.

Landres et al. (1998, 134) note the significance of boundaries in natural resource management. They argue that traditional land management planning allows "incompatible and conflicting land uses of adjacent lands that in turn sever beneficial flows and enhance detrimental flows into natural areas." They specifically cite the differing management directives that direct management actions in Wilderness and non-Wilderness lands within National Forests as an example. Whereas Wilderness areas are managed for naturalness, non-Wilderness lands are managed for commodity use. Incompatible land uses stem directly from these differing management directives, and have measurable ecological impacts (Landres et al. 1998).

The GYE is a landscape that is managed under varying management directives as exemplified, for instance, by the federal agency mission statements in Table 4. With varying land management directives, a question arises as to the extent to which the landscape is or could be managed in relation to the GYE boundary rather than in a piecemeal fashion indicative of individual administrative boundaries. There is no ecosystem-wide land use policy in the GYE, nor a set of overall ecosystem guidelines that each ecosystem unit could follow. Yet, as Clark and Glick note (1998, 238), the GYE presents a unique opportunity to manage a large landscape "boundary-less" because many ecological processes still operate at large scales (though risks to these processes are mounting, Primm and Clark 1996). Such management, they purport, would sustain biological diversity, unique natural features, and human communities within the ecosystem. Groups such as the Greater Yellowstone Coalition exist primarily in the hope

that ecosystem management will become a reality within the entire GYE (see Harting and Glick 1994).

To manage the GYE as a boundary-less ecosystem, however, there would need to be common meeting ground between all GYE land managers, and a "need to join organizational and community planning" (Wallace et al. 1996). This need stems from the perception that traditional land use planning, which focuses on individual management units, fails to consider each unit within a larger land mosaic and thus fails to acknowledge the negative and positive contributions each land unit has on all other land units (Landres et al. 1998). To avoid the perceived consequences of traditional land use planning, Reichman and Pulliam (1996) argue that ecosystem science must be incorporated into management decisions at a regional level and that such incorporation is an essential component of ecosystem management. Szaro et al. (1998b) similarly note that an ecosystem approach emphasizes region-based objectives, with scopes and approaches defined appropriately for each given ecological situation.

Echoing Reichman and Pulliam (1996) and Szaro et al. (1998b), Brunckhorst and Rollings (1999) note that it is now generally accepted that the appropriate scale for pursuing sustainable, environmental objectives is at the level of landscapes or regions, depending on the scale necessary to sustain ecological processes. Brunckhorst (2000) specifically addresses the need for regional planning in an environmental planning or management context:

Increasingly, scientists and managers are recognizing the need to plan regionally in order to act locally. To be effective, management and local action must occur in a regionally integrated manner. ...local community groups and individual action are essential, as are communication and partnership with them, but all our actions must be planned for scales and

priorities that will contribute to maintaining ecological processes and functions at larger scales (Brunckhorst 2000, 16).

A similar call for regional planning was made in 1968 by the United Nations Educational, Scientific, and Cultural Organization (as cited in Grumbine 1992, 132):

We have come to a period in human history when there is a great need for ... landscape or regional planning ... a multidisciplinary, multi-agency, public-private joint planning that can only stem from the existence and nature of natural ... ecosystems (UNESCO 1968, 16).

Additionally, Galindo-Leal and Bunnell (1995) argue that ecosystem management requires an approach which integrates planning across various levels. To accomplish this, Landres et al. (1998) suggest that an adjustment of the spatial and temporal scales of planning is needed to fit ecosystem-wide issues. If a regional ecosystem management plan was created, Sportza (1999) argues that all regional plans should be as compatible as possible with land use plans that exist at smaller scale, administrative units, and should not be contradictory.

In the GYE, a regional effort to plan land uses within an ecosystem-wide context does not exist. If it did, however, an initial step in such planning could be for each land management agency to recognize their unit as part of the GYE—something larger than their individual unit. Slocombe (1993a) notes that recognition of a greater ecosystem in pre-established management units is an important step towards ecosystem-wide decision making. Additionally, Christensen et al. (1996, 682) argue that “reconciliation of objectives and actions of the various stakeholders within the domain of an ecosystem must be a central element in implementation of sustainable management strategies.”

Similarly, Harris et al. (2001), in noting that it is acceptable for individual territories within an ecosystem to maintain some level of autonomy and control in

ecosystem management, also note the importance of these individual territories sharing in a common, regional vision regarding the ecosystem in question. To have success in interagency cooperation and planning, the authors state that there must be a shared recognition that the resources of an ecosystem are worth protecting. For the various agencies involved, legislative recognition of a region and its important ecological values is a starting point for giving recognition and legitimacy to the ecosystem and interagency cooperation. The authors note that legislative recognition can begin with adopting a "common vision" statement in which the region's importance is noted (Harris et al. 2001).

However, it would be no small undertaking for planners and/or managers within pre-established jurisdictional land units to recognize their unit as part of a greater ecosystem. Many federal agencies are very, and sometimes only, committed to the traditional missions and objectives within their given unit (see Keiter 1991 and Lockhart 1991). Brunson (1998, 81) notes that "we live in a very territorial society" and humans are bound to control their spaces based on "legal authority and emotional attachment." In the GYE specifically, both federal and local agencies have been noted to place emphasis on administrative autonomy (Primm and Clark 1996, Clark 1999).

However, Beatley (1994) argues that planners have a moral obligation to consider land units beside their own. According to Beatley, there are several ethical questions that planners must grapple with. One of these questions pertains to whom or to what planners might have obligation (something Beatley calls the moral community). Three dimensions of the moral community exist: the biological, the temporal, and the spatial/geographic. Of special note is the spatial/geographic dimension. This dimension involves questions

“about the extent of duties beyond borders, and whether or not we are obligated to consider environmental impacts and degradation which occur to other communities, states, and nations” (Beatley 1994, 16). Beatley concludes that planners do have an ethical obligation to consider environmental degradation outside their borders, and calls for planners to incorporate the natural environment into their land-use plans.

The remainder of this chapter will specifically examine the land use/management plans that are in place in the GYE to determine if each plan specifically mentions that unit's spatial inclusion in the GYE. While a specific mention of such is not a requirement of ecosystem management, it falls in line with the arguments of Slocombe (1993a) and Harris et al (2001). Overall, in the context of ecosystem management, the importance of working within an ecological boundary as opposed to an administrative boundary has been noted, as has the importance of a regional planning perspective. Slocombe (1993a) argues that it may be difficult to abolish administrative boundaries, but that it is not impossible to transcend them. Transcending boundaries can include single administrative units recognizing their place in a greater ecosystem, which Slocombe argues is an important first step in ecosystem management. Harris et al. (2001) note that legislatively recognizing ecosystems and their values provides legitimacy to the ecosystem concept and furthers interagency cooperation and planning. Thus, one way to determine if GYE administrative units are recognizing their units as part of a larger, ecological whole is to determine to what extent GYE administrative units specifically recognize themselves as part of the GYE. Currently, there is no legal framework that directs any GYE administrative unit to recognize themselves as part of the GYE, thus,

any unit that decides to so does so on a voluntary basis. What such a mention means in the terms of ecosystem management will frame the discussion that follows.

Methods and Sources

Using the comprehensive land use/management plan that exists for each administrative unit in the GYE, a search was conducted to determine if the particular unit in question recognized themselves as part of the "Greater Yellowstone Ecosystem." While various land use plans are required of GYE agencies through several enabling legislations, this discussion focuses on the overarching (comprehensive) land management plans that are required to be produced by each agency. These overarching plans, each having agency- and state-specific names, provide the legal framework for management and land use decisions of given areas. Because these plans are meant to guide management for several years, these plans guide policy beyond the tenure of individual, elected officials.

It must be noted that there are limitations to the above method. A search for the terms "Greater Yellowstone Ecosystem" does not represent the only way to assess whether GYE administrative units recognize themselves as part of the GYE. There are instances where multi-agency/multi-jurisdictional, environmental projects are taking place in the GYE (see Barbee et al. 1991 and Chapter 4), and these efforts could be interpreted as an acknowledgement by those involved that their lands are ecologically connected to one another. Thus, this research stands as only one piece of information about the extent to which GYE administrative units may think of their unit as being part of a larger whole called Greater Yellowstone. Providing information about the extent to

which GYE land use/management plans state that a unit is part of the GYE, and interpreting what this means in terms of ecosystem management, will provide valuable information, but this research should be augmented by other studies that examine similar questions.

This research is qualitative in nature. It uses existing documents to provide insight into institutional settings. As cited by Mahoney (1997), Lincoln and Guba (1985) define a document as "any written or recorded material" not strictly prepared for evaluation or an inquirer, and as such, can be divided into two major categories: public records and personal documents (Guba and Lincoln, 1981). Mahoney (1997) also notes Lincoln and Guba's (1985) definition of public records—those that serve the purpose of "attesting to an event or providing an accounting". In this context, the land use plans of GYE government agencies are considered public records because they provide an accounting of features and management directives for the given unit of planning.

Qualitative analysis is often used in academic geography, and has broadened the focus of geographic research since the quantitative revolution in the 1960s (Robinson 1998). In particular, Robinson (1998, 409) notes "qualitative methods are best used for problems requiring a depth of insight and understanding, especially when dealing with explanatory concepts." He further elaborates that qualitative research exhibits the following: a preference for naturally occurring data and field research, a preference for meanings rather than behavior and for an individual's own interpretation of events, the rejection of natural science as a model, a preference for inductive, hypothesis-generating research which requires strong theory if generalizations are to be made, and a need for

reflexivity in which the researcher is aware of her/himself in juxtaposition to the subject of inquiry.

Results

National Parks

The National Park Service (NPS), through the directive of 16 U.S.C.A. § 1a-7(b), is to create and revise general management plans for each unit within the NPS. These plans, which are “for the preservation and use” of each unit are to be revised “in a timely manner.” Table 5 presents the required components of each NPS general management plan.

Table 5. Required Components of National Park Service General Management Plans. Source: 16 U.S.C.A. § 1a-7(b).

- measures for the preservation of the area's resources;
- indications of types and general intensities of development (including visitor circulation and transportation patterns, systems and modes) associated with public enjoyment and use of the area, including general locations, timing of implementation, and anticipated costs;
- identification of and implementation commitments for visitor carrying capacities for all areas of the unit; and
- indications of potential modifications to the external boundaries of the unit, and the reasons therefore (16 U.S.C.A. § 1a-7(b)).

Yellowstone National Park's last Master Plan was completed in 1974. This Plan does not explicitly use the term “Greater Yellowstone Ecosystem.” However, under a subsection entitled “Regional Considerations,” there is a suggestion of a Greater Yellowstone concept. The plan states, “Together, Yellowstone National Park and Grand Teton National Park immediately to the south comprise the strategic core of a vast upland

wilderness that is held almost exclusively within Federal ownership. Five national forests and parts of three other define its parameters" (YNP 1974, 4). The Plan goes on to call for regional and local planning and "subsequent zoning" that would protect the environment from overzealous recreation, abundant solid waste, and overused roads (YNP 1974, 4). This section concludes by stating, "It is imperative that there be an expanded effort to upgrade coordinated planning for land and water resources. Only within such a framework can the region's unique qualities be sustained" (YNP 1974, 4). Later in the plan the Park calls for more specific efforts to coordinate planning—with states, counties, municipalities, and appropriate federal agencies within the regional area. Specifically:

A regional approach unquestionably challenges the traditional mandates of an area jurisdictionally divided along many county, State, and Federal levels. Cooperation and compromise, essential to such a confederation, will not come easily. Nevertheless, a new land-use ethic is imperative, and the common need to resolve today's complex problems must be recognized and accommodated if the park's finite natural environment is to be perpetuated (YNP 1974, 14).

Grand Teton National Park's last Master Plan was completed in 1976. This Plan does not explicitly use the term "Greater Yellowstone Ecosystem." However, under a subsection entitled "Regional Considerations," as with Yellowstone's Master Plan, there is a suggestion of a Greater Yellowstone concept. In part the discussion in this subsection mimics that found in Yellowstone's Master Plan: "Grand Teton National Park, together with Yellowstone National Park, comprises the strategic core of a vast upland wilderness, which is held almost exclusively within Federal ownership. Five national forests and parts of three others define its perimeter" (GTNP 1976, 12). Later in the subsection appears: "An overall plan for preserving the region's prime scenic attributes

must be developed; likewise, guidelines for the management of rare and endangered species have to be established and enforced. ...Since the ultimate resolution of these issues will have an important bearing on the long-range plans of all the entities involved, efforts to upgrade the coordination of planning for land and water resources within the region should be expanded. Only within such a framework can the region's unique qualities be preserved" (GTNP 1976, 14).

National Forests

The National Forest Management Act of 1976 (NFMA) directs the USFS to develop and adopt Land and Resource Management Plans (LRMP). Each National Forest is required to have a LRMP and revisions of such plans are to take place, at a minimum, every 15 years. The 1982 National Forest Management Act Planning Regulations (36 CFR 219) set forth planning principles to be followed during LRMP development (Table 6).

Gallatin National Forest's (GNF) last LRMP was completed in 1987. In the Plan's "Forest Location" section it states, "The Gallatin Forest is a significant part of the Greater Yellowstone Area and coordinated management of the entire area is essential" (GNF 1987, V-1). The Plan further elaborates on this concept by recognizing "The Greater Yellowstone Area" as one of fifteen forest resource elements. The Plan devotes four paragraphs to this subject, the topics of which focus on Greater Yellowstone's physical, biogeographic, recreational, and commodity-use characteristics (GNF 1987, V-26). Within these paragraphs, GNF recognizes that the NPS and USFS missions can conflict,

and states that coordination between these agencies and others must continue to insure coordinated management of the entire "Greater Yellowstone Area."

Table 6. Planning Principles of the 1982 National Forest Management Act Planning Regulations. Source: 36 CFR 219.

- Establishment of goals and objectives for multiple-use and sustained-yield management of renewable resources without impairment of the productivity of the land;
- Consideration of the relative values of all renewable resources, including the relationship of nonrenewable resources, such as minerals, to renewable resources;
- Recognition that the National Forests are ecosystems and their management for goods and services requires an awareness and consideration of the interrelationships among plants, animals, soil, water, air, and other environmental factors within such ecosystems;
- Protection and, where appropriate, improvement of the quality of renewable resources;
- Preservation of important historic, cultural, and natural aspects of our national heritage;
- Protection and preservation of the inherent right of freedom of American Indians to believe, express, and exercise their traditional religions;
- Provision for the safe use and enjoyment of the forest resources by the public;
- Protection, through ecologically compatible means, of all forest and rangeland resources from depredations by forest and rangeland pests;
- Coordination with the land and resource planning efforts of other Federal agencies, State and local governments, and Indian tribes;
- Use of a systematic, interdisciplinary approach to ensure coordination and integration of planning activities for multiple-use management;
- Early and frequent public participation;
- Establishment of quantitative and qualitative standards and guidelines for land and resource planning and management;
- Management of National Forest System lands in a manner that is sensitive to economic efficiency; and
- Responsiveness to changing conditions of land and other resources and to changing social and economic demands of the American people.

Custer National Forest's (CNF) last LRMP was completed in October of 1986 (CNF 1986). The Beartooth District of the CNF is the only district within the Forest

considered to be a part of the GYE. In the main body of the LRMP, there is no mention of the forest, the Beartooth District, or any of its management areas being included in the GYE. However, there is language that appears in appendix seven which alludes to the CNF as part of the GYE. This appendix states that the "forest is a part of the Yellowstone Grizzly Bear Ecosystem (YGBE) which includes Yellowstone National Park and portions of the Gallatin, Shoshone, Bridger-Teton and Targhee National Forests."

Shoshone National Forest's last LRMP was completed in January of 1986 (SNF 1986). There is no mention of the forest being included in the GYE.

Bridger-Teton National Forest's last LRMP was completed in November 1989. In the Plan's "Physical Setting" section, there is a subsection entitled "Greater Yellowstone Area." This section states, "The northern one-half of the Bridger-Teton National Forest is also part of what has been called the 'Greater Yellowstone Ecosystem'" (BTNF 1989, 28). A map entitled "Greater Yellowstone Area" follows this discussion. (It is interesting to note the Forest's interchangeable use of "area" and "ecosystem" in naming the Greater Yellowstone region). Further references are made to the "Greater Yellowstone Ecosystem," mostly in relation to the GYE being a place of high-quality natural amenities.

Although the Caribou-Targhee National Forest is one administrative unit, both the Caribou National Forest and Targhee National Forest were at one time administratively managed as separate forests (CNF 2003). Today, they maintain their own LRMPs. The last LRMP for the Targhee National Forest was completed in April 1997. The plan states, in relation to desired future conditions that, "The Forest functions as an integral

part of the Greater Yellowstone Ecosystem as well as adjacent systems sustaining habitat and conditions necessary for free movement of wildlife" (TNF 1997a, 11-2). The last LRMP for the Caribou National Forest was completed in February 2003. Only a portion of the Caribou National Forest is considered to be in the GYE (Figures 1 and 2).

Although the 2003 LRMP does not identify them as such, the following portions of the Caribou National Forest (as labeled in the Plan) would be considered part of the GYE: caribou range and overthrust mountains, Webster ridges and valley, and pruess ridges and hills. The only mention of the GYE in the Plan occurs in a discussion of the caribou range and overthrust mountain area. This section states that "linkage habitat between the Caribou and the Targhee NF and Greater Yellowstone Ecosystem" will be emphasized (CNF 2003, RFP 4-9).

The Beaverhead-Deerlodge National Forest's last LRMP was completed in 1986 (BNF 1986). The Tobacco Root, Gravelly, and Madison planning units, as identified in the Plan, are the only units within the Forest considered to be a part of the GYE. There is no mention of the forest or any of its planning areas being included in the GYE.

Bureau of Land Management Lands

The Federal Land Policy and Management Act of 1976 (FLPMA) directs the BLM to produce land use plans. These plans guide management decisions and actions on these lands. Before 1985, BLM land use plans were called Management Framework Plans (MFPs). Since 1985, BLM land use plans have been called Resource Management Plans (RMPs). These plans cover planning areas that tend to coincide with BLM field office boundaries. Section 202 of FLPMA states that the BLM in its land use planning

efforts must follow certain planning directives (Table 7). In the GYE, nine RMPs and one MFP exist (Appendix A). There are no GYE BLM RMPs or MFPs that specifically acknowledge that their unit is within the GYE.

Table 7. Federal Land Policy and Management Act Land Use Planning Directives.
Source: 43 U.S.C.A. § 1712(c).

- Follow the principles of multiple use and sustained yield;
- Use a systematic, interdisciplinary approach, fully considering physical, biological, economic and social aspects of public land management;
- Identify, designate, protect and specially manage areas of critical environmental concern (ACECs);
- Consider relative significance of the public land products, services, and use to local economies;
- Rely on the inventory of the public lands, their resources, and other values, to extent such information is available;
- Consider present and potential uses of the public lands;
- Consider the relative scarcity of the values involved and the availability of alternative means (including recycling) and sites for realization of those values;
- Weigh long-term benefits to the public against short-term benefits;
- Comply with applicable pollution control laws; and
- Coordinate the land use inventory, planning, and management activities of or for such lands with the land use planning and management programs of other Federal departments and agencies and of the states, tribes, and local governments within which the lands are located.

National Wildlife Refuges

The National Wildlife Refuge System only received mandatory planning directives in 1997 when the National Wildlife Refuge System Improvement Act (NWRSA) was passed. This act requires that 15-year comprehensive conservation plans be developed for each refuge by 2012. Prior to 1997 voluntary master planning was in place on national wildlife refuges. Of the three GYE national wildlife refuges, only

Grays Lake National Wildlife Refuge wrote a master plan (GLNWR 1972). This plan does not mention the GYE. The three National Wildlife Refuges within the GYE are slated to begin their comprehensive conservation planning efforts within the next three to four years. Conservation plans, under the direction of NWRSA (16 USC 668dd), will need to address the items listed in Table 8.

Table 8. National Wildlife Refuge System Improvement Act Planning Directives.
Source: 16 USC 668dd

Comprehensive conservation plans must address:

- the purposes of each refuge comprising the planning unit;
- the distribution, migration patterns, and abundance of fish, wildlife, and plant populations and related habitats within the planning unit;
- the archaeological and cultural values of the planning unit;
- such areas within the planning unit that are suitable for use as administrative sites or visitor facilities;
- significant problems that may adversely affect the populations and habitats of fish, wildlife, and plants within the planning unit and the actions necessary to correct or mitigate such problems; and
- opportunities for compatible wildlife-dependent recreational uses.

This section also requires that the USFWS:

- consult with adjoining Federal, State, local, and private landowners and affected State conservation agencies; and
- coordinate the development of the conservation plan or revision with relevant State conservation plans for fish and wildlife and their habitats.

State Lands

The state lands within the GYE are managed according to various state constitutions and statutes. State lands in Montana are managed to produce long-term income for public schools (MDNRC). The Montana State Forest Land Management Plan, approved by the State Land Board in May 1996, guides management of forested trust lands owned by the state of Montana (MDNRC 1996). The Plan offers general

management philosophy and specific resource management standards. The GYE is not mentioned in these philosophies and standards.

The state of Wyoming does not have an overarching state land management plan (Perko 2003 pers comm.). Instead, state trust land management is broadly guided by the state constitution, Article 18, Section 003. Management and control of state trust lands resides with the Board of Land Commissioners. These lands and the funds they generate are reserved for the sole benefit of the public schools and other designated public institutions in Wyoming.

Similarly, the state of Idaho does not have an overarching state land management plan (Bacon 2003 pers comm.). State endowment lands are managed according to guidance set forth in Idaho state statute 58-156. This statute instructs that state endowment lands are to be "held in trust by the state board of land commissioners and are managed to generate the maximum long-term financial returns to the public school endowment."

County Lands

County planning in the states of Montana, Wyoming, and Idaho is enabled through state statutes, and in general is aimed at providing guidance for local land use decision-making.

Montana. Prior to 1999, Montana counties were instructed to develop county comprehensive plans, or master plans (see 76-1-103, MCA - Montana Code Annotated). In 1999, however, the state legislature revised this statute to address the perceived use of outdated and imprecise planning guidelines (MEIC). The new statute calls for the

replacement of county comprehensive plans/master plans with growth policy plans.

Comprehensive plans/master plans passed prior to 1999 can only qualify as Growth Policy Plans if they meet the more stringent guidelines as set forth in the 1999 Growth Policy Statute. Until Montana counties adopt Growth Policy Plans, any new zoning or subdivision ordinances passed since 1999 cannot be upheld by the law (McGrath 2002). Those comprehensive plans and ordinances that were passed prior to 1999 remain in effect until a growth policy is adopted. The 1999 growth policy legislation (76-1-601, MCA) requires that growth policies address the criteria listed in Table 9.

Wyoming. County land use planning in Wyoming is enabled by the 1975 State Land Use Planning Act (W.S.S. 9-8-101—9-8-302). This Act mandates the creation and adoption of a county land use plan. Prior to this legislation, county land use planning in Wyoming was voluntary. There are no criteria that Wyoming counties have to follow in creating land use plans. Language guiding the land use planning process can be found, however, in the State Land Use Planning Act itself. Land use planning in the Act is defined as “the process which guides the growth and development of an area and assures the best and wisest use of that area's resources now and in the future” (W.S.S. 9-8-102-vi). A local land use plan is defined as “any written statement of land use policies, goals and objectives adopted by local governments. Such plans shall relate to an explanation of the methods for implementation, however, these plans shall not require any provisions for zoning. Any local land use plan may contain maps, graphs, charts, illustrations or any other form of written or visual communication” (W.S.S. 9-8-102-ix).

Idaho. County land use planning in Idaho is enabled through the 1975 Local Land Use Planning Act (I.C. 67-6501—67-6538). This act mandates the creation and

adoption of a county comprehensive plan. As mandated by I.C. 67-6508, Table 10 lists the required elements that must be addressed in all county comprehensive plans.

Table 9. Required Elements of Montana Growth Policy Plans.
Source: 76-1-601, MCA

- community goals and objectives;
- maps and text describing an inventory of the existing characteristics and features of the jurisdictional area, including:
 - land uses;
 - population;
 - housing needs;
 - economic conditions;
 - local services;
 - public facilities;
 - natural resources; and
 - other characteristics and features proposed by the planning board and adopted by the governing bodies;
- projected trends for the life of the growth policy for each of the following elements:
 - land use;
 - population;
 - housing needs;
 - economic conditions;
 - local services;
 - natural resources; and
 - other elements proposed by the planning board and adopted by the governing bodies;
- a description of policies, regulations, and other measures to be implemented in order to achieve the goals and objectives established pursuant to subsection (2)(a);
- a strategy for development, maintenance, and replacement of public infrastructure, including drinking water systems, wastewater treatment facilities, sewer systems, solid waste facilities, fire protection facilities, roads, and bridges;
- an implementation strategy that includes:
 - a timetable for implementing the growth policy;
 - a list of conditions that will lead to a revision of the growth policy; and
 - a timetable for reviewing the growth policy at least once every 5 years and revising the policy if necessary;
- a statement of how the governing bodies will coordinate and cooperate with other jurisdictions that explains:
 - if a governing body is a city or town, how the governing body will coordinate and cooperate with the county in which the city or town is located on matters related to the growth policy;
 - if a governing body is a county, how the governing body will coordinate and cooperate with cities and towns located within the county's boundaries on matters related to the growth policy;
- a statement explaining how the governing bodies will:
 - define the criteria in 76-3-608(3)(a); and
 - evaluate and make decisions regarding proposed subdivisions with respect to the criteria in 76-3-608(3)(a); and
- a statement explaining how public hearings regarding proposed subdivisions will be conducted.

Table 10. Required Elements of Idaho County Comprehensive Plans.
Source: I.C. 67-6508

- (a) Property Rights -- An analysis of provisions which may be necessary to insure that land use policies, restrictions, conditions and fees do not violate private property rights, adversely impact property values or create unnecessary technical limitations on the use of property and analysis as prescribed under the declarations of purpose in chapter 80, title 67, Idaho Code.
- (b) Population -- A population analysis of past, present, and future trends in population including such characteristics as total population, age, sex, and income.
- (c) School Facilities and Transportation -- An analysis of public school capacity and transportation considerations associated with future development.
- (d) Economic Development -- An analysis of the economic base of the area including employment, industries, economies, jobs, and income levels.
- (e) Land Use -- An analysis of natural land types, existing land covers and uses, and the intrinsic suitability of lands for uses such as agriculture, forestry, mineral exploration and extraction, preservation, recreation, housing, commerce, industry, and public facilities. A map shall be prepared indicating suitable projected land uses for the jurisdiction.
- (f) Natural Resource -- An analysis of the uses of rivers and other waters, forests, range, soils, harbors, fisheries, wildlife, minerals, thermal waters, beaches, watersheds, and shorelines.
- (g) Hazardous Areas -- An analysis of known hazards as may result from susceptibility to surface ruptures from faulting, ground shaking, ground failure, landslides or mudslides; avalanche hazards resulting from development in the known or probable path of snowslides and avalanches, and floodplain hazards.
- (h) Public Services, Facilities, and Utilities -- An analysis showing general plans for sewage, drainage, power plant sites, utility transmission corridors, water supply, fire stations and fire fighting equipment, health and welfare facilities, libraries, solid waste disposal sites, schools, public safety facilities and related services. The plan may also show locations of civic centers and public buildings.
- (i) Transportation -- An analysis, prepared in coordination with the local jurisdiction(s) having authority over the public highways and streets, showing the general locations and widths of a system of major traffic thoroughfares and other traffic ways, and of streets and the recommended treatment thereof. This component may also make recommendations on building line setbacks, control of access, street naming and numbering, and a proposed system of public or other transit lines and related facilities including rights-of-way, terminals, future corridors, viaducts and grade separations. The component may also include port, harbor, aviation, and other related transportation facilities.
- (j) Recreation -- An analysis showing a system of recreation areas, including parks, parkways, trailways, river bank greenbelts, beaches, playgrounds, and other recreation areas and programs.
- (k) Special Areas or Sites -- An analysis of areas, sites, or structures of historical, archeological, architectural, ecological, wildlife, or scenic significance.
- (l) Housing -- An analysis of housing conditions and needs; plans for improvement of housing standards; and plans for the provision of safe, sanitary, and adequate housing, including the provision for low-cost conventional housing, the citing of manufactured housing and mobile homes in subdivisions and parks and on individual lots which are sufficient to maintain a competitive market for each of those housing types and to address the needs of the community.
- (m) Community Design -- An analysis of needs for governing landscaping, building design, tree planting, signs, and suggested patterns and standards for community design, development, and beautification.
- (n) Implementation -- An analysis to determine actions, programs, budgets, ordinances, or other methods including scheduling of public expenditures to provide for the timely execution of the various components of the plan. Nothing herein shall preclude the consideration of additional planning components or subject matter.

Appendix B lists the current comprehensive land use plans or growth policy plans for all GYE counties. A review of these documents revealed that only one GYE county formally recognizes their unit as part of the GYE: Teton County in Wyoming. In the first chapter of the Jackson and Teton County Comprehensive Plan there is a section that addresses the community vision. This in part states, "The vision also includes the intent that development on private lands in Teton County be compatible with surrounding public land values, including Grand Teton National Park, Yellowstone National Park, and Bridger-Teton National Forest, because all towns, neighborhoods and resorts in Teton County are integral to the Greater Yellowstone Ecosystem" (TCPDD p. 1-5).

Discussion and Conclusions

Several authors have noted the significance of administrative boundaries in the context of altering region-wide ecological processes and functions (e.g. Christensen et al. 1996, Glick and Clark 1998, and Landres et al. 1998). Ecosystem management, which places emphasis on planning and managing in accordance with an ecological boundary, is suggested as a way to overcome the perceived consequences of administrative boundaries. Several authors have argued that in order to achieve ecosystem-based planning and management within a particular ecological region, there should be integrated planning across existing planning levels (e.g. Wallace et al. 1996, Reichman and Pulliam 1996, and Brunckhorst 2000). To foster ecosystem-wide planning and management, Slocombe (1993a) argues that pre-existing management units need to recognize that they are a part of a greater ecosystem. Harris et al. (2001) note that one way this can be done is through existing administrative units legislatively recognizing the

ecosystem in question (through the creation of a vision statement, for example). Such recognition gives legitimacy to the ecosystem concept and interagency cooperation and planning (Harris et al. 2001).

Based upon the arguments of Slocombe (1993a) and Harris et al. (2001), this research reviewed the current, overarching land use planning/management documents that apply to each GYE administrative unit. Each document was searched to see if that particular unit specifically stated that they are a part of the GYE.

Since there is no legal framework that directs any GYE administrative unit to recognize themselves as part of the GYE, any unit that decides to mention that it is a part of the GYE is doing so on a voluntary basis. The data shows that in GYE National Wildlife Refuges, BLM units, states, and most counties, there are no specific statements within comprehensive land use planning/management documents that frame these units as part of the GYE. (Only Teton County, Wyoming specifically states that their unit is part of the GYE.). In the case of GYE National Parks and most National Forests, however, the data shows that these units do specifically frame their unit as being part of the GYE. The language found within the Yellowstone and Grand Teton National Park Master Plans is especially interesting in that in the mid-1970s, these Parks recognized that they were the core of a larger ecosystem, and promoted regional land use planning—or what can be seen as the beginnings of an ecosystem management approach to land use planning in the area.

These results, and what they suggest in terms of ecosystem management in the GYE, lend themselves to two different interpretations. One interpretation stems from the dominant concepts present within the ecosystem management literature. Within this

literature, there is an emphasis to manage regional ecosystems as wholes, with the assumption being that such management will better preserve ecological processes and functions. Because these ecosystems are usually crisscrossed with administrative boundaries, however, the challenge is to integrate planning and management and encourage ecosystem-wide thinking. In this light, the fact that some GYE administrative units specifically recognize themselves as part of the GYE in their overarching land use/management documents is a good thing because this is one way in which to legitimize cross-boundary cooperation and the GYE concept itself. Additionally, this kind of recognition from government agencies ("the top") can provide leadership or "champions" that ecosystem management needs (Slocombe 1998b).

Another interpretation of this data stems from the geographic notion of place. The GYE is a place, a place with a history. The government institutions that dominate land use and management decisions in the GYE have been present for decades. These institutions—the NPS, the USFS, county governments, etc.—have established their own missions and their own guidelines. These institutions, by their very own nature and legislative requirements, have tended to think within the confines of their boundaries (Clark and Harvey 1990), but the philosophy of ecosystem management requires that agencies think across administrative boundaries. Thus, because ecosystem management philosophy is still relatively new and government organizations are slow to change (Mohai and Jones 1995, and Kennedy and Quigley 1998), the fact that many GYE administrative units do not specifically mention that their unit is part of the GYE in their land use planning/management plans is not necessarily surprising. Thus, when thinking

about the GYE as a place, a missing reference to a unit being part of the GYE may be more of a reflection of place-attributes rather than a defiance of the GYE concept.

Noting the above results and interpretations, two questions arise: 1.) could, and 2.) should, GYE administrative units move towards specifically framing their unit as part of the GYE in their overarching land use planning/management plans? First, many USFS LRMPs, BLM RMPs, and county land use plans are currently being revised or are slated to be revised. If they would so desire, there does appear to be a basis, based upon the land use planning directives discussed previously, for GYE government agencies to recognize their unit as part of the GYE—especially federal agencies. For example, the NPS, in its general management plans, must include “measures for the preservation of the area's resources” (16 U.S.C.A. § 1a-7(b)). Such a measure could be a formal recognition of the unit being a part of a larger ecosystem on which it depends. The USFS has several planning principles that would support an individual unit which would like to recognize itself as part of a greater ecosystem. Planning principles relating to the preservation of natural heritage, the consideration of interrelationships between components of ecosystems, and coordination of planning and management initiatives with other federal, state, and local agencies all leave room for recognition of being a part of a greater ecosystem. Similarly, each BLM unit must in its planning efforts coordinate planning and management activities with other federal, state, and local agencies. Again, this coordination requirement leaves room for an official recognition of being a part of a greater ecosystem. Although the nation's National Wildlife Refuges are just now undergoing comprehensive land use planning, these plans will require that the unit in question identify significant problems that may “adversely affect the populations and

habitats of fish, wildlife, and plants within the planning unit and the actions necessary to correct or mitigate such problems" (16 USC 668dd). Such a requirement could open the door for a National Wildlife Refuge to recognize itself as part of a greater ecosystem and identify actions within that ecosystem that may need to be taken to mitigate harm to the unit in question. It is not clear whether land use planning directives that guide state and county planning in Montana, Wyoming, and Idaho provide as much ability to recognize units as part of a larger ecosystem: while state and county directives do not seemingly provide a foundation for recognizing units as part of a greater ecosystem, they do not seemingly indicate a prohibition of such a recognition.

The second question is if GYE counties should specifically mention that their unit is part of the GYE in their overarching land use planning/management. There is no one, clear answer to this question. As previously discussed, a mention of inclusion in the GYE would potentially prove beneficial in the context of ecosystem management because such a mention could bring benefits such as legitimization of cross-boundary cooperation and the GYE concept itself. Additionally, such an inclusion could also be beneficial in terms of fostering a regional place identity, the importance of which in relation to environmental protection has been noted by Foster (1995), Hough (1990), and Simonson (1989). As Graham and Healey (1999, 643) note, planners have an important role in framing "collective meanings of place." It can be argued then that when GYE planners choose to frame their respective units within the context of the GYE, they are potentially contributing to the fostering of a regional place identity.

As Jobes (1991) notes, however, the people who live within the GYE can have diverse views about natural resource management in the area. It may be that all people or

government institutions are not comfortable framing their place of inhabitation as part of the GYE. For instance, Grumbine (1992) notes that government agencies are hesitant to use the "greater ecosystem" concept because of its scientific and political uncertainties. Authors have also noted that in the past, the GYE concept has been considered a call to action—specifically action in line with the dominant themes of ecosystem management (see Schullery 1997 and Barker 1996). If these feelings still exist, it could be that some GYE residents themselves may not support using the GYE concept in land use/management plans because past studies have documented the resentment of some GYE residents toward various ecosystem management principles (see Jobes 1991, Power 1991, and Reading et al. 1994). Glick and Clark 1998 specifically note that any notion that pertains to ecosystem management is commonly perceived as a threat to traditional cultures, economies, and political power. If these sentiments are real worries to GYE planners and managers, they might want to forgo a specific mention of being a part of the GYE.

The discussion about whether or not GYE planners and managers should pursue mentioning their respective units as parts of the GYE is essentially a discussion about place. Recasting each administrative unit as part of the GYE, if not done so already, recasts it as a different place than it was before. Ultimately the planners and/or managers who write the governing land management plans for their units make the initial call as to whether to include a specific mention of their unit as being a part of the GYE. Hillier (1997) explains the power these planners/managers have:

Planners traditionally believe themselves to be neutral, rational, experts, offering objective and balanced appraisals rather than making value judgments. Yet planners must inevitably bring their own values into their

work, making judgments as to the good versus the right; what is important, which interests should carry how much weight, what is possible to be achieved and so on. Planners and governance reserve the ultimate power to define, redefine, organize and re-organize space into place of their choosing (Hillier 1997, 32).

Because many administrative units within the GYE are currently revising or slated to revise their overarching land use planning/management documents, the opportunity exists for planners and managers to recast their unit as part of the GYE if they have not done so already. In other words, planners and managers have the opportunity at present to exert their power by redefining the places in which they operate. Doing so in the context of the GYE could prove helpful by establishing a base on which to build support for ecosystem management, or ecosystem-wide thinking. It must be noted, however, that not recasting administrative units as part of the GYE is not necessarily a setback to ecosystem management, and may be the avenue to choose if planners and/or managers expect a public outcry that could result in the agency at hand abandoning any ecosystem-wide pursuits.

CHAPTER 4

CASE STUDIES OF THE GREATER YELLOWSTONE COORDINATING
COMMITTEE AND WILDFIRE MANAGEMENTIntroduction

Ecosystem management is an emerging management philosophy in which human societies coexist with their environment, rather than reigning over their environment (Booth and Kessler 1996). Several definitions of ecosystem management exist, and are listed in Table 1, Chapter 1, page 5. Several core themes of ecosystem management have been identified, including the need for management across administrative boundaries, the need for interagency cooperation, the need to maintain ecological integrity, and the recognition of humans as ecosystem components (see Grumbine 1994, Christensen et al. 1996, Grumbine 1997, Phillips 1997). In addition to these themes, successful ecosystem management requires ecosystem-wide decision making (Reichman and Pulliam 1996, Brunckhorst 2000). The recognition that an ecosystem exists is the initial step in this process (Slocombe 1993a).

This chapter will explore these core themes of ecosystem management through two case studies of management practices in the Greater Yellowstone Ecosystem (GYE). These case studies will show the extent to which the GYE concept is recognized through management initiatives and subsequently provide insight into the extent to which ecosystem management themes exist in these two, specific, management examples. The first case study will explore the Greater Yellowstone Coordinating Committee (GYCC).

This committee is made up of federal land managers who are governed by the commitment to coordinate and cooperate in management practices that affect the GYE. The second case study will explore wildfire management in the GYE.

The GYE is cited as the preeminent laboratory for ecosystem management (Primm and Clark 1996), and there have been efforts to implement facets of such management in the past (see Chapter 2). The two case studies presented here represent current management practices within the GYE, and although there is not an official ecosystem management plan or regional land use plan in place in the GYE, these case studies can provide insight into how current management reflects ecosystem management in these instances. Each case study will be presented separately, and is meant to stand on its own.

Methods

A case study approach was used for this research. A case is the situation, individual, group, or organization of interest in a study (Robson 1993). In this instance, the cases are the Greater Yellowstone Coordinating Committee (a group and a situation) and wildfire management (a situation).

A case study can be defined as "a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence" (Robson 1993, 52). Wolcott (2001) specifically views case studies as a form of reporting. Regarding methodology, Stoecker (1991, 98) argues "a case study is not a method in the most typical sense, but more of a

design feature, or even more broadly, a frame determining the boundaries of information gathering.”

Definitions of what a case study is show that there is no single manner in which to define or conduct a case study. In fact, a combination of methods is usually used when conducting case studies (Meyer 2001, and Trochim 2001). Yin (1994), as cited in Tellis (1997), cites six usual sources of evidence in case studies: 1) documents, 2) archival records, 3) interviews, 4) direct observation, 5) participant-observation, and 6) physical artifacts. Information for the case studies presented here came from documents and interviews, specifically, from focused interviews, land use planning documents, informational guides, and the relevant academic literature. Focused interviews are those in which key topics are identified by the interviewer, but the order of questions is not fixed (Robson 1993).

For the GYCC case study, face-to-face interviews were conducted with the following people: Mary Maj, Executive Coordinator of the Greater Yellowstone Coordinating Committee (Maj October 2002), and Jerry Reese, Forest Supervisor of Caribou-Targhee National Forest and former Chair of the Greater Yellowstone Coordinating Committee (Reese November 2001). The topics of these interviews focused on the history of the GYCC and its present role in interagency management in the GYE. The primary document used for information and analysis in this case study was the Greater Yellowstone Coordinating Committee Briefing Guide (June 2001). The academic literature, as cited in this chapter, also provided much information on the GYCC. Because of its length, a listing of people from which information came for the wildfire management case study can be found in Appendix C. The topics of these

interviews focused on past and current wildfire policy, and the factors that have led to current policy. Again, the academic literature, as cited in this chapter, also provided information for this case study.

Case studies tend to be selective, focusing on one or two issues that are fundamental to understanding the system being examined (Tellis 1997). Lubbe (2003, 11-12) explains further:

The philosophy behind the case study is that sometimes just by looking carefully at a practical, real-life instance, a full picture can be obtained of the actual interaction of variables or events. The case study allows the investigator to concentrate on specific instances in an attempt to identify interactive processes that may be crucial but that are transparent to the large-scale survey.

This perspective has particular relevance to this research. The GYCC and wildfire management are viewed as real-life, GYE-specific phenomena, from which a fuller picture of interactions can be obtained. In other words, these case studies can provide an insight into the recognition of the GYE concept and the presence of ecosystem management — particular insights that may be overlooked through a more general, large-scale survey of management practices in the GYE.

The use of two case studies in this inquiry represents Robson's (1993) multiple case study approach as opposed to his holistic case study approach (which is a single case study at the global/whole level). As Soy (1996) notes, researchers from many disciplines use case studies for a variety of reasons, including the following reasons which have applicability to this research: to describe an object or phenomenon, to explain a situation, and to explore. A number of other GYE-related topics could have been used for case studies in this research as well, but it is not within the scope of this research to investigate

all GYE-related topics. Robson (1993) notes that generalizing to the whole population is not an appropriate use for case studies, but that case studies should stand independently and be used to provide particular insight.

Case Study: The Greater Yellowstone Coordinating Committee

Review

The Greater Yellowstone Coordinating Committee (GYCC) formed in 1964 with the signing of a Memorandum of Understanding that provided "for mutual cooperation and coordination in the management of core federal lands in the Greater Yellowstone Area" (as cited in GYCC 2001, 2). This Memorandum was revised in 1986, and was an affirmation of the 1964 document (GYCC 1987). According to Schullery (1997) and Barbee et al. (1991), the GYCC was a low-profile group that for many years after its formation dealt mostly with mundane administrative matters. During these early years the GYCC was comprised of the following: the superintendents of Yellowstone and Grand Teton National Parks, the supervisors of the Beaverhead, Bridger-Teton, Custer, Gallatin, Shoshone, and Targhee National Forests, the National Park Service's (NPS) regional director, and the three regional foresters of the United States Forest Service (USFS) whose forests are represented in the GYE.

By 1985 the GYCC had been in existence for just over 20 years. It was in this year that the House subcommittees on Public Lands and National Parks and Recreation expressed concern about the adequacy of interagency cooperation in the GYE, and held a joint hearing on the matter. This hearing resulted in a Congressional Research Service report (CRS 1986) that had two major findings: the GYCC was not comprehensive in

either membership or approach, and existing agency information pertaining to natural resources and non-commodity resource use was inadequate (Lichtman and Clark 1994).

As Barbee et al. (1991) note, the hearings resulted in increased attention in ecosystem protection and management in the GYE and produced a renewed awareness that the multiple agencies involved in the GYE were not coordinating efforts in such a way as to protect the integrity of the whole system. As a result of these hearings, the GYCC was revitalized (Keiter and Boyce 1991, Barbee et al. 1991). This revitalization resulted in the publication of The Greater Yellowstone Area: An Aggregation of National Park and National Forest Management Plans (GYCC 1987), which in turn spurred what is known as the "Vision exercise" (both of which are discussed in Chapter Two).

Simply, the Vision exercise was an attempt by the GYCC to implement various facets of ecosystem management, especially interagency cooperation. The GYCC was very active and publicly known throughout the Vision process (approximately between 1987 and 1992), but subsequently returned to its low-profile stature after the Vision exercise garnered much negative publicity (Jensen 2000, Maj 2002 pers comm.). Caribou-Targhee National Forest Supervisor Jerry Reese notes that the GYCC had to regroup after the Vision exercise, but that the group maintained and continues to maintain the focus of the Vision exercise by seeking to work across administrative boundaries (Reese 2001 pers comm.). Maj reports that the difference between GYCC during the Vision exercise and GYCC today is that the GYCC is not out in the public "waving flags" when it is taking an action that might be construed as ecosystem management (Maj 2002 pers comm.).

Reese notes that the GYCC again became revitalized in the late 1990s when the group secured annual funding through the Department of Interior and Department of Agriculture to hire an executive coordinator and to fund GYCC-appointed projects. Before this, the GYCC had no financial resources to put towards GYCC management efforts, and no staff to help coordinate GYCC meetings (Reese 2001 pers comm.). The ability to hire an executive coordinator, for instance, brought better organization and continuity to GYCC (Reese 2001 pers comm.). The executive coordinator has the responsibility of organizing the now twice-yearly meetings of the GYCC, among other things. GYCC meetings are held in the spring and the fall, traditionally in Bozeman, Montana and Jackson, Wyoming, respectively. Additionally, as a result of the first GYCC executive coordinator, in 2001 the GYCC produced the Greater Yellowstone Coordinating Committee Briefing Guide (GYCC 2001). There are no stated purposes of the Briefing Guide. Rather, the document serves as a source that defines the GYCC, explores its history, and presents current GYCC management initiatives.

The release of the Briefing Guide provided the first public document that, in some detail, reviewed the GYCC. The goals of the GYCC are presented early in the Briefing Guide and are provided in Table 11.

Additionally, the Briefing Guide presents a synopsis of GYCC related committees. Some of these committees were formed explicitly by the GYCC and must report to the GYCC on its activities. Other committees are ones that the GYCC has affiliated itself with, but are outside of direct GYCC supervision. These groups are summarized in Table 12. Many of the groups do not meet regularly, but only when there is pressing work to tackle (Maj 2002 pers comm.).

Table 11. Goals of the Greater Yellowstone Coordinating Committee.

Source: Greater Yellowstone Coordinating Committee Briefing Guide, 2001

•Provide leadership in making coordinated decisions that serve the public and help sustain the resources. Insure coordination of planning, strategies, and practices across national park, national forests, and national wildlife refuge units. •Set GYCC level priorities and assign resources to achieve objectives. •Provide a forum for interaction with federal, state, local agencies, private organizations, and the public. Help foster a climate that encourages coordination and sharing. •Identify and provide for resolution of emerging issues within the GYA. •Minimize duplication of effort; seek opportunities to share information, resources, and data. •To the extent permissible by law and agency mission, make rules and regulations consistent across the GYA.
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Table 12. Greater Yellowstone Coordinating Committee: Affiliated Committees.

Source: Greater Yellowstone Coordinating Committee Briefing Guide, 2001

<u>Committee</u>	Reports directly to GYCC
GYA Clean Air Partnership	X
GYA Fire Management Team	X
GYA Science Group	X
GYA Weed Group	X
GYA Hydrologist Team	X
Whitebark Pine Cooperative	X
Tri-State Trumpeter Swan Group	X
Northern Yellowstone Cooperative Wildlife Working Group	
Jackson Hole Elk Working Group	
Greater Yellowstone Bald Eagle Working Group	X
Interagency Grizzly Bear Committee, Yellowstone Ecosystem Subcommittee	
Greater Yellowstone Interagency Brucellosis Committee	
Greater Yellowstone Winter Use Group	X
Greater Yellowstone-Teton Clean Cities Coalition	
Beartooth Highway Working Group	

The Briefing Guide also lists 51 projects that the GYCC funded in 2000 and 2001. Each project is described in terms of a project description and geographic location and is categorized under one of six headings: noxious weed management, wildlife studies and projects, soil and watershed management, Yellowstone cutthroat trout conservation efforts, whitebark pine restoration, land patterns, and recreation and visitor services. These projects will be revisited in the discussion.

In addition to having financial assistance, the late 1990s also brought a compositional change to the GYCC. In 1999 the GYCC invited the U.S. Fish and Wildlife Service (USFWS) to join its ranks. The agency, which manages the National Wildlife Refuge System, accepted the invitation. It was determined that one representative from the USFWS would join the GYCC and represent the two wildlife refuges which the GYCC explicitly defines as being a part of Greater Yellowstone—the National Elk Refuge and Red Rocks Lake National Wildlife Refuge.

In the fall of 2002 the Wyoming, Idaho, and Montana state directors of the Bureau of Land Management (BLM) were invited to one of GYCC's annual meetings. The purpose of the invitation was to introduce the BLM to the GYCC and facilitate BLM involvement with the committee (Maj pers. comm.). The BLM declined to attend.

Today, the GYCC continues to meet twice a year in the hopes of advancing its goals. It has never, and continues not to impose decisions upon the units within the group (GYCC 1987, Reese pers. comm.). Reese notes that the Land and Resource Management Plans and Master Plans that guide management in National Forests and National Parks, respectively, ultimately govern each unit. The GYCC also does not have any decision-making power or legal authority to direct land use planning and management, and leaves

interagency cooperation voluntary and to the discretion of individual group members (Clark et al. 1991).

Discussion

Two interrelated themes of ecosystem management are especially relevant in a discussion about the GYCC: the need to work within an ecological boundary as opposed to administrative boundaries and the need for interagency cooperation and collaboration. In discussions of ecosystem management there is common agreement that interagency cooperation and collaboration must be present so that managers can focus management efforts within an ecological boundary as opposed to across administrative boundaries (Grumbine 1994, Galindo-Leal and Bunnell 1995, Haeuber 1996, Phillips 1997, Szaro et al. 1998b). Thomas (1996) explicitly argues that the only way to achieve maximum effectiveness in ecosystem management is for federal agencies such as the USFS to collaborate and work with state and county governments, other agencies, and private landowners. Szaro et al. (1998b) note that ecosystem management is an approach that attempts to involve all stakeholders in defining sustainable methods of sustainable planning and management at the regional level.

The mere existence of the GYCC is an example of interagency cooperation in the GYE, but as was first pointed out by the CRS report of 1986 and is evident today, the GYCC is not compositionally comprehensive. Thus, based on Thomas (1996) and Szaro et al. (1998b), the GYCC's member composition can be interpreted as an obstacle to ecosystem management. A compositionally comprehensive GYCC would at a minimum include representatives from the NPS, the USFS, the USFWS, the BLM, the three

ecosystem states, and the numerous GYE counties (the county commissioners or county planners, for example). The spatial extent represented by these units is illustrated in GYE maps that are commonly used in academic literature, including those which appear in Marston and Anderson (1991), Goldstein (1992b), Rasker (1993), Clark (1999), and that which appears in Chapter 2. Despite these common spatial depictions of the GYE, the GYCC continues to be inclusive of only federal representatives who represent the core of the ecosystem, even though this was a criticism of the CRS report.

It is possible that the GYCC only includes representatives from some Greater Yellowstone units because its definition of Greater Yellowstone differs from what is commonly used in academia. (The GYE, as defined by academia, is based on various physical and ecological characteristics, which Marston and Anderson (1991) argue have developed from a scientific understanding of the area. Such understanding, they argue, is required to implement ecosystem management in the GYE). Upon inspection of GYCC documents, however, it appears that the GYCC does acknowledge the spatial extensiveness of the GYE. A definition of a Greater Yellowstone that includes federal, state, and private lands is recognized in the Aggregation document as well as both the draft and final Vision documents. A more recent document, the Briefing Guide, begins with the following statement: "The Greater Yellowstone Area (GYA) is comprised of two national parks, parts of six national forests, two national wildlife refuges, and other federal, state, and private lands" (GYCC 2001, 2). Thus it appears that the GYCC recognizes the spatial extent of the GYE, but continues to exist without representatives from the BLM, the states, or local communities. (The GYCC did, however, recently attempt to include the BLM state directors in its activities.)

It is also possible that the GYCC only includes representatives from some Greater Yellowstone units because the GYCC wishes to remain a federal-only entity (despite criticism from the CRS report). The GYCC does state that its role is to “provide leadership, guidance, and coordination for the national parks, national forests, and national wildlife refuges in the GYA” (GYCC 2001, 2). It defines these GYA units as Yellowstone National Park, Grand Teton National Park, John D. Rockefeller Jr. Memorial Parkway, Shoshone National Forest, Bridger-Teton National Forest, Caribou-Targhee National Forest, Gallatin National Forest, Custer National Forest, Beaverhead-Deerlodge National Forest, the National Elk Refuge, and Red Rock Lakes National Wildlife Refuge. These units presently correspond with representatives who are members of the GYCC. However, the role of the GYCC tends to change as it takes in more members. For instance, in the draft version of the Vision document, the GYCC is said to coordinate management among Greater Yellowstone Parks and Forests. At that time, the GYCC was comprised of only representative from Greater Yellowstone National Parks and Forests. Then, as it acquired a representative from the USFWS, the role of the GYCC changed to reflect that inclusion: Its role now is to coordinate management efforts between Greater Yellowstone National Parks, Forests, and Wildlife Refuges. It can be hypothesized that if the GYCC acquired a representative from the BLM, the GYCC would again change its role accordingly. Thus, it appears that the role of the GYCC continually changes as it acquires new members. This makes sense when considering that the GYCC has never claimed that its role is to represent all lands in the GYE, or even all federal lands in the GYE. The role of the GCC is predicated on who is a member. Because the role of the GYCC appears flexible, a possibility does seem to

exist for the GYCC to be even more inclusive, for example, of state and county government representatives. Should this occur, the GYCC would once again redefine its role.

Both Keiter and Boyce (1991) and Clark et al. (1991) note that non-comprehensive membership in the GYCC lessens the success of ecosystem management in the region, especially as it pertains to interagency management and cross-boundary management initiatives because key stakeholders who play important roles in land management are left out of relevant ecosystem-wide management discussions and potential decisions. Additionally, Grumbine (1997) argues that the exclusion of any ecosystem stakeholder in interagency cooperation attempts significantly reduces the chance for successful ecosystem management because not all of the affected parties will be knowledgeable about the perceived problems that are being addressed.

When considering the place attributes of the GYE, however, it may be that the GYCC is more effective at achieving ecosystem management as it is comprised now, than it would be if it included more stakeholders—say, for example, representatives from counties of the GYE. It has been documented that the residents of the GYE have differing values regarding natural resource management in the area (see Jobes 1991, Reading et al. 1994, and Chapter 5). Several authors have noted that in the context of ecosystem management, the bringing together of value-diverse stakeholders can result in environmentally damaging decisions (e.g. Slocombe 1993b, Cortner 1996, Ascher 1999). Thus, the fact that the GYCC does recognize the spatial extent of the GYE, but does not operationalize it in its member composition may be a reflection that the GYCC

recognizes the GYE as a place—a place with diverse residents who might impede the group's efforts to achieve the ecological goals of ecosystem management.

Additionally, although the GYCC does not officially include state and county stakeholders, the GYCC does involve itself in several committees that address ecosystem issues (as shown in Table 12), and some, but not all, of these committees involve state and local entities. Thus, while the GYCC has only been comprised of federal agencies, this has not seemed to hinder its ability to foster cooperation with other GYE entities.

As it is comprised, are the actions of the GYCC in line with the goals of ecosystem management? Specifically, do the actions of GYCC represent actions that are carried out in a way that is cognizant of the GYE boundary as opposed to administrative boundaries? Do the actions of GYCC represent attempts to maintain or restore ecological integrity? While it is beyond the scope of this research to address the latter, one way the former can be addressed is by looking at the geographic scope of projects that GYCC funds.

During 2000 and 2001 the GYCC funded 51 projects that fall under one of six headings: noxious weed management, wildlife studies and projects, soil and watershed management, Yellowstone cutthroat trout conservation efforts, whitebark pine restoration, land patterns, and recreation and visitor services. All of these issues (or topics) have been determined to be of importance to Greater Yellowstone by the GYCC (GYCC 2001). Projects funded by the GYCC in 2000 and 2001 are summarized by areas of coverage in Table 13. This table shows that the majority of the projects funded by GYCC in 2000-2001 are applicable to one GYCC unit (70.5 percent). A total of seven projects include all the units represented by the GYCC.

In the context of the ecosystem management theme of working within an ecological boundary as opposed to administrative boundaries, Table 13 shows that the majority of GYCC projects are carried out within the confines of single, GYE administrative units. Considering the current particularities of the GYE as a place, however, this is not surprising in that the GYE continues to be managed by agencies with differing missions and mandates who operate largely as separate units.

Table 13. 2000-2001 Projects Funded by the Greater Yellowstone Coordinating Committee. Source: Greater Yellowstone Coordinating Committee Briefing Guide, 2001

<u>Area of Coverage</u>	<u>Number of Projects</u>
All units of the GYCC	7
All GYCC national forests	2
Custer, Gallatin, and Shoshone National Forests	1
Grand Teton National Park, National Elk Refuge, Bridger-Teton N.F.	1
Custer and Gallatin National Forests	2
Grand Teton National Park, Caribou-Targhee National Forest	1
Yellowstone National Park and Gallatin National Forest	1
One national park only	6
One national forest only	30
Total	51

The projects themselves could represent what Burroughs and Clark (1995) argue is an obstacle to ecosystem management. These authors have noted that the historical management of GYE environmental issues have occurred "within narrow problem constructs which are separate and competing," and as such, ecosystem management is difficult to achieve (Burroughs and Clark 1995, 655). With the majority of GYCC-funded projects being applicable to only one unit, and with the projects dealing with narrow issues such as the Duck Creek Wetlands Critical Land Acquisition on the Gallatin

National Forest and whitebark pine planting on the Shoshone National Forest (see GYCC 2001), it appears that management of the GYE, through the GYCC, continues to be defined through narrow problem constructs.

Synthesis

The GYCC has organizationally evolved over the years in various manners. The GYCC is now able to fund projects, whereas in the past it did not have this capability. Funding projects enables the GYCC to further its identified priorities, which are based on what GYCC members feel are pressing ecosystem issues. These projects tend to deal with narrowly-defined issues and are carried out with a limited geographic scope, which could be considered more characteristic of traditional natural resource management than ecosystem management, but may be the only way for GYCC to operate given the social and legal frameworks that are present in the GYE. The GYCC also has experienced the pain of trying to change the status quo. The Vision exercise was a trying, but educational experience for the GYCC. It appears that from the experience, the GYCC learned it is safe to work out of the public eye. That work still entails working across administrative boundaries in the hopes of sustaining resources, however. The GYCC is now more inclusive of GYE stakeholders than when it first formed, but still lacks a comprehensive membership because some key stakeholders are not represented. While this may be viewed as a detriment to ecosystem management, it may, in the case of the GYE, be a more effective way for the GYCC to accomplish other ecosystem management goals.

Case Study: Federal and State Wildfire Management in the Greater Yellowstone Ecosystem

Review

The GYE landscape is crisscrossed with administrative boundaries, but a wildfire knows none of these. A wildfire does not stop at the Yellowstone National Park boundary. It can very easily cross into the Gallatin National Forest through the spatially continuous distributions of fuels, such as lodgepole pine, that are dominant in the area. Administrative boundaries, however, have a great effect on wildfire policy.

The GYE has a long history with fire; it has been shaped by this ecological process for thousands of years—perhaps most evidently in the evolution and distribution of existing flora and fauna (Romme and Despain 1989, Davis and Mutch 1989, Knight and Wallace 1989, Knight 1991). Though wildfires occur every year in the GYE, the most famous fire season had to be that of 1988. It was in that year that the Northern Rockies saw its largest complex of fires in 50 years (Christensen et al. 1989). Thirty-six percent of Yellowstone National Park burned in 1988 (32,152 hectares) (Despain et al. 1989). Approximately 567,000 hectares burned in the entire GYE (Franke 2000).

The GYE fires of 1988 were of a high intensity and occurred over a relatively large proportion of the area, and though research suggests that a similar fire season probably occurred in the 1700s (see Romme and Despain 1989), it seems that many managers, policymakers, and citizens were taken aback by the fires of 1988 (Knight 1991). The wildfires, especially within Yellowstone National Park, became highly politicized, and blame for the fires quickly fell on land managers (Lichtman 1998).

Prior to the 1988 fire season, Yellowstone and Grand Teton National Parks and several of the GYE national forests with designated Wilderness areas had created fire plans that allowed naturally ignited wildfires to burn (Knight 1991). As Elfring (1989) describes, because of the politicizing nature of the 1988 fire season, these plans were put on hold while the government-appointed Fire Management Policy Review Team (Team) reviewed all wilderness wildfire plans in the GYE. When the Team issued its final report (FPMRT 1989), it reaffirmed that wildfire played an important role on public lands, but did recommend several actions including revising individual unit fire plans to strengthen fire policy, and strengthening cooperation between federal agencies (Elfring 1989). Mostly, however, the fire policy that had been in place prior to 1988 had been vindicated (Elfring 1989, Lichtman 1998, YNP 2001).

Post-1988, the GYE national parks and national forests were required to revise their wildfire management plans, and they could not allow a naturally-ignited wildfire to burn until these plans were approved (Knight 1991, Franke 2000). Yellowstone National Park, for instance, suppressed all wildfires from 1989 until the summer of 1992 (Franke 2000). In 1989, Paul Schullery expressed early concern over what new fire management policies could look like:

A common thread in the current dialogues is the fear that while natural fire may be respected in principle, it will be eliminated in fact. It is easy to imagine that the political process may create a policy that in all respects is a model of approval—that expresses all the affirmative sentiments about the importance of allowing fire to play its natural role in the dynamic processes of the national parks—but that is so restrictive in its ‘circuit breakers’ that in fact no fire of any useful size could ever occur (Schullery 1989, 53).

New fire management plans that emerged post 1988 remained supportive of letting naturally ignited wildfires burn. Keiter and Boyce (1991, 383) note that the fact that Congress did not legislatively alter fire management policy after 1988, “suggests a surprising degree of public understanding—or at least tolerance—of the role ecological processes play in Greater Yellowstone...” However, some of Schullery’s early concerns did come to light. Franke (2000) notes that the revised fire plans still allowed for naturally-ignited wildfires to burn, but they had to meet prescription, or in other words, meet criteria pertaining to fire behavior, weather, and fuel characteristics. Additionally, these criteria would have had to be viewed in terms of the regional and national fire situation (Franke 2000).

Today, Yellowstone and Grant Teton National Parks and most GYE Wilderness areas have wildfire management plans that allow some naturally-ignited wildfires to burn. The act of allowing a naturally-ignited wildfire to burn is now called “wildland fire use,” and the GYCC defines it “as the management of naturally ignited fires to accomplish specific, prestated resource management objectives, in predefined geographic areas, as outlined in fire management plans” (GYCC 2000, 8). Wildland fire use is equivalent to the popular “let burn policy” language that was used in the late 1980s and early 1990s.

Figure 3 shows the GYE areas in which there is an approved fire management plan that allows for wildland fire use. In all areas not under such a plan, some type of fire suppression is used to try to control and suppress all wildfires.

When considering the management principles that underlay each administrative unit depicted in Figure 3, the pattern is not surprising—it reflects agency missions. Whereas National Parks and designated Wilderness areas are to a large degree managed

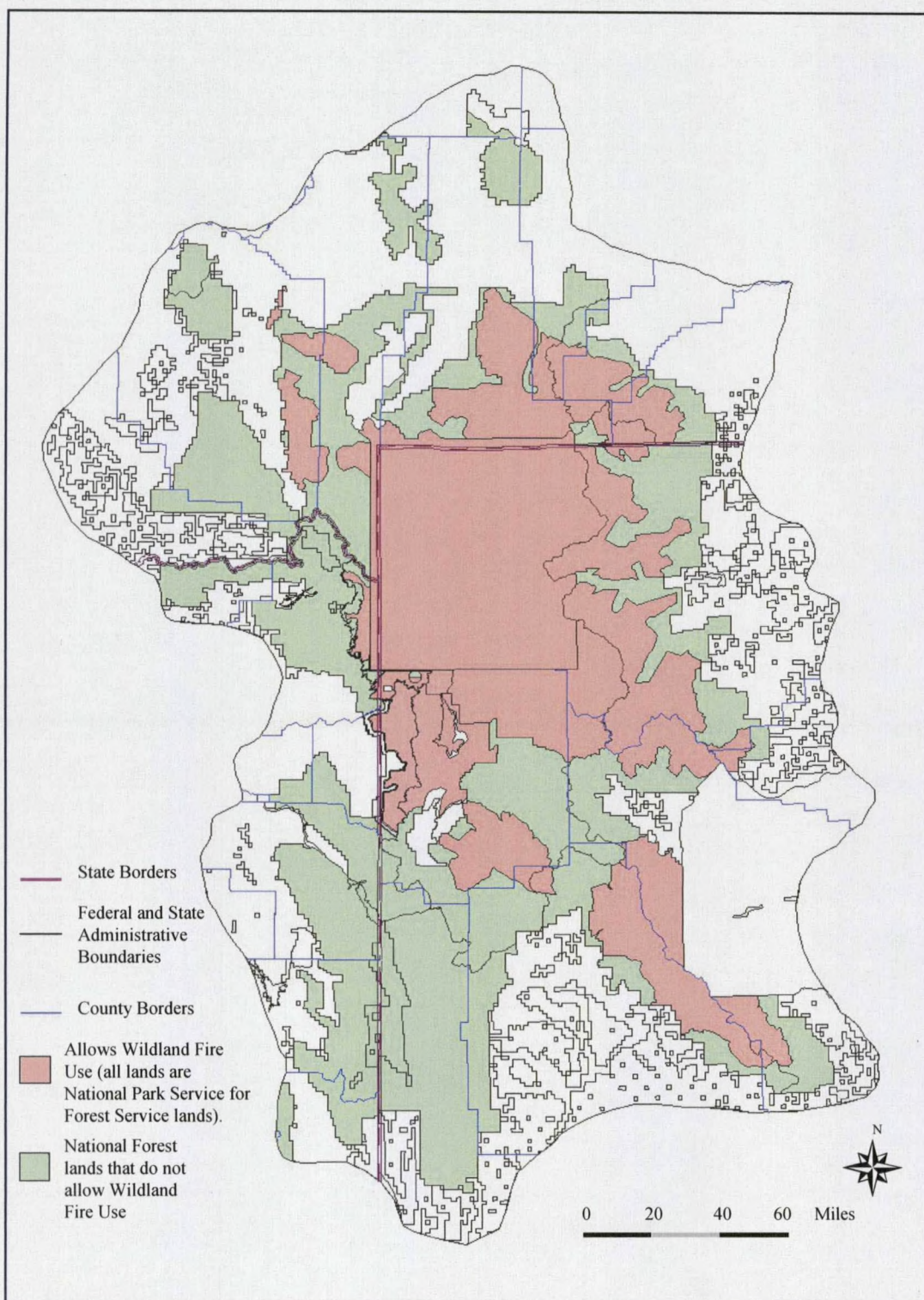


Figure 3. The Potential for Wildland Fire Use in the Greater Yellowstone Ecosystem. Map by Bob Snyder, Montana State University.

to maintain natural ecological conditions (per administrative policy), non-Wilderness federal lands, state lands, and private lands are managed for a variety of uses that generally conflict with wildland fire use. Thus, within the GYE, it is the lands that are managed by the NPS and the Wilderness areas managed by USFS and BLM that have the greatest potential for wildland fire use.

For example, managers of USFS Wilderness lands must "permit lightning-caused fire to play, as nearly as possible, their natural ecological role within wilderness" (USFS 1993, 1). The National Park Service uses similar language, and specifically in Yellowstone National Park, management is to "allow fire to play its ecological role in the park to the greatest extent possible through the use of appropriate management techniques" (NPS 1991). However, on GYE multiple use lands such as non-Wilderness lands managed by the USFS, lands managed by the BLM, and lands managed by the states of Montana, Idaho, and Wyoming, wildfire is unwanted and is automatically suppressed. (The legal mandate to suppress fires in these areas can be found in the multitude of fire management plans and statutes that guide fire management in the GYE, and such mandates were reiterated by fire management officials at the time of this research.)

Suppression of wildfires on multiple-use lands is becoming less automatic, however. With the passing of the 1995 Federal Wildland Fire Management Policy and Program Review (1995), all federal land management agencies were directed to achieve a balance between fire suppression and fire use. The GYCC (2000) notes that this policy has removed many of the barriers and constraints in allowing wildland fire use on non-Wilderness lands. In response to this policy change, the 1997 revision of the Targhee

National Forest Land and Resource Management Plan (TNF 1997a) and the 2003 revision of the Caribou National Forest Land and Resource Management Plan (CNF 2003) permit wildland fire use in areas outside of designated Wilderness areas. The Targhee National Forest has been the first to act on this fire policy opportunity by creating a wildland fire use plan for the Madison-Pitchstone subsection of the forest—a non-Wilderness subsection. This subsection was chosen because it borders the Jedediah Smith Wilderness on the southern end, a Wilderness area that has an approved fire plan that allows for wildland fire use (Kidd 2002 pers comm.). Per the 1995 Federal Wildland Fire Management Policy, a similar undertaking to incorporate wildland fire use on non-Wilderness lands is occurring on BLM lands in the Upper Snake District of Idaho (Belger 2002 pers comm.).

Although wildland fire use can be used as a management tool on federal lands to a greater extent today than in the past, as was the case with revised fire management plans post-1988, today's wildland fire use is restricted by various criteria. For example, the Jedediah Smith Wilderness Fire Management Plan only allows wildland fire use if each of the criteria in Table 14 are met. Similar criteria are found in other USFS Wilderness fire management plans (see USFS 1993).

One of the common themes found throughout fire management plans and fire policy (i.e., The Federal Wildland Fire Management Policy and Program Review (1995), the National Fire Plan (2000), and the Western Governors Association's A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: 10-year Comprehensive Strategy (WGA 2001)) is the emphasis placed on the protection of life and property at risk from a wildfire. Fire managers are required by the 1995

Wildland Fire Management Policy to make firefighter and public safety the first priority in every fire management activity.

Table 14. Wildland Fire Use Criteria for the Jedediah Smith Wilderness.

Source: Jedediah Smith Wilderness Fire Management Plan (TNF 1997b, 41)

- National, USFS Intermountain Region, and Greater Yellowstone preparedness levels allow wildland fire use.
- Protection of life is assured.
- Protection of property outside of wilderness is assured.
- Acceptable air quality is predicted
- Adequate project funding is available to manage the fire
- Adequate personnel resources are available to carry out the management of the fire.
- Existing and forecast fire behavior forecasts indicate that wildland fire use will meet criteria in the burn plan.
- A risk assessment of impacts to threatened and endangered species shows that there will be no predicted long-term impact to the recovery of the species.
- Social, political, and economic assessments indicate no significant impact to neighboring communities and residents.

This is listed as the first guiding principle of fire management, and is a criterion that must be considered in wildfire management decisions. The second principle (the principle that gives fire managers more leeway to allow for wildland fire use outside of Wilderness) recognizes that wildland fire is an essential ecological process that results in natural ecosystem change. The principle notes that this notion must be incorporated into the fire planning and management process.

Another common theme emerging in discussions of wildfire policy is the wildland-urban interface. The wildland-urban interface is an area where high fire-risk wildlands mix with human development (Cortner et al. 1990, Plevel 1997).

Discussion

Three themes of ecosystem management are especially relevant in a discussion about wildfire management in the GYE: 1) ecological integrity 2) management within an ecological boundary as opposed to administrative boundaries, and 3) humans as ecosystem components. While the latter two themes are self-explanatory, the concept of ecological integrity necessitates further explanation. Grumbine (1997, 43) notes that "ecological integrity includes maintaining viable populations of native species, representation of ecosystem types across their natural range of variation, maintaining ecological processes, management over the long term, and accommodating human use within the above constraints." Christensen et al. (1996) list ecosystem integrity as a fundamental precept for ecosystem management, and there is general academic agreement that maintaining ecological integrity should take precedence over other ecosystem management goals (Grumbine 1994). These authors make the case that ecological integrity is fundamental to ecosystem management.

In relation to Grumbine's (1997) definition of ecological integrity, the effects of giving priority to ecological integrity are noteworthy. Grumbine (1997) argues that maintaining ecological integrity entails preserving key ecological components such as biological diversity and ecological processes, while allowing for human use that does not hinder maintenance of either. The concept of human populations living in such a manner as to not disrupt ecological integrity is an example of how ecosystem management differs from traditional resource management.

In this case study, wildfire is presented as an ecological process, and in line with Grumbine's (1997) definition, such processes are commonly cited as processes that should be embraced under the philosophy of ecosystem management because of their ability to contribute to ecological integrity (e.g. Varley and Schullery 1991, Keiter and Boyce 1991, Crossley 1996). Clark and Minta (1994, 106) do not use the terms ecological integrity, but do note that ecosystem management should not strive to preserve natural features, objects, or scenes in some predestined state. Rather, they argue that ecosystem management should strive for the preservation of natural processes (see also Christensen et al. 1996, 669).

Brussard et al. (1998, 12) distinguish between high integrity ecosystems and impacted ecosystems: "Ecosystems with high integrity show little influence of human actions and maintain their historical structure, species composition, and disturbance regime solely through natural ecological, evolutionary, and biogeographic processes." According to this philosophy, wildfire, as a disturbance regime, should occur as nature dictates if high ecosystem integrity is desired by planners and managers. The authors note that an impacted ecosystem is one in which human activity has modified much of the ecosystem. They note that an ecosystem with a non-historic structure and composition can be evidence of impacted ecosystems. Wildfire suppression is known to cause a change in vegetative structure and composition, and thus would be evidence of an impacted ecosystem.

A question arises, then, as to if the present wildfire policy in the GYE is meeting the ecosystem management goal of ecosystem integrity. A number of factors can lead to wildfire suppression in the GYE, as discussed below. From an ecological perspective,

the suppression of wildfires in the GYE could be viewed as detrimental to ecosystem integrity because wildfire is no longer occurring across the GYE landscape as it would without suppression efforts. Wildfire suppression can be interpreted as an act which preserves the present state of the lands in question, which would be counterintuitive to the ecosystem management theme of ecological integrity (which promotes the allowance of ecological processes). Additionally, using the rationale of Brussard et al. (1998), wildfire suppression could be interpreted as a human action that could be diminishing the degree of integrity that exists in the GYE, because although the GYE is currently seen as a mostly "intact" ecosystem (see Barbee et al. 1991, Rasker 1993, Clark and Minta 1994, Lichtman and Clark 1994), continued fire suppression could lead to the GYE becoming an impacted ecosystem—one that "has been modified sufficiently by human activity" and has lost much of its original integrity (Brussard et al. 1998, 13).

One factor that contributes to wildfire suppression in the GYE is administrative boundaries: wildfire management in the GYE is generally predicated on administrative boundaries as opposed to ecological boundaries. For example, although a naturally-ignited wildfire can be managed for wildland fire use in the Bridger Wilderness of the Bridger-Teton National Forest (BTNF), this same wildfire would call for some kind of suppression technique once it crossed the Wilderness boundary into non-Wilderness lands of the BTNF (Dykehouse 2003 pers comm.). Knight (1991) similarly notes how administrative boundaries can affect wildfire suppression in the GYE. Noting that wildfire suppression has been more effective on roaded GYE lands as opposed to unroaded GYE lands (such as those found in national parks), Knight states, "Fires on

adjacent land can burn into the parks. Therefore, suppression outside park boundaries is essentially fire suppression within" (Knight 1991, 91).

As exemplified by these examples, administrative boundaries undeniably impact wildfire occurrence throughout the GYE. One interpretation of this data could be that wildfire management in the GYE is not fully recognizing the GYE concept in decisions concerning wildfire management because instead of thinking of the GYE as an ecological whole, wildfire management continues to think of the GYE as separate, administrative units.

Other factors lead to wildfire suppression in the GYE, as well, including those of an economic, cultural, political, and legal nature. For instance, wildfire has culturally been perceived as a destructive force rather than an important ecological force (Hesseln 2001). This in turn creates a political environment in which wildfire is usually condemned and opposed (Lichtman 1998). On lands such as those managed by the USFS, wildfire can threaten a harvestable timber stand, thus triggering suppression because of a potential economic loss (Crossley 1996). Legal mandates come into play when factors such as air quality and national preparedness levels (as outlined in Table 14) are not met, thus triggering suppression.

Specifically, the wildland-urban interface is a cultural-geographic factor that is increasingly affecting wildfire management decisions (see Cortner et al. 1990 and Hesseln 2001). Knight and Clark (1998, 175) note that "Human development along the interface between public and private lands results in ... the alteration of ecological processes." This situation is true in the GYE in regards to the ecological process of wildfire. Patterns of wildfire occurrence within the GYE are being altered because of the

need to suppress wildfires that show a potential to effect private lands. When a wildfire begins on federal land, and potentially threatens a private dwelling or land parcel, there is added pressure to protect these private entities from the wildfire (Hesseln 2001, Burleson 2001 pers comm., Perkins 2001 pers comm.).

One example of how the wildland-urban interface affects wildfire management and subsequent occurrence in the GYE is exemplified through management discussions that are currently occurring within the Gallatin National Forest (GNF). According to GNF Fire Management Officer Bill Breedlove, when the GNF begins its Land and Resource Management Plan revision process in 2004, the GNF would like to use the direction given in the 1995 Federal Wildland Fire Management Policy to identify areas outside of GNF Wilderness areas where the option for wildland fire use could be put into place (Breedlove 2003 pers comm.). However, both Breedlove and the GNF Fire Management Plan give pause to such an idea because of the amount of private development occurring on private lands along the GNF boundary line, or in other words, in wildland-urban interface.

Specifically, the GNF Fire Management Plan makes several references to the wildland-urban interface. The Plan explicitly mentions that the Forest has a problem with wildland-urban interface development. The Plan notes that this problem stems from rapid population growth in and around Gallatin County (its neighbor to the north), with seemingly little attention given to potential wildfire risk (GNF 2002).

A second example of how the wildland-urban interface affects wildfire management in the GYE comes from Rand Herzberg (2001 pers comm.), the District Ranger on the Beartooth District of the Custer National Forest. The Absaroka-Beartooth

Wilderness comprises a significant portion of the Beartooth District. Although the Absaroka-Beartooth Wilderness has management strategies that allow for wildland fire use, Herzberg finds few opportunities to put such management strategies into play.

Herzberg explains how increasing development in the wildland-urban interface has been and will continue to affect his fire management decisions:

I'm a risk taker, but I'm careful when it comes to deciding about fires. I'm a real believer in letting fires play their natural role and I struggle with decisions I have to make. There's just not a lot of opportunity for me to let fire burn. I'm afraid the fire would escape the Wilderness boundary and head onto private land where people have built and there are very few cases where that boundary issue is not a potential here. It's just socially unacceptable for me to let a fire burn into private lands (Herzberg 2001 pers comm.).

The wildland-urban interface has garnered much attention in the last decade as more development has occurred in fire-prone areas. To address the hazard associated with such development, much emphasis has been placed on homeowners to make their properties fire-safe (see Cohen 2000, FEMA 2000, Oppenheimer 2000, Power 2000.). Having wildland-urban interface residents make their dwellings fire-safe, however, does not mean that managers such as Herzberg will have more potential to let a wildfire burn. The wildland-urban interface, as a geographic area, remains, and this factor alone has been shown to lead to wildfire suppression.

Because the wildland-urban interface, along with other social and economic factors, lead to wildfire suppression in the GYE, it could be argued that these factors are an obstacle to achieving the ecosystem management goal of ecological integrity and that they, along with administrative boundaries, reflect a situation where the GYE is not viewed as an ecological whole. However, the GYE is a place—a place where people

live—and the recognition of humans as ecosystem components is a dominant theme in the ecosystem management literature, as well. Thus, wildfire suppression that occurs because of the wildland-urban interface and/or other socio-economic reasons could be interpreted as the appropriate ecosystem management response because ecosystem management recognizes humans as ecosystem components. This could also reflect managers' recognition that the GYE is not just defined by its ecology, but by its people, as well.

In the case of wildfire, then, there is potentially a conflict between the ecosystem management themes of ecological integrity and humans as ecosystem components. There is not a straightforward answer to which theme should trump the other (though authors have argued that humans should choose sustainable ways of living in order to allow for the highest degree of ecosystem integrity: see Slocombe 1993b, Grumbine 1994, and Brunckhorst and Rollings 1999, and other authors have noted that human needs and wants must remain a high priority: see Salwasser 1994). Viewing the GYE through the geographic lens of place, however, allows for the possibility that both themes can coexist. Because the GYE is a place where people live, where timber is extracted, and where visitors come to recreate, it may be that wildfire should not burn everywhere because of the potential socio-economic consequences. Additionally, however, the GYE is also a place where many lands are managed for their wild character, and it may be that wildfire should be permitted to burn to achieve goals such as the maintenance of ecological integrity. Thus, the challenge for managers in the GYE who want to manage according to ecosystem management is trying to balance the ecosystem management themes of

ecological integrity and humans as ecosystem components. In this light, current wildfire management in the GYE could be interpreted as striving for this balance.

Synthesis

Wildfire has played an important role in GYE landscape diversity and the presence and composition of flora and fauna. Wildfire management in the GYE today recognizes the role wildfire has played and continues to play in the ecosystem, allowing wildfires to burn unsuppressed in some areas under certain conditions in order to achieve ecological objectives. Wildfire management in the GYE also calls for the suppression of some wildfires due to legal, cultural, and socio-economic reasons. Although it can be argued that wildfire management does not recognize the GYE as an ecological whole because it suppresses wildfires based on factors such as arbitrary administrative boundaries, the fact that wildfire management does suppress wildfires that threaten the wildland-urban interface may reflect an understanding by managers that the GYE is more than just an ecological ecosystem—it is an ecosystem that includes humans, as well. Thus, wildfire managers may be predicating wildfire management in the GYE on the notion that the GYE is a “place” and wildfire may not be appropriate for every location or situation. Having such a perspective—a place perspective—allows managers to achieve, but balance, the goals of ecosystem management.

CHAPTER 5

SURVEY OF NEW WEST RESIDENTIAL COMMUNITIES

Introduction

People occupy and interact with ecosystems. They require goods and services from them, and use them for recreational purposes. People influence ecosystem patterns and processes, and these patterns and processes in turn affect people. There cannot be a complete separation of people and the ecosystems of which they are intricately a part.

The management philosophy of ecosystem management recognizes human-environment interactions. Although ecosystem management strives to maintain native biodiversity, ecological patterns, and ecological processes in the hopes of achieving long-term ecological stability, ecosystem management also views people as involved and integral components of the environment. Definitions of ecosystem management commonly recognize the human element of ecosystem management as evidenced by 11 out of the 12 definitions that appear in Table 1, Chapter 1. These definitions recognize that ecosystem management must occur within an informed and/or integrated cultural context. This marks a shift from traditional resource and land management philosophies that viewed humans as only visitors to and potential problems for ecosystems (Field 1996).

While humans are seen as an important component of the ecosystem management equation, little has been studied in regard to the general public's attitudes towards this emerging management philosophy (Bengston et al. 2001). The aim of this chapter is to

contribute to this scarce information by surveying a select group of residents in the Greater Yellowstone Ecosystem (GYE), an area that does not have a single, integrated ecosystem management plan in place, but is often cited as an area which is suited to such management. This survey will gauge the extent to which the GYE concept is recognized by residents, gauge the extent to which these GYE residents are familiar with ecosystem management, and also provide information about the extent to which this population segment lends support to the ecosystem management themes of ecological integrity, working across ecological boundaries as opposed to administrative boundaries, and regional land use planning/management. The results will be interpreted in the context of the potential for ecosystem management in the GYE.

Background

The GYE is home to over 370,000 people. These residents have divergent attitudes and opinions about their local environment and development, and how the two should be weighted in management decisions. Reading et al. (1994) note that the prevalence of diverse attitudes in the GYE is due to differing and varying natural resource dependencies. For example, the authors note that people dependent on tourism are reliant on the protection of wildlife, scenic vistas, and other phenomena that attract visitors, whereas other people are dependent on resources that can be extracted from the environment such as timber. Therefore, tourism dependencies can often times be in direct conflict with extractive resource dependencies, and result in differing views towards natural resource management (Reading et al. 1994).

Today, the economic structure of the GYE is changing, which could result in changing views towards natural resource management in the GYE. Power (1991), Rasker (1993), and Rasker and Hansen (2000) note that the GYE has seen a decreased economic dependence in traditional resource extraction industries, and is experiencing an increase in economic growth today due to entrepreneurial activity and the service and professional sectors. This recent growth is driven in part by an influx of migrants to the GYE who are drawn to the area's ecological and social amenities (Johnson and Rasker 1993, Rasker and Glick 1994, Rasker and Hansen 2000). Rudzitis (1999) found that many new migrants to the rural West are environmentally concerned citizens who prefer preservation management strategies over traditional commodity based management strategies. Despite these changing values, Rasker and Alexander (2003, 3) note that "the mythology of the cowboy economy exists" both throughout the rural West and in the GYE, which leads to the perpetuation of poor business decisions—some of which can negatively affect the environmental amenities that appear to be important to the region's economic growth.

Because the GYE has retained its vital ecological components, and because threats to the system are mounting, the GYE has been cited as a prime laboratory for ecosystem management (Primm and Clark 1996). Although no official ecosystem-level management plan or initiative exists in the GYE, some GYE residents have been exposed to the ecosystem management concept through organizations such as the Greater Yellowstone Coalition (GYC) and the Greater Yellowstone Coordinating Committee (GYCC), through involvement with local or federal agencies, or through the media. In the summer of 1988 Reading et al. conducted a survey to ascertain the extent to which

concerns about ecosystem management existed in the GYE, and the factors that led to either concern or support of it (Reading et al. 1994). This exploratory study of 308 GYE residents found that most respondents were supportive of coordinated management to protect wildlife, geothermal, and other natural characteristics found in the GYE. Nearly two-thirds of the respondents, however, feared that ecosystem management would entail greater government control of area. Additionally, most respondents believed that the economic and social stability of GYE communities were dependent on resource extraction industries, and were not willing to jeopardize community characteristics for the protection of the GYE. Respondents also seemed unaware of the number of agencies involved in managing the GYE, which led the study authors to conclude that respondents may not be aware of the "management coordination problem" within the area (Reading et al. 1994, 362).

Reading et al. (1994) also made several links between demographic characteristics of respondents and their attitudes toward ecosystem management. Respondents who had large land holdings, those from rural areas, those dependent on federal lands for income, and those employed in agriculture or timber industries showed strong utilitarian, dominionistic, and libertarian values. They showed a firm understanding of the natural world, and low support for ecosystem management. Fears about ecosystem management included a loss of traditional control of federal lands to outside interests and further restrictions on resource development. Generally, respondents who were young, had high-income, were well-educated, and were members of environmental groups supported restrictions on natural resource development and increased protection for wildlife and protected areas within the GYE. These respondents

were also likely to endorse ecosystem-level management in the GYE (Reading et al. 1994).

The study by Reading et al. (1994) is one of few studies that have explored attitudes towards ecosystem management, and is the only one that pertains to the GYE. Bengston et al. (2001), as part of their study which addresses changing attitudes towards ecosystem management in the United States between 1992 to 1998, inventoried the ecosystem management literature and found that little research has been conducted on public attitudes, and that no studies until theirs had addressed attitudinal change over time. They concluded that the lack of public attitude research might be due to the fact that the general public has little or no knowledge about ecosystem management. In their study, Bengston et al. (2001) conducted content analyses of the news media and found that the nature of ecosystem management discussions in the media have changed over time, from discussions about its legitimacy to regional and local debates about its implementation. The authors also found that public acceptance of ecosystem management depends largely on how the public perceives and understands it, and that these perceptions and understanding depend in large part on how the news media characterizes ecosystem management. While inquiries such as those conducted by Bengston et al. (2001) are important and noteworthy, this study is more narrow in its scope. It looks at knowledge of and attitudes toward the GYE and ecosystem management, but does not investigate why or how GYE residents have the knowledge or attitudes that they do.

Rationale

This study, carried out through a mail survey, has three objectives:

- 1.) to gauge the extent to which the GYE concept is recognized by a segment of GYE residents,
- 2.) to gauge the extent to which these GYE residents are familiar with ecosystem management, and
- 3.) to provide information about the extent to which the knowledge and attitudes of this segment of residents lends support to the ecosystem management themes of ecological integrity, interagency cooperation, and regional land use planning and management.

The general philosophy that guides all of these objectives is the generally-agreed-upon notion that people who live within ecosystems must be included in any ecosystem management initiative, and subsequently, their opinions and values towards the environment and its management will come into play. This notion thus frames the following specific rationales:

First, the phrase "Greater Yellowstone" (whether referred to as an ecosystem or an area) has been in existence for some time, but no studies have been conducted to see the extent to which the phrase is recognized by GYE residents and how these residents define it. I argue in this present study that these queries are pertinent to a study of ecosystem management. Shindler and Cheek's (1999) notion of public ownership is especially relevant. These authors find that public ownership of environmental decisions and plans is a necessary component of successful and meaningful environmental planning and management initiatives. I argue that this same notion is true in regards to identifying

the GYE. For there to be the possibility of ecosystem management in the GYE, I argue that residents must first take ownership of the GYE concept.

Second, Bengston et al. (2001) have noted that there may be unfamiliarity with the concept of ecosystem management within the general public. This present research specifically asks respondents if they are familiar with the concept, and asks them to define it in their own words. Thus, in terms of the survey's sample population, these research questions will not only provide data about the extent of familiarity with the concept, but also identify the common ways in which people define it. This information could subsequently be used to inform planning and management officials interested in applying ecosystem management in the GYE.

Third, the ecosystem management themes of 1.) ecological integrity, 2.) management across ecological boundaries, and 3.) regional land use planning/management are common in the ecosystem management literature. This survey aims to explore the extent to which survey respondents show support for these themes by either directly, or indirectly, asking questions about all three themes. The theme of ecological integrity is addressed indirectly in the survey through various questions that address the topic of wildfire. Ecosystem integrity includes the maintenance of viable populations of native species, a representation of all ecosystem types, and the maintenance of ecological processes (Grumbine 1997). As an ecological process that is seen as vital to ecosystem integrity in the GYE (Varley and Schullery 1991, Keiter and Boyce 1991, Crossley 1996), wildfire serves as an appropriate case study of ecological integrity. Because there are also arguments in the ecosystem management literature which purport that humans need to live sustainably within their environments, several

questions explore issues relating to wildfire and private land, and what measures respondents' might support in regards to reducing human risk. Lastly, some questions gauge the extent to which respondents' might support land use planning that restricts land uses in the GYE. These questions stem from authors such as Goldstein (1992a, b), who identifies ecosystem-wide zoning as a possible tool in ecosystem management. Areas in the United States that currently are subject to zoning in a regional land use program include the Pinelands National Reserve and Adirondack Park. Congress and the State of New Jersey legislatively created the Pinelands National Reserve in 1978. It is 445,500 hectares and is home to 700,000 residents (NJPC 2003). The State of New York legislatively created Adirondack Park in 1892. It is 2,430,000 hectares and is home to 130,000 full-time residents (APA 2003). These areas are governed by the New Jersey Pinelands Commission and the Adirondack Park Agency, both of which administer land use planning and management regulations. These areas differ in comparison to the GYE in a variety of ways, as noted by their size, populations, legislative designations, and regional government authorities. They are comparable, however, in that they are viewed as regional ecosystems and are comprised of both public and private lands.

Methods

The research design consisted of the following procedures:

- 1) develop a sample of residents to be surveyed,
- 2) develop and pre-test a survey instrument,
- 3) conduct the survey, and
- 4) analyze the results.

Study Communities

The population of interest in this survey is residents who live in Bozeman, Montana; Red Lodge, Montana; and Jackson, Wyoming. All three of these communities are within the Greater Yellowstone Ecosystem (Figure 4). They are all associated with near-pristine natural amenities, are economic hubs for their counties, and serve as the county seat. The counties in which these communities occur are those which have had a strong tie to traditional land uses such as ranching and farming, and continue to do so to some extent, but are now experiencing strong economic growth in the service sector (Rasker and Alexander 2003). All of these communities have seen a population increase over the past 30 years due to an influx of migrants, and as a result, more land in and around these communities is being converted from agriculture to housing.

The changes taking place in these three communities are represented by the concept of the New West, which is often evoked as a way in which to describe the economic and social changes that are currently occurring throughout many Western communities. While the Old West is represented by traditional land uses and economies based in mining, logging, and ranching, the New West is represented by land uses and economies that are based in the service industries. On the landscape, the Old West is symbolized by horses, cattle and cowboys. The New West is symbolized by walled estates, golf courses, ski resorts, and espresso bars (Riebsame 1997). The New West is partially an artifact of new migrants who are especially drawn by the amenity values that the West offers (Rudzitis 1999, Cromartie and Wardell 1999, Rasker and Hansen 2000). Whereas the Old West distrusted the federal government and believed wholeheartedly in

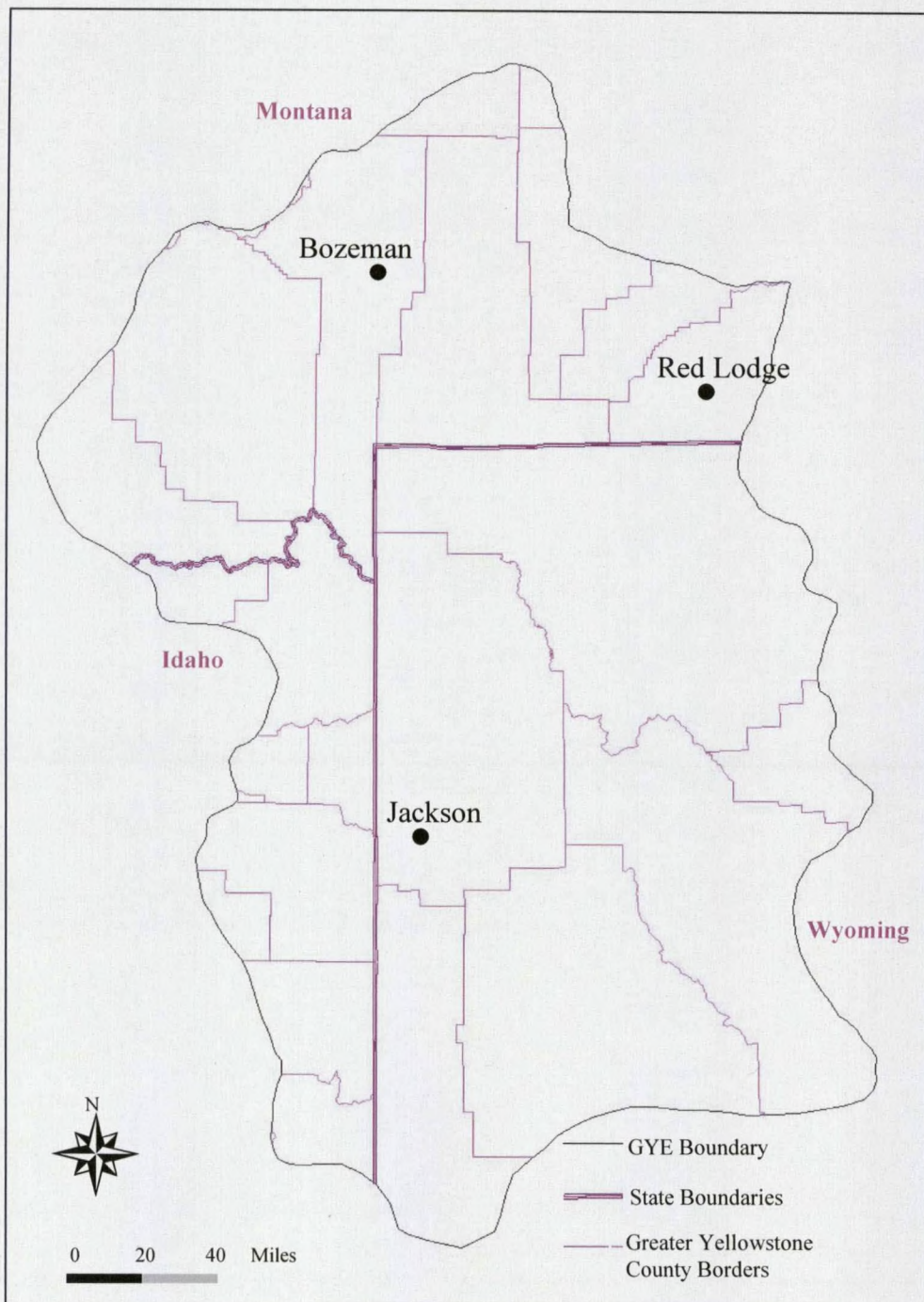


Figure 4. Greater Yellowstone Ecosystem Survey Communities: Bozeman, Montana; Red Lodge, Montana, and Jackson, Wyoming. Map by Bob Snyder, Montana State University.

the concept of multiple use, the New West represents the presence of new and different attitudes towards the environment, those which support protected landscapes for ecological and recreational purposes (Rudzitis 1996, Riebsame 1997).

Riebsame (1997) notes that although Westerners disagree on what the West is or should be, there is no doubt that the West is changing. Rudzitis (1996) argues that New Westerners will not displace Old Westerners, but that Old Westerners will ultimately change in the presence of their changing New West communities. Change is only beginning to occur according to Hoelscher (2001), who notes that the New West has only emerged over the last thirty years.

Bozeman, Red Lodge, and Jackson are communities that exhibit New West characteristics, but that have also retained some Old West characteristics as well, such as ties to ranching and farming. By surveying these emerging New West communities, then, we might expect to see views that both support and oppose concepts such as ecosystem management. Considering Jobes (1991) characterization of social ecology (Table 3, Chapter 2, Page 28) and applying it to the GYE, we also might expect to see varying views towards ecosystem management. Bozeman and Red Lodge are considered to be a part of Jobes' Zone II, while Jackson is mentioned as both a Zone I and Zone II community (Jobes 1991). These zones are characterized by some polarity in views towards the GYE (see Table 3, Chapter 2).

Bozeman, Montana. Bozeman is located in Gallatin County, near the northern boundary of the GYE. It is approximately 90 miles north of Yellowstone National Park via two main highways. Thirty-eight percent of the county is federal land (Rasker 1993), and 56 percent is private land (Rasker and Alexander 2003). There are state and county

lands in Gallatin County, as well. Bozeman provides easy access to Gallatin National Forest, and the Bridger Bowl and Big Sky Ski Areas.

From 1990 to 2000 the population of the city of Bozeman rose 39.6 percent, from 22,600 residents to 31,636 residents. The Bozeman 2020 Community Plan (BCP 2001) notes that a strong economy and an ongoing trend of migration to the West facilitated this increase. During this same time period, the population of Gallatin County increased 34 percent, from 50,463 residents to 67,831 residents. In 2000, the Bozeman 2020 Community Plan reported that the largest employment industry in Bozeman was services (such as medical services, educational services, and professional services), which accounted for 42 percent of employed persons.

Red Lodge, Montana. Red Lodge is located in Carbon County, near the northeast boundary of the GYE. Forty-five percent of Carbon County is federal land (CCGP 2003), and 54 percent is private land (Rasker and Alexander 2003). There are also some state and county lands in Carbon County. The Beartooth Highway, which traverses the Beartooth Plateau for 60 miles between Red Lodge and Yellowstone National Park, is a designated scenic route into Yellowstone National Park, thus making Red Lodge a tourist stop for many Park visitors. Red Lodge's immediate neighbor to the south is the Beartooth District of the Custer National Forest. The District is mostly made up of the Absaroka-Beartooth Wilderness. On the outskirts of Red Lodge is Red Lodge Mountain—a ski resort in the winter and an 18-hole golf course in the summer and fall.

Between 1990 and 2000 the population of Red Lodge rose 11 percent, from 1,958 residents to 2,177 residents. During this same time period, the population of Carbon County rose 18 percent, from 8,080 to 9,552 residents. The largest employer in Carbon

County is Red Lodge Mountain. The amenity-based character of Red Lodge and the surrounding area has resulted in the establishment of many retail stores, restaurants, and lodging facilities along Main Street.

Jackson, Wyoming. Jackson is located immediately to the south of Grand Teton National Park and the National Elk Refuge in Teton County, Wyoming. Jackson is also located in close proximity to the Bridger-Teton National Forest. Two nearby ski resorts, Snow King and Jackson Hole, offer year round recreational opportunities. Ninety-seven percent of the county is federal land (Rasker 1993), and three percent is private land.

The proximity of Jackson to various recreational opportunities have made it a popular tourist destination, and the downtown is a mixture of art galleries, souvenir stores, clothing stores, cowboy bars, and low-end and high-end eateries. Between 1990 and 2000, the population of Jackson rose 85 percent, from 4,677 residents to 8,647 residents. During this same time the population of Teton County rose by 63 percent, from 11,172 residents to 18,251 residents.

Sampling Strategy

A simple random sampling procedure was used to identify 200 households in each community to which the survey would be sent. The most recent telephone directories for each community provided a listing of households. A listing of Bozeman households was acquired from the Bozeman subsection of the Bozeman and Surrounding Area QwestDex Telephone Directory, in use through June 2003. A listing of Red Lodge households was acquired through the Red Lodge subsection of the Billings and Southeastern Montana QwestDex Telephone Directory, in use through December 2003. A listing of Jackson

households was acquired from the Jackson Hole, Grand Teton and Yellowstone National Parks, Star Valley, WY, Teton Valley, ID, and Surrounding Area QwestDex telephone directory, in use through June 2003.

The Bozeman telephone directory, within the Bozeman subsection, provides names, addresses, and phone numbers via two columns on each page. Selection of names and addresses was achieved by selecting the first residential name in the right-hand column with a Bozeman zip code (59715 or 59718). This method produced 172 names and addresses. To acquire 28 additional names and addresses, 28 random page numbers within in the range of the directory's Bozeman subsection page numbers were produced via the random number generating web site: <http://www.random.org>. After producing 28 random numbers, which now corresponded with page numbers of the Bozeman subsection, an additional 28 names and addresses were chosen by accessing these pages and selecting the first residential name in the left-hand column with a Bozeman zip code.

The Red Lodge subsection within the Billings and Southeastern Montana telephone directory provides names, addresses, and phone numbers via two columns on each page. The Red Lodge subsection in the phone directory, being only 18 pages long, required different sampling methods than the Bozeman selection. Twelve names and addresses were chosen from each of the first 17 pages of the Red Lodge subsection. In each column the first, fifth, tenth, fifteenth, twentieth, and twenty-fifth names and addresses with a Red Lodge zip code (59068) were selected. Because the column length on the eighteenth page of the Red Lodge section was only a quarter the length of the first seventeen pages, only the first and fifth names and addresses were selected from each column on this page. Although this method should have produced 208 names and

addresses, it only produced 199. This is because some listings that appeared as the first, fifth, tenth, fifteenth, twentieth, or twenty-fifth listing were either business listings, non-Red Lodge zip codes, or listings without an address. In these cases the next applicable listing was chosen. From this applicable listing, counting resumed to determine the next applicable listing. In some instances, some pages had so many business listings, etc. that only a few residential listings could be chosen. To ascertain one additional name and address, one random number within the range of page numbers represented by the Red Lodge subsection of the telephone directory was generated through <http://www.random.org>. This number, which corresponded with a page number, was accessed and the last name in the left column was selected.

Sampling procedures for the selection of Jackson residents initially mirrored that for Bozeman and Red Lodge, and surveys were sent to selected names and corresponding street addresses. However, these surveys were returned. Jackson does not have postal street delivery, and strictly uses post office boxes. It was decided that another 200 surveys would be sent to Jackson post office boxes. The Jackson post office was contacted to obtain a list of all post office boxes in Jackson. The post office box numbers in Jackson fell within the ranges of 1-5002 and 6271-15600. To begin the process of randomly selecting potential post office boxes, these ranges were entered separately into a program available on <http://www.random.org> which generates randomized sequences. Once the two randomized sequences were in hand, the first 200 numbers from each randomized list were chosen for a total of 400. It had previously been noted by the Jackson post office that not all of the numbers within the two ranges were in use, so the 400 numbers were sent to the Jackson post office where a postal employee crossed off

those numbers that were not in use as post office boxes. This procedure eliminated 133 numbers, thus leaving 267 potential post office boxes. These numbers were entered into an Excel sheet so that each potential box number had a corresponding Excel row number. To eliminate 67 post office boxes, a random list of numbers ranging from one to 267 was generated via <http://www.random.org>. The first 67 numbers generated by this procedure were used to eliminate corresponding rows in the Excel sheet. This method produced 200 post office box numbers to which the survey was sent.

Development and Pre-Test of Survey Instrument

The survey instrument itself was a 5-page, 49-question document, which was accompanied by a cover letter that informed the reader that their household had been chosen at random to participate in the survey. While content was the same, the surveys and cover letters were personalized for each of the three communities (Appendices D, E, and F). The letter explained the purpose of the survey and asked that the person who filled out the survey be 18 years old or older, and be the person who most recently had his or her birthday. The letter also made respondents aware that a gift certificate would be awarded at random to one respondent from each community.

Within the survey, five major areas of inquiry were explored: i) demographics, ii) knowledge of the GYE and ecosystem management, and the ecosystem management themes of iii) ecological integrity, iv) working across ecological boundaries as opposed to administrative boundaries, and v) regional land use planning and ecosystem management. Two questions were open-ended: those which asked the respondent to define, in their own words, the Greater Yellowstone Ecosystem and ecosystem management. These

questions appeared on the first page of the survey. Respondents were asked not to turn the first page until they had completed the entire page. Upon turning the page, respondents were provided with a standard definition of the GYE and ecosystem management and were encouraged to use these definitions throughout the rest of the survey. These definitions were provided in hopes that they would standardize respondents' definitions, or in other words, promote commonly understood terms.

A pre-test of the survey was conducted in mid-January 2003 amongst Montana State University undergraduate students, graduate students, faculty, and faculty spouses. The purpose of the pre-test was to acquire information pertaining to the survey's clarity and ease of completion. Each person involved in the pre-test was asked to read the cover letter, complete the survey, and offer comments. Comments were subsequently taken into consideration during the final cover letter and survey editing process.

Surveys were sent to Bozeman and Red Lodge residents on February 3, 2003 and resent to Jackson residents on February 18, 2003. Surveys from all locales were collected through March 21, 2003. A total of 76 surveys were returned from Bozeman, 59 from Red Lodge, and 64 from Jackson for a total of 199 returned surveys (33 % return rate overall).

Methods of Statistical Analysis

All survey responses were nominal and ordinal in type. Individual responses were coded into an Excel spreadsheet, and all surveys were analyzed through Minitab statistical software. The survey's two open-ended questions had to be first placed into categories before they were entered into the Excel spreadsheet. Definitional categories

were determined by first looking through many surveys and noting dominant themes that seemed to be emerging. From this stage, themes were combined, and final categories defined. Each definitional category was assigned a discrete number for coding purposes. The final categories can be found in Tables 17 (for the GYE) and 19 (for ecosystem management).

Descriptive statistics are presented for all results. Additionally, two nonparametric tests of significance are used in the survey analysis. The Chi square test for independence is used to test for a relationship between two variables. Although originally planned as the main tool for analysis, the use of this test proved limited because the small sample size resulted in low observed cell frequencies. In a few instances, when data were pooled across responses, Chi square was able to be computed. The Mann Whitney test is used to test the equality of two population medians. It is used in this analysis to determine significant differences between responses from Bozeman, Red Lodge, and Jackson.

The primary measure of association used throughout the survey analysis is Spearman's rho (r_s). Spearman's rho is a non-parametric correlation coefficient that is a measure of association between two ordinal variables and is based on ranks. Spearman's rho is commonly used when there are multiple scores associated with the variables.

With a response rate of 33%, some attention must be given to the non-response factor. When there is not a 100% return rate, non-response bias must be considered (Hager et al. 2002, Cui 2003), although a moderately low response rate does not necessarily indicate that non-response bias is present (Cui 2003). There are several reasons why a potential respondent may not choose to participate in a survey. The issue

of salience is perhaps most relevant to this survey. Salience is the association between the respondent and the survey material, especially regarding the importance and/or timeliness of the survey topic. Sheehan and McMillan (1999) found that salience has a strong positive correlation with response rate. If potential respondents do not find the survey material relevant, they may not respond (Cui 2003). In this present case, the possibility does exist that people who were interested in the GYE and/or ecosystem management self-selected to be a respondent, and those who did not have a high interest in the GYE and/or ecosystem management selected themselves to not be a respondent. Because of this factor, it is possible that the survey respondents are different than survey non-respondents (Robson 1993). Other factors that may have affected the return rate include the fact that there was no follow-up after the initial survey was sent (Dillman et al. 1993, Bourque and Fiedler 1995, Cui 2003), and the lack of an official sponsorship (Goyder 1982, Fox et al. 1988, Yammarino et al. 1991, Bourque and Fiedler 1995).

In the development stage of this research, several steps were taken in the hopes of increasing the response rate. Each outgoing envelope had a hand-written address, and a first class stamp. Both of these methods have been shown to slightly increase response rate (Fox et al. 1988, Dillman et al. 1993, Bourque and Fiedler 1995). Each survey packet that was sent included a self-addressed stamped envelope for respondents to return their survey. This has also been shown to increase response rates (Fox et al. 1988, Dillman et al. 1993). A gift certificate was also offered via a random drawing to one survey respondent in each survey community. Goyder (1982), Bourque and Fiedler (1995), and Cui (2003) have noted that incentives can increase response rates.

Because there is no sure way to know how severe non-response bias might be (Robson 1993), researchers need to be cautious in making inferences to the population if they feel their response rate is significantly low. In this case, the response rate can be considered moderate to moderately-low, but overall, average for a mail survey (Bourque and Fielder 1995). Inferences will be made to the populations of Bozeman, Red Lodge, and Jackson, but with the caveat that another study should be conducted to confirm these results.

Results and Discussion

Demographic Characteristics

Table 15 presents demographic characteristics of survey respondents. The majority of respondents were male (55%). Half the respondents (50.5%) were between 35 and 55 in age. Almost all of the respondents (91.5%) classified themselves as full time residents in the town in which they received the survey. Over half of the respondents had college degrees. The most frequently cited respondent occupations were management, business, construction, healthcare, and education. Sixty percent of the respondents have lived in the GYE for 11 or more years, while 40% have lived in the GYE for 10 years or less.

All respondents were asked if they had residences in the wildland-urban interface, which can be defined as an area where high-fire risk wildlands mix with human development (Cortner et al. 1990, Plevel 1997). Forty-five percent of respondents indicated that their primary residence was in the wildland-urban interface. Eleven percent reported that they had a secondary residence in the GYE that was also in the in

the wildland-urban interface, and 7.5% reported that they have a secondary residence in the wildland-urban interface, but outside the GYE. An attempt was made to explore associations between having a residence in the wildland-urban interface, and various wildfire-related questions, but the small sample size prohibited such associations.

Table 15. Demographic Characteristics of Survey Respondents.

<u>Age</u>		<u>Gender</u>	
18-24:	3.5 %	Female:	45 %
25-35:	14 %	Male:	55 %
36-45:	21.5 %		
46-55:	29 %		
56-65:	15 %		
66-75:	10 %		
76-85:	5.5 %	<u>Classification of residency</u>	
>86:	1.5 %	Full time:	91.5 %
		Half time:	5 %
		Quarter time:	3.5 %
<u>Length of residency in present community</u>		<u>Highest Level of Education Completed</u>	
< One year:	3.5 %	9 th or below:	.5 %
1-5 years:	20 %	10 th grade:	.5 %
6-10 years:	16.5 %	12 th grade:	14 %
11-20 years:	21 %	College, Freshman:	3 %
21-30 years:	19 %	College, Sophomore:	5 %
> 30 years:	20 %	College, Junior:	5 %
		College, Senior:	46 %
		Masters:	19 %
		Doctorate:	7 %
<u>Occupation</u>			
Management	12.0 %	Architecture	2.0 %
Business	12.0 %	Farming	1.5 %
Construction	9.0 %	Installations	1.5 %
Education	9.0 %	Legal	1.5 %
Healthcare	9.0 %	Production	1.5 %
Computer	7.0 %	Transportation	1.5 %
Arts/Media	8.5 %	Community	0.7 %
Other	5.0 %	Fishing	0.7 %
Life, Physical,		Forestry	0.7 %
Social Science	5.5 %	Homemaker	0.7 %
Building	3.5 %	Personal Care	0.7 %
Food	3.5 %	Protective	
Office	2.8 %	Services	0.7 %

Familiarity with the Greater Yellowstone Ecosystem and Ecosystem Management

When asked if they were familiar with the Greater Yellowstone Ecosystem concept, 82% of respondents indicated that they were. A higher percentage of Jackson respondents were familiar with the GYE concept (92%), than respondents in Bozeman and Red Lodge (79% and 75 % expressed familiarity, respectively). Table 16 displays the educational characteristics of those who reported being familiar or non-familiar with the GYE. A Spearman's rho test of association found that there is no association between knowledge of the GYE and educational level ($r_s = -0.132$, $df=197$, $\alpha=.05$).

Table 16. Highest Level of Education for Respondents Who Reported Being Familiar or Non Familiar With the GYE Concept.

	<u>Familiar</u>			<u>Not Familiar</u>		
$\leq 11^{\text{th}}$ grade	n=0,	0.0	(0.0)	n=2,	5.5	(1.0)
12 th grade	n=18,	11.0	(9.0)	n=10,	28.0	(5.0)
College, Freshman-Junior	n=22,	13.5	(11.0)	n=4,	11.0	(2.0)
College, Senior	n=81,	50.0	(41.0)	n=10,	28.0	(5.0)
Masters	n=28,	17.0	(14.0)	n=9,	25.0	(4.5)
Doctorate	n=14,	8.5	(7.0)	n=1,	3.0	(0.5)
Totals	n=163,	100.0	(82.0)	n=36,	100.0	(18.0)

(For each category, Familiar or Not Familiar, three numbers are given. The first number (n=) represents the raw count for each cell. The second number that appears represents the column percentage. The third number that appears is that category's overall contribution (in percent) to the total response (N=199)).

Respondents who were familiar with the GYE concept were also asked how they define the GYE. Responses were coded into ten different categories, and are summarized in Table 17. Almost three quarters of the respondents defined the GYE as a geographical area, symbolizing the most popular way in which to define the GYE. Just over a quarter

of the respondents indicated that the GYE was an area of similar biotic/abiotic characteristics and processes.

Table 17. Definitions of the Greater Yellowstone Ecosystem as Provided by Survey Respondents (n=163).

Themes found in written definitions	% of respondents who used the theme to define the GYE
Land in/around Yellowstone National Park (n=118)	72.0%
Similar biotic/abiotic characteristics and processes (n=43)	26.0%
Cross-boundary interactions/internal & external influences (n=22)	13.0%
An area where people live (n=20)	12.0%
Yellowstone River, other rivers, watersheds (n=18)	11.0%
Mammal migrations (n=9)	5.5%
Means management for protection (n=7)	4.0%
An area irrespective of political boundaries (n=2)	1.0%
Sustains itself (n=2)	1.0%
A concept used to stop public use (n=1)	0.6%

Respondents were also asked about their familiarity with ecosystem management. When asked if they were familiar with the concept of ecosystem management, 80% of respondents indicated that they were. Again, a higher percentage of Jackson respondents were familiar with ecosystem management (84%), than respondents in Bozeman and Red Lodge (75% and 81%, respectively). Table 18 displays the educational characteristics of those who reported being familiar or non-familiar with the concept of ecosystem management. A Spearman's rho test of association found that there is a significant and negative association (at the 0.05 α level) between knowledge of ecosystem management and educational level ($r_s = -0.170$, $df=197$, t obtained $= -2.42$, $\alpha.05$).

Table 18. Highest Level of Education for Respondents Who Reported Being Familiar or Non Familiar With the Concept of Ecosystem Management.

	<u>Familiar</u>			<u>Not Familiar</u>		
<=11 th grade	n=1,	1.0	(0.5)	n=1,	2.5	(0.5)
12 th grade	n=16,	10.0	(8.0)	n=12,	30.0	(6.0)
College, Freshman-Junior	n=21,	13.0	(10.5)	n=5,	12.5	(2.5)
College, Senior	n=78,	49.0	(39.0)	n=13,	32.5	(6.5)
Masters	n=29,	18.0	(15.0)	n=8,	20.0	(4.0)
Doctorate	n=14,	9.0	(7.0)	n=1,	2.5	(0.5)
Totals	n=159,	100.0	(80.0)	n=40,	100.0	(20.0)

(For each category, Familiar or Not Familiar, three numbers are given. The first number (n=) represents the raw count for each cell. The second number that appears represents the column percentage. The third number that appears is that category's overall contribution (in percent) to the total response (N=199)).

Respondents who were familiar with ecosystem management were also asked to define the concept in their own words. Definitions were coded into 14 different categories, and are summarized in Table 19. Thirty percent of the respondents defined ecosystem management as sustaining or maintaining ecosystems. Other common ways to define ecosystem management included the notions of managing natural resources and finding a balance between the needs of people and ecosystems.

A Chi square test for independence found that an association exists between familiarity with the GYE and familiarity with ecosystem management (X^2 obtained=59.34, df=1, $\alpha=.02$). A Spearman's rho test of association found a positive and significant relationship between these two variables ($r_s=.546$, df=197, $\alpha=.05$).

Table 19. Definitions of Ecosystem Management as Provided by Survey Respondents (n=159).

Themes found in written definitions	% of respondents who used the theme to define ecosystem management
Sustaining or Maintaining ecosystems (n=49)	31.0%
Managing natural resources (n=38)	24.0%
Finding a balance between the needs of people and ecosystems (n=24)	15.0%
Avoiding or fixing damage caused by humans (n=21)	13.0%
Managing wildlife habitat/corridors (n=16)	10.0%
Emphasis is on ecological boundaries, not political boundaries (n=14)	9.0%
Manipulating or utilizing the ecosystem for human use and benefit (n=12)	7.5%
Understanding relationships/Having a holistic view (n=11)	7.0%
Managing land use (n=10)	6.0%
Entails sustainable human populations (n=7)	4.4%
Allows for minimal human activity (n=6)	3.7%
Studying ecosystems (n=7)	4.4%
Maintaining ecological processes (n=4)	2.5%
Maintaining and education about water quality (n=3)	2.0%

Respondents were also asked if they had read or heard about ecosystems prior to the survey. Of those who said they were familiar with the GYE, 87% also said they had either heard or read about ecosystems prior to the survey; 13% had not. Of those who said they were not familiar with the GYE, all respondents reported that they had not read or heard of ecosystems prior to the survey. If a respondent had heard or read about ecosystems prior to the survey, they were asked if they generally thought of humans as one component of the system. Eighty-four percent of the respondents indicated that they do think of humans as one component of ecosystems, and 15% said that they do not. Of the 84% of respondents who did report that they think of humans as part of ecosystems, 11% included a notion of humans in their definition of the GYE; 89% did not.

Discussion. Although definitions varied, most survey respondents were familiar with the GYE and ecosystem management concepts, and a significant relationship was found to exist between these two variables. Half of the respondents defined the GYE as a geographical area. The definitions for ecosystem management were more varied, with the largest proportion of respondents defining ecosystem management as sustaining or maintaining ecosystems. Because definitions of the GYE and ecosystem management were provided later in the survey, it cannot be known whether survey respondents based their own definitions on the provided definitions. However, steps were taken to minimize this possibility.

Only 12% of respondents included humans in their definition of the GYE. In definitions of ecosystem management, humans appeared in definitional themes to a small extent as well. Because ecosystem management recognizes humans as part of ecosystems, and generally encourages human participation in ecosystem management initiatives, this finding is noteworthy. By the absence of humans in these definitions, then, it might be hypothesized that the general public generally views ecosystems and ecosystem management separate from human activities. However, later in the survey, when directly asked if they generally think of humans as part of ecosystems, 84% of the respondents indicated that they did. This disconnect could be attributed to the fact that respondents wrote their definitions of the GYE and ecosystem management using what they felt were the most important defining concepts, and by this method, unconsciously left out humans. When asked later, however, respondents had the chance to report that they do think of humans as part of ecosystems. This suggests, then, that respondents do

think of humans as part of the GYE and ecosystem management, but perhaps to a lesser extent than other factors such as physical geography, wildlife and/or ecological processes.

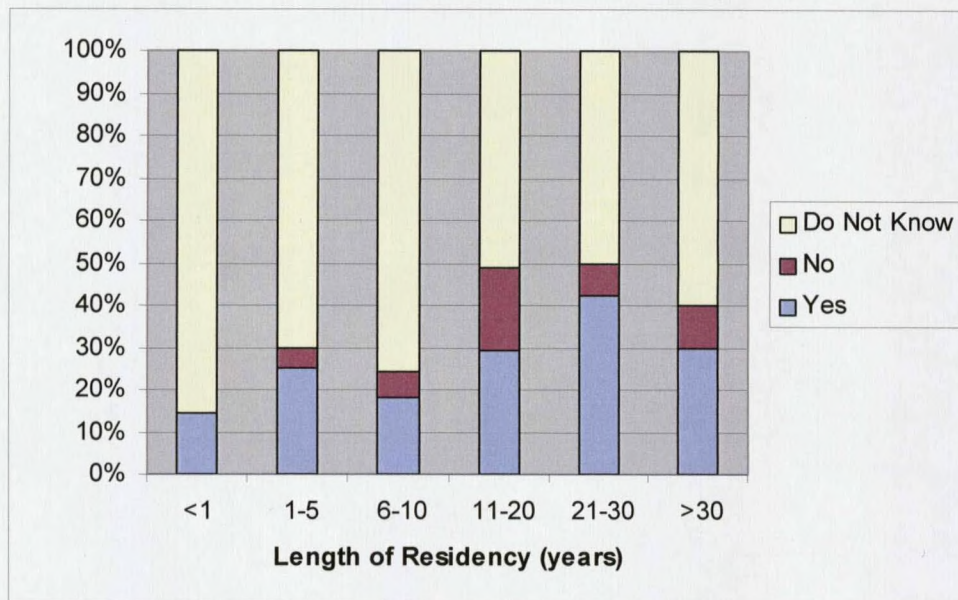
General Knowledge About the Greater Yellowstone Ecosystem

Multi-Agency Land Use Plan. Four survey questions assessed the knowledge of survey respondents. When asked if there was one, multi-agency land use plan for the entire GYE, 63% of the respondents reported that they did not know. Thirty-three percent of the respondents answered (correctly) that there was not such a plan, and four percent answered (incorrectly) that there was a plan.

Leaders Meeting. The second knowledge question addressed whether or not survey respondents knew that the superintendents of Yellowstone and Grand Teton National Parks and the supervisors of the surrounding National Forests meet to discuss ecosystem issues. This question stems from the existence of the Greater Yellowstone Coordinating Committee, which is a committee comprised of GYE National Park superintendents and Forest Service supervisors who meet twice a year to discuss GYE-related topics. Overall, 62% of the respondents said they did not know if the leaders meet, 29% (correctly) responded that the leaders do meet, and 9% of the respondents (incorrectly) stated that the leaders do not meet. Figure 5 presents respondent's answers in relation to how long they have lived in the GYE. In each residency group, at least 50 percent of the respondents did not know if the Park superintendents and Forest supervisors meet. Of those that have lived in the GYE for ten years or less, 74% reported a "do not know" answer to this question, while 54% of those who have lived in the GYE

for 11 or more years reported a “do not know” answer. However, in general, as length of residency increases, so does respondents’ knowledge of the Park superintendents and Forest supervisors meeting.

Figure 5. A Comparison of Survey Respondents’ Length of Residency in Their Current Locale and Their Answers to: “Do the Superintendents of Yellowstone and Grand Teton National Parks, Along With the Supervisors of the National Forests Surrounding the Parks, Meet to Discuss Ecosystem Issues?”



Wildfire. The third and fourth knowledge questions addressed knowledge related to wildfire in the GYE. When asked if wildfire is a natural component of the GYE, 93% of the respondents (correctly) answered yes. Three and a half percent of the respondents answered no, and three and a half percent of respondents reported that they did not know.

The final knowledge question asked if Yellowstone National Park is the only management area within the GYE that permits lightning-caused wildfires to burn. A majority of the respondents answered (correctly) that it is not (47.5 %), but a large

percentage of respondents also answered that they did not know (45.5%). Seven percent of respondents answered that lightning-caused wildfires are not allowed to burn. Other areas in the GYE that allow lightning-caused wildfires to burn include Grand Teton National Park, and several Wilderness areas in GYE national forests. Length of residency does not appear to influence this knowledge. Of those respondents who reported that they did not know if Yellowstone National Park is the only management area within the GYE that permits lightning-caused wildfires to burn, 52% had lived in the GYE for 10 years or less, and 48% had lived in the GYE for 11 years or more. Of those who (incorrectly) reported that Yellowstone was the only management area within the GYE that permits lightning-caused wildfires to burn, 43% had lived in the GYE for 10 years or less, and 57% had lived in the GYE for 11 years or more. (A Spearman's rho test of association confirmed the observation of no apparent relationship: $r_s = -0.1066$, $df = 196$. Not significant at the .05 level.)

Discussion. Respondents' answers to the four knowledge questions provide preliminary insight into the respondents' level of awareness of various GYE-related issues. For instance, a majority of respondents did not know if there is one, multi-agency land use plan for the entire GYE. This could be the result of a lack of awareness regarding the extent of land use planning in the ecosystem. Similarly, the majority of respondents did not know if the GYE Park superintendents and Forest supervisors meet to discuss ecosystem issues. Again, this could be the result of a lack of awareness regarding interagency cooperation within the GYE.

There does seem to be awareness among the respondents regarding wildfire as a natural process in the GYE. However, respondents were more mixed in their knowledge

(or awareness) about where lightning-caused wildfires are permitted to burn unsuppressed in the GYE. While almost half of the respondents correctly reported that Yellowstone National Park is not the only GYE unit where wildfires can burn unsuppressed, almost as many reported that they did not know.

Authors such as Christensen et al. (1996) and Phillips (1997) have noted that educated stakeholders are important in any ecosystem management attempt. Hough (1990) specifically stresses that regional place identity, which can be key to implementing ecosystem management, begins with regional environmental literacy. Respondents' answers to these four knowledge questions show mixed awareness of certain GYE-related issues. Reading et al. (1994), in their survey of GYE residents, also found mixed results concerning knowledge of GYE-related issues. Thus, there appears to be room for an increased regional literacy in the GYE.

Support of Land Use Planning

Three questions addressed the extent to which respondents thought the GYE concept should be applied in land use planning efforts throughout the GYE. Table 20 summarizes responses regarding the extent to which survey respondents thought the GYE concept should be considered in land use planning at various government planning levels. Respondents showed overall support for considering the GYE in land use planning efforts at the federal, state, and local level. Three Spearman's rho tests of association showed moderately strong and significant associations between responses presented in Table 20 (statements 1&2 $r_s = -0.6512$, $df=196$, $\alpha=.05$; statements 1&3 $r_s=.6352$, $df=196$, $\alpha=.05$; statements 2&3 $r_s = -0.6383$, $df=196$, $\alpha=.05$). A Mann-Whitney test for equality in

medians was conducted for responses to each statement found in Table 20, as well ($\alpha=.05$). Based on the samples, the test found no significant differences in responses between residents of Bozeman, Red Lodge, and Jackson.

Table 20. Responses of GYE Residents to Questions Regarding Land Use Planning.

	1. GYE <u>should not</u> be considered in land use planning at the federal level				2. GYE <u>should</u> be considered in land use planning at the state level				3. GYE <u>should not</u> be considered in land use planning at the local level			
	Overall %*	B	RL	J %**	Overall %*	B	RL	J %**	Overall %*	B	RL	J %**
Completely Agree	7	3.5	1	2.5	54	21	16	17	6.5	.5	3	3
Generally Agree	5.5	2.5	2	1	32	11	10	11	6.5	2.5	1	3
Neither Agree or Disagree	9.5	1.5	4.5	3.5	8	2.5	2.5	3	12.5	4.5	5.5	2.5
Generally Disagree	25	11	5.5	8.5	4	2	1	1	28	13	6	9
Completely Disagree	53	19	17	17	1.5	.5	.5	.5	46	18	14	14

*Total response N=198.

**B=Bozeman, RL=Red Lodge, J=Jackson. Bozeman response n=75, Red Lodge n=59, and Jackson n=64.

Also related to land use planning, respondents were asked to report the extent to which they would like their county land use planners to consider land use goals of neighboring federal land managers. The largest proportion of respondents reported that they would like to see "more" consideration of federal land use goals (49%). Ten percent reported that they would like to see "less" consideration, 20% reported that they would like to see the same, and 21% reported that they did not know. A moderately weak, and significant association was found between the extent to which respondents would like to their county land use planners to consider land use goals of neighboring federal land managers and statement three in Table 20 ($r_s = -0.2324$, $df=195$, $\alpha=.05$).

Respondents were also asked the extent to which they would support a GYE regional land use plan which defined uses of land for the entire ecosystem (including federal, state, and private lands). Forty-five percent of respondents reported that they would support such a plan to "some" extent. Twenty-three percent reported they would support such a plan "a great deal." Fifteen percent of respondents reported that they would support such a plan "only a little," and 17% reported that they would not support such a plan at all.

Similarly, respondents were asked the extent to which they agree or disagree that a regional effort to plan land uses in the GYE may be an effective method of tackling environmental concerns in the area. Seventy-nine percent of the respondents agreed that a regional effort to plan land uses would be effective, with 31% in complete agreement and 48% in general agreement. Eleven percent neither agreed nor disagreed, nine percent generally disagreed, and one percent completely disagreed. A moderate and significant association ($r_s=.51$, $df=192$, $\alpha.05$) was found to exist between the questions which asked respondents to define the extent to which they support a regional land use plan which predefined uses of land for the entire ecosystem and the extent to which they agree that a regional effort to plan land uses in the GYE may be effective at tackling environmental issues (see Table 21).

Discussion. Land use planning and management that occurs at a regional scale and transcends administrative boundaries is commonly cited as a mechanism to achieve successful ecosystem management (see Grumbine 1992, 1994, Galindo-Leal and Bunnell 1995, Haeuber 1996, Christensen et al. 1996, Phillips 1997, Slocombe 1998a, Landres et al. 1998, and Brunckhorst 2000). The responses given by the survey respondents tend to

support such planning and management. For instance, respondents expressed a high level of support for considering the GYE concept in land use planning efforts at the federal, state, and county levels. Respondents also expressed overall support for county land use planners to consider goals of neighboring federal land managers. These two findings

Table 21. Support for a Regional Land Use Plan in the GYE Which Would Predefine Land Uses by Support for a Regional Land Use Planning Effort in the GYE to Tackle Environmental Concerns.

(Each cell represents the number of respondents in that category, N=194)

	Would you support a GYE regional land use plan which predefined used of land for the entire ecosystem (including predefined uses for all federal, state, and private lands)?			
	<u>Not at all</u>	<u>Only a little</u>	<u>Some</u>	<u>A great deal</u>
A regional effort to plan land uses in the GYE may be an effective method of tackling environmental concerns in the area.				
<u>Completely Agree</u>	3	2	27	30
<u>Generally Agree</u>	11	21	48	13
<u>Neither Agree Nor Disagree</u>	9	1	9	1
<u>Generally Disagree</u>	8	5	3	1
<u>Completely Disagree</u>	2	0	0	0

suggest that respondents are accepting of land use planning efforts that transcend the boundaries of traditional administrative units. Additionally, respondents also supported the notion of regional land use planning as a method of tackling GYE environmental concerns. They also tended to support the notion of a GYE regional land use plan that could zone land uses. Although restrictive land uses are not necessarily an outcome of ecosystem management, restrictive tools such as zoning could be used to achieve the

various goals of ecosystem management (Walther 1986, Goldstein 1992a, b, and Christensen et al. 1996). Thus, while respondents' responses concerning land use planning in the GYE are not unanimous, respondents tend to support facets of land use planning that have the potential to lead to successful ecosystem management.

Ecosystem Management

Respondents were asked to report the extent to which they agreed that the GYE should be managed according to ecosystem management philosophy. It was suggested that respondents use the definition provided for ecosystem management to answer this question. Overall, most respondents (75%) agreed that the GYE should be managed according to ecosystem management philosophy, with 35% completely agreeing, and 40% generally agreeing. Fifteen percent neither agree nor disagree that the GYE should be managed according to ecosystem management philosophy, nine percent generally disagree, and one percent completely disagree. Responses amongst the three survey communities were generally similar, as outlined in Table 22. A Mann-Whitney test for equality in medians was conducted for each community ($\alpha=.05$), and no significant differences in responses were found between residents of Bozeman, Red Lodge, and Jackson were found.

The overall responses to the statement in Table 22 (N=198) were also compared to responses given for the following statement (which was presented under the prior subheading): A regional effort to plan land uses in the GYE may be an effective method of tackling environmental concerns in the area. A Spearman's rho test of association

found a moderate and significant association between these two variables ($r_s=.5599$, $df=195$, $\alpha=.05$).

Table 22. Responses of Bozeman, Red Lodge, and Jackson Residents to the Following Statement: "The GYE Should be Managed According to Ecosystem Management Philosophy."

	Bozeman n=75	Red Lodge n=59	Jackson n=64
Completely Agree	32% (n=24)	32% (n=19)	42% (n=27)
Generally Agree	45% (n=34)	42% (n=25)	33% (n=21)
Neither Agree nor Disagree	11% (n=8)	17% (n=10)	19% (n=12)
Generally Disagree	8% (n=6)	4% (n=2)	6% (n=4)
Completely Disagree	4% (n=3)	5% (n=3)	0% (n=0)

Respondents were also asked to respond to a scenario in which the respondent owned land in the GYE and the GYE was being managed under the philosophy of ecosystem management. Respondents were asked the extent to which they would find it acceptable if ecosystem management placed limits on how they could use their private property. Almost half of the respondents thought that such limits were generally acceptable (49%). Those who reported that such limits were completely acceptable made up the smallest proportion of respondents (11.5%). Twenty-seven percent thought limits on use of property that is privately owned were generally not acceptable; and 13% thought such limits were completely not acceptable. A Mann Whitney test for equality in population medians ($\alpha=.05$) found no significant difference between the three survey communities and the extent to which they would find it acceptable if ecosystem management placed limits on how they could use their private property.

A Chi square test for independence was conducted to ascertain if there was an association between the statement which asked about acceptability of restrictions on private property use and the statement which asked if respondents would support a regional land use plan which predefined land used for the entire ecosystem. When the data were pooled across responses (Table 23), the relationship was found to be dependent (X^2 obtained=57.71, $df=2$, $\alpha=.02$). A Spearman's rho test of association found the relationship to be positive, moderate, and significant ($r_s=.54$, $df=189$, $\alpha.05$).

Table 23. Acceptability of Limits on Private Property Use by Support for a Regional Land Use Plan in the GYE Which Would Predefine All Ecosystem Land Uses.

(Each cell represents the number of respondents in that category, N=191)

	Imagine that you owned land in the GYE and that the entire GYE was being managed under the philosophy of ecosystem management. If such management placed limits on how you, a private property owner, could use your land, how acceptable would this be to you?	
	Generally or Completely Not Acceptable	Generally or Completely Acceptable
Would you support a GYE regional land use plan which predefined uses of land for the entire ecosystem (including predefined uses for all federal, state, and private lands)?		
<u>Not at all</u>	29	4
<u>Only or a little OR Some</u>	46	68
<u>A great deal</u>	1	43

A Chi square test for independence was also conducted to ascertain if there was a relationship between the scenario that placed limits on private property use in the GYE and the responses given to the statement presented in Table 22. After pooling the data,

this test found that the two variables are not independent (X^2 obtained=41.47, $df=2$, $\alpha.02$). The likelihood of respondents accepting limits on private property use under an ecosystem management philosophy is associated with whether they also find it acceptable for the GYE to be managed under an ecosystem management philosophy. A Spearman's rho test of association found the association between these two variables to be moderate and significant ($r_s=0.456$, $df=191$, $\alpha.05$).

The acceptability of applying ecosystem management in the GYE was also explored in relation to education level. Overall, people with a college degree or higher represent 72% of all survey respondents. A categorization of people who have college degrees and their reported level of acceptability of ecosystem management in the GYE is summarized in Table 24. It can be seen that a high level of education is present across all possible responses. However, those who hold a college degree, and either completely or generally agree that the GYE should be managed under an ecosystem management philosophy, comprise 58% of all survey respondents.

Table 24. Educational Characteristics of Respondents Who Gave a Response to the Following Statement: "The GYE Should be Managed According to Ecosystem Management Philosophy."

	A. Respondents who hold a college degree (N=142) and responded as follows:	B. Column A's proportion when considering all respondents (N=198):
Completely Agree	n=51	.260
Generally Agree	n=64	.320
Neither Agree Nor Disagree	n=13	.065
Generally Disagree	n=9	.045
Completely Disagree	n=5	.025

The subject of the GYE being managed according to ecosystem management was also explored in relation to respondents' length of residency in the GYE (Table 25). Of respondents who have lived in the GYE for 30 or more years (n=40), 12.5% either generally or completely disagreed that the GYE should be managed according to ecosystem management philosophy, and 67.5% completely or generally agreed that the GYE should be managed according to ecosystem management philosophy. Twenty percent of the respondents who have lived in the GYE for 30 or more years neither agreed nor disagreed that the GYE should be managed according to ecosystem management. Of the 12.5% who disagree that the GYE should be managed according to ecosystem management philosophy, 75% have a college degree (or higher). Of the 67.5% who agree that the GYE should be managed according to ecosystem management philosophy, 59% have a college degree (or higher).

Table 25. Length of Residency by Support for Managing the GYE According to an Ecosystem Management Philosophy.

(Each cell represents the number of respondents in that category, N=198)

	How long have you lived in the town/area in which you received this survey?				
	≤5 years	6-10 yrs	11-20 yrs	21-30 yrs	>30 yrs
The GYE should be managed according to ecosystem management philosophy.					
Completely Disagree	0	0	2	2	2
Generally Disagree	2	3	2	2	3
Neither Agree Nor Disagree	11	2	3	6	8
Generally agree	21	16	15	15	13
Completely agree	13	12	19	12	14
Total:	47	33	41	37	40

Of those who have lived in the GYE for five years or less ($n=47$), no respondents completely disagreed that the GYE should be managed according to an ecosystem management philosophy. Four percent generally disagreed, and these respondents all had college degrees. Twenty-three percent of the respondents who have lived in the GYE for five years or less neither agreed nor disagreed that the GYE should be managed according to ecosystem management philosophy, and 19% of these people had college degrees (or higher). Seventy-three percent of the respondents who have lived in the GYE for five years or less generally or completely agreed that the GYE should be managed according to ecosystem management philosophy, and 55 percent of this group had college degrees (or higher).

Discussion. After being provided with a standard definition of both the GYE and ecosystem management, a majority of respondents agreed to some extent that the GYE should be managed according to ecosystem management philosophy. These respondents also supported the notion that regional land use planning may be an effective method of tackling environmental concerns in the GYE. Additionally, these same respondents showed a willingness to accept restrictions on private property use. However, 24.5% of the respondents thought limits on use of property that is privately owned were not acceptable. This finding could hold implications for mechanisms that could be used to implement facets of ecosystem management in the GYE. For instance, Goldstein (1992 a, b) argues that a regional authority could implement ecosystem-wide zoning in the GYE to preserve vital ecosystem lands. With nearly a quarter of the respondents reporting that would not find limits on private property use acceptable, it may be that zoning of any type would be met with significant opposition. This finding may indicate that this sector

of respondents is less willing to accept personal restrictions in the context of ecosystem management.

Having a college degree appeared to somewhat affect respondents' level of support for managing the GYE according to ecosystem management philosophy. Even though respondents with a college degree were found to both agree and disagree that the GYE should be managed according to ecosystem management philosophy, over half of the respondents with a college degree reported that they either generally or completely agreed that the GYE should be managed according to ecosystem management philosophy. Reading et al. (1994) also found that well-educated GYE residents supported ecosystem-level management in the GYE. It is also interesting to note that the majority (67.5%) of respondents who have lived in the GYE for over 30 years agreed that the GYE should be managed according to an ecosystem management philosophy, 20% neither agreed nor disagreed, and 12.5% disagreed. The percentage that agreed that the GYE should be managed according to an ecosystem management philosophy might be a higher percentage than anticipated because these people may be more likely to have ties to the traditional economies and Western way of life that characterized their communities 30 or more years ago.

Wildfire

Respondents were asked several questions which pertained to wildfire. When asked the extent to which they thought all wildfires should be suppressed in the GYE, 20% of respondents completely disagreed that all wildfires should be suppressed and 37% generally disagreed. Twenty-two percent of the respondents neither agreed nor

disagreed, 14% generally agreed, and seven percent completely agreed that all wildfires should be suppressed in the GYE.

Any respondent who did not completely agree that all wildfires in the GYE should be suppressed was instructed to provide their opinion concerning allowing lightning-caused wildfires burn in certain administrative units in the GYE. The same geographic units were presented under two different scenarios. The first scenario stated that managers within the GYE recognized that a lightning-caused wildfire was going to provide important ecological benefits. Respondents were then asked to state the extent to which they agreed that such a wildfire should be permitted to burn in the listed administrative units. The results are summarized in Table 26. For each administrative unit except county lands, 50% or more of the respondents agreed that a lightning-caused wildfire should be permitted to burn. Respondents showed the highest support for allowing a lightning-caused wildfire to burn in GYE national parks (72%), and designated Forest Service and BLM Wilderness areas (79% and 72%, respectively).

The second scenario asked respondents to state the extent to which they thought a wildfire should be suppressed in the given list of administrative units if the wildfire had the potential to burn onto private lands. Results are found in Table 27.

Unlike responses given for the first scenario, responses in the second scenario were more even across the range of response choices. For instance, in the first scenario, 50% or more of the respondents agreed that a lightning-caused wildfire should be permitted to burn in every unit except county lands, and in cases such as national parks and Wilderness areas, almost three quarters of the respondents agreed that wildfires

Table 26. Responses Regarding the Extent to Which Respondents Feel a Lightning-Caused Wildfire Should be Permitted to Burn in GYE Administrative Units if the Wildfire Will Provide Important Ecological Benefits.

	National Parks	Designated Wilderness Areas of National Forests	Non Wilderness areas of National Forests	Designated Wilderness areas of BLM lands	Non- Wilderness areas of BLM lands	National Wildlife Refuges	State Managed Lands	County Lands
Completely Agree	17% n=31	23% n=41	13% n=23	21% n=38	14% n=25	15% n=28	12% n=22	7% n=13
Generally Agree	55% n=100	56% n=102	44% n=79	51% n=93	38% n=70	40.5% n=74	38% n=69	31% n=55
Neither Agree Nor Disagree	13% n=24	11% n=20	20.5% n=37	15% n=27	22% n=40	19% n=34	27% n=49	19% n=35
Generally Disagree	14% n=25	9% n=17	17% n=31	11.5% n=21	21% n=38	20% n=36	20% n=36	30% n=54
Completely Disagree	1% n=2	1% n=2	5.5% n=10	1.5% n=3	5% n=9	5.5% n=10	3% n=6	13% n=23
Totals	100% N=182	100% N=182	100% N=180	100% N=182	100% N=182	100% N=182	100% N=182	100% N=180

should be permitted to burn. In the second scenario, however, only one administrative unit garnered 50% or more of respondent agreement—nearly 60% of the respondents agreed that a wildfire should be suppressed on county lands if it has the potential to burn onto private lands. In all other administrative units, however, respondents appear to be more divided in their opinions on wildfire suppression. Although responses are divided in the second scenario, there is more overall agreement that wildfires should be suppressed than agreement that they should not be suppressed. The lone exception was in the case of wildfires burning in Forest Service Wilderness lands. In this case, more

respondents (47%) expressed disagreement with suppressing a wildfire if it had the potential to burn onto private lands (39% percent expressed agreement).

Table 27. Responses Regarding the Extent to Which Respondents Feel Lightning-Caused Wildfires Should be Suppressed in GYE Administrative Units if They Have the Potential to Burn Onto Private Lands.

	National Parks	Designated Wilderness Areas of National Forests	Non Wilderness areas of National Forests	Designated Wilderness areas of BLM lands	Non- Wilderness areas of BLM lands	National Wildlife Refuges	State Managed Lands	County Lands
Completely Agree	13.5% n=24	10% n=19	13% n=23	12% n=21	13.5% n=24	13.5% n=24	11% n=20	23% n=41
Generally Agree	34.5% n=62	29% n=52	32% n=58	29% n=53	34.5% n=62	32% n=58	37% n=67	36.5% n=66
Neither Agree Nor Disagree	12% n=22	14% n=25	22% n=40	15.5% n=28	21% n=38	17% n=31	22% n=39	16% n=29
Generally Disagree	30% n=55	36% n=65	26% n=47	33% n=60	24% n=44	28% n=51	23% n=42	19% n=34
Completely Disagree	10% n=18	11% n=20	7% n=13	10.5% n=19	7% n=13	9.5% n=17	7% n=13	5.5% n=10
Totals	100% N=181	100% N=181	100% N=181	100% N=181	100% N=181	100% N=181	100% N=181	100% N=180

Another set of questions asked respondents to report the degree to which they agree with tools available to address human risk associated with wildfire. Two questions specifically asked respondents about mitigation tools that are and could be used in the wildland-urban interface.

Respondents were asked the degree to which they agree that GYE counties are sufficiently addressing community wildfire risk by requiring wildland-urban interface residents to clear brush around their homes and utilize proper building materials. The

largest proportion of respondents (42%) reported that they to some extent disagree that GYE counties are sufficiently addressing wildfire risk through these measures, but a large proportion also reported that they neither agreed nor disagreed (34%). Twenty-four percent of respondents generally or completely agree that counties are sufficiently addressing wildfire risk in the wildland-urban interface.

Another question asked respondents about restricting development in the wildland-urban interface. The majority of respondents agree that GYE county planners should restrict development in the wildland-urban interface (65%). Fifteen percent neither agree nor disagree, and 20% disagree that GYE county planners should restrict development in the wildland-urban interface. Table 28 shows how respondents in each community responded to the notion of restricting development in the wildland-urban interface. A Mann-Whitney test for equality in medians was conducted for each community. No significant differences in responses were found between respondents of Bozeman and Red Lodge, but significant differences in responses were found between respondents from Jackson and Bozeman ($W=5928$, $p=0.0025$, $\alpha=.05$), and Jackson and Red Lodge ($W=4088$, $p=0.0241$, $\alpha=.05$). Because respondents were asked if their primary residence was in the wildland-urban interface, a Spearman's rho test of association was conducted ($\alpha=.05$) to assess if a relationship existed between residence in the Jackson wildland-urban interface and the responses Jackson residents reported for restricting development in the wildland-urban interface. No association or significance was found ($r_s=0.0192$; $df=62$).

Table 28. Responses of Bozeman, Red Lodge, and Jackson Residents to the Following Statement: "GYE County Land-Use Planners Should Restrict Development in the Wildland-Urban Interface."

	Bozeman n=75	Red Lodge n=59	Jackson n=64
Completely Agree	24% (n=18)	24% (n=14)	15% (n=10)
Generally Agree	55% (n=41)	41% (n=24)	33% (n=21)
Neither Agree nor Disagree	5% (n=4)	24% (n=14)	19% (n=12)
Generally Disagree	12% (n=9)	8% (n=5)	25% (n=16)
Completely Disagree	4% (n=3)	3% (n=2)	8% (n=5)

The final question in this group of wildfire-related questions dealt with respondents' expectations of state and federal managers to address wildfire risk. When asked if GYE counties should expect neighboring state and federal land managers to reduce fire risk on their respective lands so that risk to county residents is minimized, 19% completely agreed, 46% generally agreed, 14% neither agreed nor disagreed, 14% generally disagreed, and seven percent completely disagreed. In a Chi Square test for independence, responses to this question were compared with responses to whether or not the respondent's primary residence was in the wildland-urban interface (Table 29). The variables were found to be independent ($X^2=4.638$, $df=4$, $\alpha=.05$).

Discussion. Wildfire is a natural disturbance agent within the GYE. It has shaped the evolution of the flora and fauna of the GYE for thousands of years, and is seen as an ecological process that is vital to ecosystem integrity (see Romme and Despain 1989, Davis and Mutch 1989, Knight and Wallace 1989, Knight 1991, Varley and Schullery 1991, Keiter and Boyce 1991, Crossley 1996). Thus the various wildfire-related questions presented in the survey serve as a measure of respondents' support for this one component of GYE integrity.

Table 29. Residence in the Wildland-Urban Interface by Agreement That Federal and State Land Managers Should Reduce Wildfire Risk to GYE County Residents.

(Each cell represents the number of respondents in that category, N=197)

	Do you consider your primary residence to be in the wildland-urban interface?		
	Yes	No	Total
GYE counties should expect neighboring state and federal land managers to reduce fire risk on their respective lands so that risk to county residents is minimized.			
Completely Disagree	4	10	14
Generally Disagree	14	13	27
Neither Agree Nor Disagree	11	17	28
Generally agree	39	52	91
Completely agree	21	16	37
Total:	89	108	197

Respondents were asked to report their level of support for allowing lightning-caused wildfires to burn in certain administrative areas. When presented with a scenario in which managers viewed a wildfire as providing important ecological benefits, the majority of respondents agreed to some extent that the wildfire should be able to burn in all administrative areas, except in the case of county lands. Overall, the fact that most respondents agreed that lightning-caused wildfires should be able to burn in most administrative units is in line with the ecological principles of ecosystem management. Additionally, these findings could also be interpreted as reflecting place meanings that respondents' ascribe to GYE administrative units. Because counties are the administrative unit in which the respondents' live, it may be that respondents' do not feel that wildfire is an appropriate force in such a place. It may be that that respondents do

feel that wildfire is an appropriate force in the other administrative units, however, as evidenced by their willingness to let wildfire burn in these units if it would provide important ecological benefits.

In a second scenario that was presented, one in which a lightning-caused wildfire had the potential to burn onto private lands, support to allow wildfires to burn was not as strong. In other words, respondents' lent more support to the suppression of wildfires when private land was threatened than in the first scenario which did not present private land as a variable. Again, these findings could be interpreted as reflecting place meanings that respondents' ascribe to the GYE in that they could be a reflection of respondents' feelings that wildfire is not an appropriate force in a human setting (for social, economic, and/or aesthetic reasons, for example). These interpretations are thus reflective of a situation where, even though wildfire suppression in effect freezes the present ecological/physical state, and this is not what the ecological principles of ecosystem management aim to accomplish (Clark and Minta 1994, Christensen et al. 1996), human interests may affect the implementation of the ecological principles characteristic of ecosystem management.

Although respondents did support wildfire suppression when private land was potentially at risk, when presented with ways in which to address human risk associated with the wildland-urban interface, respondents reported interesting results. On one hand, over half of the respondents reported that they agreed that GYE county planners should restrict development in the wildland-urban interface. Similarly, when asked if they agreed that GYE counties are sufficiently addressing the wildland-urban interface by requiring homeowners to clear brush and utilize proper construction materials, 42% of

respondents reported that they disagreed, or in other words, they thought GYE counties were not being sufficient. (However, 34% neither disagreed nor agreed. This group could in fact have chosen not to disagree or agree, but they could have also felt that they did not know enough about the topic to respond). The fact that respondents generally agree that development in the wildland-urban interface should be restricted, coupled with respondents' views that GYE counties are not sufficiently addressing the wildland-urban interface, could suggest that these respondents understand the types of consequences that stem from wildland-urban interface development, such as wildfire suppression. Such understanding, if put into action through restricting development in the wildland-urban interface, could lead to allowing more wildfires to burn in the GYE, which in turn would enhance ecological integrity. A majority of respondents, however, also agreed that GYE counties should expect neighboring state and federal land managers to reduce fire risk on their respective lands so that risk to county residents is minimized. This perspective seems to support actions that would accommodate continued development in the wildland-urban interface. Thus, respondents' views about how to address development in the wildland-urban interface seem conflicted — they support measures that entail both restricting humans uses and accommodating human uses. This topic is in need of further study.

Conclusion

The responses of residents who live in Bozeman, Red Lodge, and Jackson provide valuable insight. Residents of New West communities are often found to support notions and decisions that claim to safeguard the environment, and the results found here mirror

that trend. Most significant, however, is that the results show that these residents are aware of the GYE concept, and overall support planning and management decisions that are in line with themes of ecosystem management. The results pertaining to support of planning, management, and ecosystem management were not unanimous, however, which may reflect differing place meanings that these residents ascribe to the GYE and may reflect Old West characteristics that remain in these communities. These un-unanimous results also correspond to Jobes (1991) Zone I and II characterizations. Because ecosystem management must occur within an informed and/or integrated cultural context, the views of all of these respondents would be important in any ecosystem management initiative in the GYE.

Based on the survey results, hypotheses can be developed regarding the way in which a large proportion of respondents from Bozeman, Red Lodge, and Jackson might respond to the various goals of ecosystem management. Although the survey focused on four specific ecosystem management themes, the results can be extrapolated to other, similar ecosystem management themes and goals. For instance, Table 30 shows that respondents might be likely to support various ecosystem management goals that sustain ecosystems and their integrity. Table 30 also shows that respondents might support interagency management and integration of science and policy. These goals relate to most themes that were addressed in the survey. With some goals that appear in Table 30, there was no immediate connection with topics that were explored in the survey, thus hypotheses cannot be made.

Table 30. Hypothesized Support of Bozeman, Red Lodge, and Jackson Respondents Concerning Goals of Ecosystem Management. Goals are an Abbreviated Version of Table 2, Chapter 1.

<u>Goal</u>	<u>Would Respondents Likely Agree with Goal?</u>	<u>Not Able To Determine</u>
Maintain Ecosystem Integrity	Yes	
Manage Based on Natural Processes	Yes	
Sustain Ecosystems for the Long-Term	Yes	
Manage within the Context of an Ecological Hierarchical Organization	Yes	
Develop and Adopt an Interdisciplinary Approach	Yes	
Facilitate Public Involvement		X
Integrate Scientific Research, Policy, and Management	Yes	
Incorporate Adaptive Management Procedures		X
Develop Education Programs and Provide Information Exchange		X
Accommodate Human Use and Occupancy		X

Of special note is the theme of "Accommodate Human Use and Occupancy."

This goal strives to incorporate human desires into the ecosystem management process.

While it can be hypothesized that many residents would support this goal, this goal can be carried out in differing ways. For example, this goal could accommodate human use, but in a way that first ensures ecological integrity (see Grumbine 1994). Conversely, this goal could be carried out so that human wants and needs are met first, and ecological needs are met second. Because of the multiple meanings this goal can have, it is not possible to make generalizations at this time.

Although this research builds upon that of Reading et al. (1994), this particular research serves as an initial effort to examine the values held by three GYE New West communities. Because the response rate to the survey was 33%, there are limitations to making generalizations to the populations of all three communities because questions arise as to the bias of survey respondents. If we make the assumption that survey respondents are in fact representative of the populations in question, these results suggest that there is a high level of support amongst residents of Bozeman, Red Lodge, and Jackson for applying ecosystem management philosophy to the GYE. Specifically, these residents are supportive of the ecosystem management themes of working across ecological boundaries, regional attempts at land use planning, and ecological integrity (as specifically examined through wildfire). However, results were not unanimous, which may be a reflection of the social characteristics that Jobes speaks of, and/or differing place meanings that these residents ascribe to the GYE. Another study would need to be conducted to confirm these results.

CHAPTER 6

CONCLUSION

Ecosystem management is proposed as a relatively new approach to natural resource management (Booth and Kessler 1996), and it has often been proposed as a management philosophy that would be suited for the Greater Yellowstone Ecosystem (GYE) (Primm and Clark 1996). A literature review of ecosystem management identifies four themes of particular importance to managing ecosystems at regional scales: i) the importance of ecological integrity, ii) the need to work across administrative boundaries, iii) the need for interagency cooperation, and iv) recognition of humans as ecosystem components. What is often missing from what is largely an ecological literature is the notion that ecosystem management, if carried out, will ultimately occur not within just a space on a map, but within a place. This notion has a distinct geographic component that recognizes the role of human systems. Thus, ecosystem management is not only about managing biodiversity and ecological patterns and processes, it is about managing human places and is a geographic approach to management.

This study viewed the GYE as a place—a social construction of nature which occurs within a cultural, on-the-ground, context. A geographic perspective of place was invoked to highlight the reality that exists on today's landscape—it is a coupling of human and natural systems. The GYE is not just comprised of mountains, rivers, mammals, and geysers: it is home to over 370,000 people who are affected by, and who can affect, natural resource management decisions. People are ecosystem components

too, and a discussion of the GYE and/or ecosystem management devoid of the human component would be incomplete.

Thus, through using both the ecological underpinnings of ecosystem management and the geographic perspective of place, I explored if and how the GYE concept is recognized by local stakeholders, and interpreted this information in the context of the prevalence of ecological and human themes of ecosystem management. Before this particular research, these topics had yet to be explored. It was argued that using both ecological and geographic perspectives would produce a more comprehensive discussion about these topics.

Chapter 3 explored the overarching land use planning/management document that is applicable to each GYE administrative unit to determine if that unit specifically recognized itself as part of the GYE. This methodology, in conjunction with the perspective of place, proved somewhat valuable in determining if GYE administrative units recognize their units as part of the GYE. Some GYE administrative units do specifically identify themselves as part of the GYE in their overarching land use planning/management document. While it was argued that recognition of such can be beneficial in terms of ecosystem management, it was also argued that it could result in negative consequences because the GYE is a place where all people are not comfortable with the GYE concept and what it may imply. Thus, forgoing a reference of the GYE in these documents may in fact allow the administrative unit to move forward with ecosystem management principles without causing a potential public outcry.

Chapter 4 reported two case studies of GYE management to determine if and how GYE management recognizes the GYE concept and what this means in terms of

ecosystem management. Both the ecological themes of ecosystem management and the concept of place proved helpful in analyzing this information. In the case of the Greater Yellowstone Coordinating Committee (GYCC) it was found that although the GYCC recognizes the spatial extent of the GYE, it does not reflect this in its membership.

Because ecosystem management strives to involve all stakeholders in interagency cooperation, the non-comprehensive nature of the GYCC membership could be viewed as an obstacle to ecosystem management. However, through the perspective of place, it was also argued that the GYCC may be more effective in terms of realizing the ecological goals of ecosystem management as it is comprised now. Including a more diverse set of stakeholders from throughout the GYE in the GYCC could result in the GYCC being less effective in its ecosystem management attempts. In the case of wildfire it was argued, from an ecological view, that wildfire policy in the GYE does not recognize the GYE concept, which in turn can hinder the ability to achieve the ecosystem management goal of ecosystem integrity. From a place perspective, however, it was argued that GYE wildfire policy does recognize the GYE concept (which includes people) and can be considered reflective of ecosystem management because present wildfire policy does consider the human presence in the GYE.

Lastly, the concept of place was central to the survey I conducted and presented in Chapter 5. I conducted the survey based on the notion that humans are a component of the GYE and that their voice in ecosystem management is important. The results indicate that many residents of Bozeman and Red Lodge, Montana and Jackson, Wyoming (New West communities) are familiar with the GYE concept and are supportive of planning and management that would fall in line with ecosystem management. It must be noted

that these residents are not representative of the entire GYE population, however, and thus the results cannot be used in that context. Additionally, not all residents within these communities were familiar with the GYE, nor did they all support planning and management in line with ecosystem management. This brings to the forefront the diversity of opinions that exist in the GYE regarding natural resource management, and potentially the different meanings of place that people affiliate with the GYE.

Each of these chapters illustrates that the perspective of place can provide insight into how place-specific attributes and human preferences and attitudes can affect the realization of the themes and goals of ecosystem management. Using this perspective in conjunction with an ecological perspective allowed a more complete discussion of ecosystem management to take place. The perspective of place has showed that there is a need for a more broad definition of ecosystem management—one that more fully includes humans, and is not limited to ecology alone, since the human component has been shown to have the potential to affect the outcome of ecosystem management goals.

Additionally, each of these chapters illustrates the effectiveness of using multiple methodologies and varying sources. Through my use of documents, interviews, and a mail-administered survey, I was able to explore and draw conclusions about the ways in which various GYE stakeholders may formally recognize the GYE and subsequently demonstrate themes of ecosystem management.

Although Chapters 3, 4, and 5 each represent a separate enquiry into GYE recognition and subsequent connections to ecosystem management, some of the findings in each chapter have implications in relation to the others. First, the survey results on attitudes of residents of Bozeman, Red Lodge, and Jackson reported in Chapter 5 are

relevant to the discussion about whether or not GYE administrative units should specifically reference their unit as part of the GYE in their overarching land use planning/management plan. Because the majority of survey respondents supported planning and management in line with ecosystem management, these same respondents may be likely to support administrative units formally recognizing themselves as part of the GYE. Again, however, the survey results were not unanimous, thus support for formal recognition would most likely not be unanimous either.

Second, Shindler and Cheek (1999) argue that public ownership of environmental decisions and plans is a necessary component of ecosystem management. Data from the survey reported in Chapter 5 show that in the communities of Bozeman, Red Lodge, and Jackson there is a high level of support for interagency cooperation in planning and management. This has implications in regard to the findings about GYCC membership. In Chapter 4 it was noted that the GYCC membership is not comprehensive in that it does not include representatives from all state and county governments, for example. Thus, based on the argument of Shindler and Cheek (1999), and the results of my survey, another argument emerges in support for a more comprehensive membership in the GYCC: without public involvement and support, the GYCC may not garner much public backing for its cross-boundary decisions or initiatives which, as a result, can be an impediment to ecosystem management.

Third, the case study analysis of wildfire management can be compared with the survey results pertaining to wildfire in Chapter 5. The survey results indicated that many respondents were supportive of letting wildfires burn if they would have ecological benefits. Many of the respondents were also supportive of suppressing wildfires if they

had the potential to burn onto private land. These results mirror in many ways current wildfire policy in the GYE as revealed in the case study: although current wildfire policy does not strictly promote an ecological perspective, it does promote multiple perspectives including a perspective in which humans are seen as an important ecosystem component.

Implications of a Geographic Perspective

A geographic perspective of place, if more prevalent in the ecosystem management literature, would move ecosystem management beyond what appears to be the dominance of an ecology-only philosophy. Integration of a geographical understanding of place with ecology has the potential to draw much public support within the GYE, and in the end, has the potential to foster more on-the-ground ecosystem management initiatives because it is more representative of the coupled human-natural systems that exist in today's landscapes. In other words, ecosystem management needs to be carried out in such a way that is cognizant of place. To what extent place attributes (such as GYE residents' opinions about zoning, for example) should affect the realization of the themes and goals of ecosystem management was not discussed here, but is a topic that deserves continued attention from both physical and social scientists.

If the hope is to move ecosystem management forward in the GYE, it would need to move forward with an integrated, and elevated, human-environment perspective. Geographers, who are skilled at integrating knowledge of human and physical environments, are poised to contribute to a much needed, strengthened human-environment dialogue in ecosystem management. Through the geographic perspective of place and the ability to think holistically, geographers can broaden discussions of

ecosystem management. As Hanson (1999) argues, geographers should strive to bring their message to non-geographers, and would be doing so if they engaged more in ecosystem management discussions.

Knowing the result of the Vision exercise and the diversity of views that exist in the GYE regarding ecosystem management (see Reading et al. 1994 and Chapter Five, for example), some resistance could be expected if ecosystem management became a publicized endeavor. Thus, the challenge inherent in applying ecosystem management to the GYE is trying to reconcile the diverse views that exist amongst GYE residents—views that can be interpreted as differing meanings of place that people associate with the GYE. Geographers could be key in researching and disseminating knowledge about these diverse meanings of place.

Once these meanings of place are better known, as noted in Chapter 1, GYE planners and managers could play a large role in reconciling the diverse views present in the GYE by undertaking a mission to create a regional place identity within the GYE. A GYE regional place identity could be based on the ecological characteristics that underlie the GYE concept itself, as well as current and traditional cultural characteristics that influence people's perceptions of natural resource management. A common understanding of the GYE environment—both physical and social—could lay the foundation to apply ecosystem management principles that are both environmentally and socially sustainable.

Further Research Needs

This research determined if and how local GYE stakeholders recognize the GYE concept and if recognition could be tied to themes of ecosystem management. Three main avenues of research could augment this study.

Survey of Attitudes and Knowledge Which Includes More GYE Communities

Prior to this research, only one study (conducted in 1988) had attempted to quantify the knowledge and attitudes of GYE residents towards ecosystem management (see Reading et al. 1994). The research presented in Chapter 5, while insightful in regards to three New West communities in the GYE, cannot be extrapolated to the entire GYE. Thus, new research that attempts to quantify knowledge and attitudes towards the GYE and ecosystem management, conducted at a regional scale, is needed. Such information would provide particular insight into region-wide attitudes towards the GYE concept, ecosystem management, and the possibility of implementing facets of ecosystem management. This kind of information could be used by GYE planners and managers when considering planning and management initiatives.

Inventory of Current Ecological Projects Within the GYE

As noted in Chapters 3 and 4, there are currently interagency projects occurring within the GYE that aim to tackle environmental concerns that cross administrative boundaries. There is a lack of information, however, concerning the extent to which these projects are effective. An inventory of these current projects could be carried out to determine how effective they are ecologically, and how effective they are in light of

interagency cooperation. This inventory could result in broad lessons that could then be applied to other interagency cooperation initiatives in the GYE. This information would also have the potential to show to what extent ecosystem management is being carried out under the auspices of other project names or initiatives within the GYE.

Human Perspective of the GYE as a Place

Currently, the GYE boundary is based on ecological and physical characteristics. Although people live within this boundary, and these people are considered to be residents of the GYE, these people may not consider their place of inhabitation to be the region called the GYE. Thus there is a potential for there to be a disconnect between how the residents of the GYE define their "place" of inhabitation and how ecologists or physical geographers define the GYE. A study is needed to uncover these various meanings of place that GYE residents may have. Do GYE residents define their "place" as their town, county, or the GYE? Do GYE residents perceive themselves to be members of the GYE? What boundaries do they put on the GYE and how do they see themselves connected to the GYE, if at all? What could emerge from such a study is a realization that the residents of the GYE do not have a strong connection to other parts of the GYE, which could then be interpreted as evidence of a lacking regional place identity amongst GYE residents. It could also be found, however, that the residents of the GYE do have a sense that their "place" of inhabitation is the GYE. These findings would have important implications for ecosystem management initiatives in that they would extend the ecological/physical definition of the GYE to include the geographical and place-based understanding of GYE residents.

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APPENDICES

APPENDIX A

BUREAU OF LAND MANAGEMENT RESOURCE MANAGEMENT PLANS FOR
UNITS WITHIN THE GREATER YELLOWSTONE ECOSYSTEM

Bureau of Land Management Resource Management Plans
for Units within the Greater Yellowstone Ecosystem

Grass Creek Resource Management Plan, September 1998

Cody Resource Management Plan, November 1990

Kemmerer Resource Management Plan, April 1986

Pinedale Resource Management Plan, December 1988

Lander Resource Management Plan, June 1987

Pocatello Resource Management Plan, January 1988

Medicine Lodge Resource Management Plan, 1985

Billings Resource Management Plan, September 1984

Headwaters Resource Management Plan, November 1983

Dillon Management Framework Plan, September 1979

APPENDIX B

GREATER YELLOWSTONE ECOSYSTEM COUNTY LAND USE PLANS,
CURRENT AS OF OCTOBER 2003

Greater Yellowstone Ecosystem County Land Use Plans, Current as of October 2003.

GYE County	County Land Use Plan
Montana Counties:	
Beaverhead	Beaverhead County Comprehensive Plan, 1990
Madison	Madison County Comprehensive Plan, 1999
Gallatin	Gallatin County Plan, 1998
Park	Park County Comprehensive Plan, 1998
Sweet Grass	Sweet Grass Master Plan, 1990
Stillwater	Stillwater County Master Plan, 1997
Carbon	Growth Policy for Carbon County, MT, 2003
Idaho Counties:	
Clark	Clark County Comprehensive Land Use Plan, 1997
Fremont	Fremont County Comprehensive Plan, 2003
Madison	Madison County Comprehensive Plan, 1996
Teton	Teton County Comprehensive Plan, 1996
Bonneville	Bonneville Co. Comprehensive Land Use Plan, 1995
Bingham	Bingham County Comprehensive Plan, 1982
Caribou	Caribou County Comprehensive Plan, 1998
Franklin	Franklin County Comprehensive Plan, 2001
Bear Lake	Bear Lake Comprehensive Guide, 2002
Jefferson	Jefferson County Comprehensive Plan, 1988
Wyoming Counties:	
Park	Park County Land Use Plan, 1998
Teton	Jackson/Teton Comprehensive Plan, 1994
Lincoln	Lincoln County Comprehensive Plan, 1998
Sublette	Sublette County Comprehensive Plan, 1978
Fremont	Fremont County Land Use Plan, 1978
Hot Springs	Hot Springs County Land Use Plan, 2002

APPENDIX C

FIRE MANAGEMENT CASE STUDY INFORMATION SOURCES

Fire Management Case Study Information Sources

Between June 2001 and October 2003 the following people provided information about wildfire policy in their respective GYE units:

National Parks:

Lisa Elenz, Fire Management Officer, Yellowstone National Park.

Phil Perkins, Fire Management Officer, Yellowstone National Park.

National Forests:

Bill Breedlove, Fire Management Officer, Gallatin National Forest.

Dave Sisk, Fire Management Officer, Shoshone National Forest

Wade Burlson, former Fire Management Officer, Bridger-Teton National Forest.

Rod Dykehouse, Jackson District Fire Management Officer, Bridger-Teton National Forest.

Keith Birch, former Fire Management Officer, Caribou-Targhee National Forest

John Kidd, former acting Fire Management Officer, Caribou-Targhee National Forest

Chris Ourada, Fire Management Officer, Caribou-Targhee National Forest

Paul Mock, Fire Management Officer, Custer National Forest

Rand Herzberg, District Ranger, Beartooth District of the Custer National Forest

Al Kyles, Madison District Fire Management Officer, Beaverhead-Deerlodge National Forest.

Bureau of Land Management:

Tom Boatner, Fire Management Officer, Montana Bureau of Land Management

John Glenn, Fire Management Officer, Wyoming Bureau of Land Management

Rick Belger, Upper Snake District Fire Management Officer, Idaho Bureau of Land Management

National Wildlife Refuges:

Lance Roberts, Fire Management Officer, Grays Lake National Wildlife Refuge

Denny Gomez, Refuge Manager, Red Rocks Lake National Wildlife Refuge

Steve Brock, Refuge Manager, National Elk Refuge

Wyoming, Montana, and Idaho:

Brian Shiple, Bureau Chief of Fire Management, State of Idaho

Pete VanSickle, Bureau Chief of Forestry Trust Lands, State of Montana

Ray Weidenhaft, Assistant State Forester—Fire Management, State of Wyoming

APPENDIX D

BOZEMAN, MONTANA COVER LETTER AND SURVEY

Department of Earth Sciences
Montana State University
P.O. Box 173480
Bozeman, MT 59717

February 3, 2003

Dear Bozeman Area Resident:

As part of my graduate thesis research in the Earth Sciences Department at Montana State University, I am conducting a survey of residents in Bozeman and Red Lodge, Montana and Jackson, Wyoming. Your household has been chosen at random to participate in this survey.

This survey asks you about your knowledge, attitudes, and perceptions toward ecosystem management and wildfire within the Greater Yellowstone Ecosystem. Whether you know a lot, a little, or nothing at all about these issues, your participation in this survey is important to the overall success of my research. There are no right or wrong answers. The survey should take ten to fifteen minutes to complete and I have provided a self-addressed stamped envelope for you to return your completed survey. Please return the survey as soon as possible and before February 28, 2003.

I ask that the person in your household who fills out the survey be the adult (anyone 18 years or older) who most recently had his or her birthday. Please understand that year of birth plays no role in the choice, just the most recent date. All surveys will be kept confidential.

Let me stress again that your participation in this survey is very important—especially because you are in one of the few households being asked to complete this survey. After you complete and return the survey, your responses will be combined with other survey responses and analyzed. To encourage responses I am also offering one \$15 gift certificate to the Barnes and Noble Bookstore in Bozeman. This gift certificate will be awarded at random to one Bozeman area respondent.

If you wish to know the analysis results, or be notified as to whether a winner for the gift certificate has been chosen, please write to me at the Earth Sciences Department. You will also be able to access the results via <http://sun1.giac.montana.edu/giac.html>. Final survey results are anticipated to be ready for release by June 1, 2003.

Thank you for your participation.

Sincerely,

Crystal Stanionis
Graduate student in Earth Sciences—Geography
Montana State University

Perceptions, attitudes, and knowledge about ecosystem management issues in the Greater Yellowstone Ecosystem

The following questions are the only questions within this survey that will ask you for a written answer.

1.) Are you familiar with the following concept: "Greater Yellowstone Ecosystem"?

Please circle an answer:

Yes

No

If you answered yes, proceed to question 2.

If you answered no, proceed to question 3.

2.) How do you define the Greater Yellowstone Ecosystem? (Key words and/or phrases are fine.) After answering, proceed to question 3.

3.) Are you familiar with the following concept: "Ecosystem Management"?

Please circle an answer:

Yes

No

If you answered yes, answer question 4.

If you answered no, proceed to question 5.

4.) How do you define ecosystem management? (Key words and/or phrases are fine.) After answering, proceed to question 5.

Attention:

Please do not proceed until you have completed this page.

When instructed to proceed to question 5, please do so. Please note: you will find definitions that appear prior to question 5. Please read these definitions.

Please read the following definitions of the "Greater Yellowstone Ecosystem" and "ecosystem management." Please keep these definitions in mind while answering the remaining questions.

Greater Yellowstone Ecosystem:	Geographically, the ecosystem is a 19 million-acre area of distinctive geological and biological systems and similar social characteristics situated in Idaho, Montana, and Wyoming. The ecosystem includes Yellowstone National Park, Grand Teton National Park, six national forests, Bureau of Land Management lands, national wildlife refuges, state lands, and private lands. The ecosystem is commonly cited as a prime location for the application of ecosystem management.
Ecosystem management:	A type of land management that strives to maintain both ecological and social sustainability at various scales. Management goals include working with ecological boundaries as opposed to administrative boundaries, maintaining native ecological characteristics and processes, and promoting human use and occupancy that contributes to ecosystem sustainability.

Please continue answering survey questions, beginning with question 5.

Please circle your answer to the following questions.

- | | | | |
|---|-----|----|-------------|
| 5.) Is there currently one, multi-agency land use plan for the entire Greater Yellowstone Ecosystem? | Yes | No | Do not know |
| 6.) Do the superintendents of Yellowstone and Grand Teton National Parks, along with the supervisors of the national forests surrounding the parks, meet to discuss ecosystem issues? | Yes | No | Do not know |
| 7-a.) Have you read or heard about ecosystems prior to this survey? | Yes | No | |
| **If you answered yes, answer question 7-b and then proceed to question 8. | | | |
| **If you answered no, proceed to question 8 | | | |
| 7-b.) When you read or hear about ecosystems, do you generally think of humans as one component of the system? | Yes | No | Do not know |

The following is a list of statements about management in the Greater Yellowstone Ecosystem (GYE). To what extent do you agree or disagree with each statement? Please circle the number that corresponds with your opinion.

	Completely Agree	Generally Agree	Neither Agree Nor Disagree	Generally Disagree	Completely Disagree
8.) The GYE is a concept that should not be considered in land use planning at the federal level.	5	4	3	2	1
9.) The GYE is a concept that should be considered in land use planning at the state level.	5	4	3	2	1
10.) The GYE is a concept that should not be considered in land use planning at the county level.	5	4	3	2	1
11.) A regional effort to plan land uses in the GYE may be an effective method of tackling environmental concerns in the area.	5	4	3	2	1
12.) The GYE should be managed according to ecosystem management philosophy. (Refer to the definition given above for guidance).	5	4	3	2	1

The following questions will ask you about facets of ecosystem management as they might pertain to management in the Greater Yellowstone Ecosystem (GYE). Please circle your answer to the next three questions:

- 13.) Imagine that you owned land in the GYE and that the entire GYE was being managed under the philosophy of ecosystem management. If such management placed limits on how you, a private property owner, could use your land, how acceptable would this be to you?

Completely acceptable Generally acceptable Generally not acceptable Completely not acceptable

- 14.) In general, would you like your county planners to take into more or less consideration the land use goals of neighboring federal land managers (such as the forest service, etc.)? More Less The same Do not know

- 15.) Would you support a GYE regional land use plan which predefined uses of land for the entire ecosystem (including predefined uses for all federal, state, and private lands)?

A great deal Some Only a little Not at all

The next three sets of questions will ask you about wildfires within the Greater Yellowstone Ecosystem (GYE). These questions are being posed to gauge knowledge and sentiment about wildfire occurrence in the GYE.

Please circle your answer to the following questions:

- 16.) Is wildfire a natural component of the GYE? Yes No Do not know

- 17.) Is Yellowstone National Park the only management area within the GYE where lightning-caused wildfires are permitted to burn? Yes No Do not know

For the following four questions, please circle the number that corresponds to your opinion.

	Completely Agree	Generally Agree	Neither Agree Nor Disagree	Generally Disagree	Completely Disagree
18.) GYE counties are sufficiently addressing community wildfire risk by requiring the clearing of brush and the utilization of proper construction materials by those who reside in the wildland-urban interface, commonly defined as where wildlands intermix with inhabited areas.	5	4	3	2	1
19.) GYE county land-use planners should restrict development in the wildland-urban interface.	5	4	3	2	1
20.) GYE counties should expect neighboring state and federal land managers to reduce fire risk on their respective lands so that risk to county residents is minimized.	5	4	3	2	1
21.) All GYE lightning-caused wildfires should be suppressed.	5	4	3	2	1

**If you circled the number 5 in question number 21, please skip to question number 24.

**If you circled numbers 4, 3, 2, or 1 in question number 21, please answer all of the questions that follow.

Please read the following questions and then circle the number that corresponds with your opinion.

- 22.) Imagine a lightning-caused wildfire in the Greater Yellowstone Ecosystem. Managers recognize that this wildfire will provide important ecological benefits. To what extent do you agree that such lightning-caused wildfires should be permitted to burn in the following areas?

	Completely Agree	Generally Agree	Neither Agree Nor Disagree	Generally Disagree	Completely Disagree
22-a.) National parks	5	4	3	2	1
22-b.) Designated Wilderness areas of national forests.	5	4	3	2	1
22-c.) Non-Wilderness areas of national forests.	5	4	3	2	1
22-d.) Designated Wilderness areas of Bureau of Land Management lands.	5	4	3	2	1
22-e.) Non-Wilderness areas of Bureau of Land Management lands.	5	4	3	2	1
22-f.) National wildlife refuges.	5	4	3	2	1
22-g.) State-managed lands.	5	4	3	2	1
22-h.) Gallatin County	5	4	3	2	1

- 23.) To what extent do you agree that lightning-caused wildfires should be suppressed within the following Greater Yellowstone Ecosystem areas if they have the potential to burn onto private lands?

	Completely Agree	Generally Agree	Neither Agree Nor Disagree	Generally Disagree	Completely Disagree
23-a.) Within national parks.	5	4	3	2	1
23-b.) Within designated Wilderness areas of national forests	5	4	3	2	1
23-c.) Within non-Wilderness areas of national forests	5	4	3	2	1
23-d.) Within designated Wilderness areas of Bureau of Land Management lands.	5	4	3	2	1
23-e.) Within non-Wilderness areas of Bureau of Land Management lands.	5	4	3	2	1
23-f.) Within national wildlife refuges	5	4	3	2	1
23-g.) Within state-managed lands.	5	4	3	2	1
23-h.) Within Gallatin County	5	4	3	2	1

Please answer the following questions pertaining to you:

24.) Please circle your age group. 18-24 25-35 36-45 46-55 56-65 66-75 76-85 86 and above

25.) Please circle your gender: Female Male

26.) How long have you lived in the town/area in which you received this survey ?
Please circle your answer: Less than one year 1-5 years 6-10 years
 11-20 years 21-30 years More than 30 years

27.) Please list any other communities in Montana, Idaho, or Wyoming in which you have lived. Also give the length of time you lived in that community.

Place(s): _____ Length(s) of time: _____

28.) How would classify your present residency in the town in which you received this survey?
Please circle one: full time half time quarter time

29.) How would you classify yourself?
Please circle all that apply: employed unemployed retired student

29-b.) If employed, what is your occupation? If not employed, skip to question 30.
Please check one occupation category:

☐ management	☐ healthcare	☐ farming/ranching
☐ business and financial operations	☐ protective services	☐ construction
☐ computer or engineering science	☐ food services	☐ installations, maintenance, and repair
☐ architecture	☐ building and grounds cleaning and maintenance	☐ production
☐ life, physical, and social science	☐ personal care and service	☐ transportation
☐ community and social services	☐ office and administrative support	☐ military
☐ legal	☐ fishing	☐ education, training, and library
☐ arts, design, entertainment, sports, media	☐ forestry	☐ homemaker
		☐ other (please list) _____

30.) What is the highest grade or year of school you have completed?
Please circle one: 9th grade or below 10th grade 11th grade 12th grade
 College: Freshman, Sophomore, Junior, Senior Masters Degree Doctorate Degree

31.) Do you consider your primary residence to be in the wildland-urban interface?
(Please refer to question number 18 for the definition of wildland-urban interface). Please circle one: Yes No

32.) Do you have a secondary residence or cabin *within* the Greater Yellowstone Ecosystem that you would consider to be in the wildland-urban interface? Please circle one: Yes No

33.) Do you have a secondary residence or cabin *outside of* the Greater Yellowstone Ecosystem that you would consider to be in the wildland-urban interface? Please circle one: Yes No

Thank you for all of your responses. Please refold the survey, place it in the self-addressed, stamped envelope that is provided, and mail it. If you have misplaced the envelope, please send your survey to:
The Department of Earth Sciences, Montana State University, Attn: Crystal Stanionis, P.O. Box 173480, Bozeman, MT, 59717.

APPENDIX E

RED LODGE, MONTANA COVER LETTER AND SURVEY

Department of Earth Sciences
Montana State University
P.O. Box 173480
Bozeman, MT 59717

February 3, 2003

Dear Red Lodge Area Resident:

As part of my graduate thesis research in the Earth Sciences Department at Montana State University, I am conducting a survey of residents in Bozeman and Red Lodge, Montana and Jackson, Wyoming. Your household has been chosen at random to participate in this survey.

This survey asks you about your knowledge, attitudes, and perceptions toward ecosystem management and wildfire within the Greater Yellowstone Ecosystem. Whether you know a lot, a little, or nothing at all about these issues, your participation in this survey is important to the overall success of my research. There are no right or wrong answers. The survey should take ten to fifteen minutes to complete and I have provided a self-addressed stamped envelope for you to return your completed survey. Please return the survey as soon as possible and before February 28, 2003.

I ask that the person in your household who fills out the survey be the adult (anyone 18 years or older) who most recently had his or her birthday. Please understand that year of birth plays no role in the choice, just the most recent date. All surveys will be kept confidential.

Let me stress again that your participation in this survey is very important—especially because you are in one of the few households being asked to complete this survey. After you complete and return the survey, your responses will be combined with other survey responses and analyzed. To encourage responses I am also offering one \$15 gift certificate to Red Lodge Books. This gift certificate will be awarded at random to one Red Lodge area respondent.

If you wish to know the analysis results, or be notified as to whether a winner for the gift certificate has been chosen, please write to me at the Earth Sciences Department. You will also be able to access the results via <http://sun1.giac.montana.edu/giac.html>. Final survey results are anticipated to be ready for release by June 1, 2003.

Thank you for your participation.

Sincerely,

Crystal Stanionis
Graduate student in Earth Sciences—Geography
Montana State University

Perceptions, attitudes, and knowledge about ecosystem management issues in the Greater Yellowstone Ecosystem

The following questions are the only questions within this survey that will ask you for a written answer.

1.) Are you familiar with the following concept: "Greater Yellowstone Ecosystem"?

Please circle an answer:

Yes

No

If you answered yes, proceed to question 2.

If you answered no, proceed to question 3.

2.) How do you define the Greater Yellowstone Ecosystem? (Key words and/or phrases are fine.) After answering, proceed to question 3.

3.) Are you familiar with the following concept: "Ecosystem Management"?

Please circle an answer:

Yes

No

If you answered yes, answer question 4.

If you answered no, proceed to question 5.

4.) How do you define ecosystem management? (Key words and/or phrases are fine.) After answering, proceed to question 5.

Attention:

Please do not proceed until you have completed this page.

When instructed to proceed to question 5, please do so. Please note: you will find definitions that appear prior to question 5. Please read these definitions.

Please read the following definitions of the "Greater Yellowstone Ecosystem" and "ecosystem management." Please keep these definitions in mind while answering the remaining questions.

Greater Yellowstone Ecosystem:	Geographically, the ecosystem is a 19 million-acre area of distinctive geological and biological systems and similar social characteristics situated in Idaho, Montana, and Wyoming. The ecosystem includes Yellowstone National Park, Grand Teton National Park, six national forests, Bureau of Land Management lands, national wildlife refuges, state lands, and private lands. The ecosystem is commonly cited as a prime location for the application of ecosystem management.
Ecosystem management:	A type of land management that strives to maintain both ecological and social sustainability at various scales. Management goals include working with ecological boundaries as opposed to administrative boundaries, maintaining native ecological characteristics and processes, and promoting human use and occupancy that contributes to ecosystem sustainability.

Please continue answering survey questions, beginning with question 5.

Please circle your answer to the following questions.

- | | | | |
|---|-----|----|-------------|
| 5.) Is there currently one, multi-agency land use plan for the entire Greater Yellowstone Ecosystem? | Yes | No | Do not know |
| 6.) Do the superintendents of Yellowstone and Grand Teton National Parks, along with the supervisors of the national forests surrounding the parks, meet to discuss ecosystem issues? | Yes | No | Do not know |
| 7-a.) Have you read or heard about ecosystems prior to this survey? | Yes | No | |
| **If you answered yes, answer question 7-b and then proceed to question 8. | | | |
| **If you answered no, proceed to question 8 | | | |
| 7-b.) When you read or hear about ecosystems, do you generally think of humans as one component of the system? | Yes | No | Do not know |

The following is a list of statements about management in the Greater Yellowstone Ecosystem (GYE). To what extent do you agree or disagree with each statement? Please circle the number that corresponds with your opinion.

	Completely Agree	Generally Agree	Neither Agree Nor Disagree	Generally Disagree	Completely Disagree
8.) The GYE is a concept that should not be considered in land use planning at the federal level.	5	4	3	2	1
9.) The GYE is a concept that should be considered in land use planning at the state level.	5	4	3	2	1
10.) The GYE is a concept that should not be considered in land use planning at the county level.	5	4	3	2	1
11.) A regional effort to plan land uses in the GYE may be an effective method of tackling environmental concerns in the area.	5	4	3	2	1
12.) The GYE should be managed according to ecosystem management philosophy. (Refer to the definition given above for guidance).	5	4	3	2	1

The following questions will ask you about facets of ecosystem management as they might pertain to management in the Greater Yellowstone Ecosystem (GYE). Please circle your answer to the next three questions:

- 13.) Imagine that you owned land in the GYE and that the entire GYE was being managed under the philosophy of ecosystem manager. If such management placed limits on how you, a private property owner, could use your land, how acceptable would this be to you?

Completely acceptable Generally acceptable Generally not acceptable Completely not acceptable

- 14.) In general, would you like your county planners to take into more or less consideration the land use goals of neighboring federal land managers (such as the forest service, etc.)? More Less The same Do not know

- 15.) Would you support a GYE regional land use plan which predefined uses of land for the entire ecosystem (including predefined uses for all federal, state, and private lands)?

A great deal Some Only a little Not at all

The next three sets of questions will ask you about wildfires within the Greater Yellowstone Ecosystem (GYE). These questions are being posed to gauge knowledge and sentiment about wildfire occurrence in the GYE.

Please circle your answer to the following questions:

- 16.) Is wildfire a natural component of the GYE? Yes No Do not know

- 17.) Is Yellowstone National Park the only management area within the GYE where lightning-caused wildfires are permitted to burn? Yes No Do not know

For the following four questions, please circle the number that corresponds to your opinion.

- | | Completely
Agree | Generally
Agree | Neither Agree
Nor Disagree | Generally
Disagree | Completely
Disagree |
|---|---------------------|--------------------|-------------------------------|-----------------------|------------------------|
| 18.) GYE counties are sufficiently addressing community wildfire risk by requiring the clearing of brush and the utilization of proper construction materials by those who reside in the wildland-urban interface, commonly defined as where wildlands intermix with inhabited areas. | 5 | 4 | 3 | 2 | 1 |
| 19.) GYE county land-use planners should restrict development in the wildland-urban interface. | 5 | 4 | 3 | 2 | 1 |
| 20.) GYE counties should expect neighboring state and federal land managers to reduce fire risk on their respective lands so that risk to county residents is minimized. | 5 | 4 | 3 | 2 | 1 |
| 21.) All GYE lightning-caused wildfires should be suppressed. | 5 | 4 | 3 | 2 | 1 |

**If you circled the number 5 in question number 21, please skip to question number 24.

**If you circled numbers 4, 3, 2, or 1 in question number 21, please answer all of the questions that follow.

Please read the following questions and then circle the number that corresponds with your opinion.

22.) Imagine a lightning-caused wildfire in the Greater Yellowstone Ecosystem. Managers recognize that this wildfire will provide important ecological benefits. To what extent do you agree that such lightning-caused wildfires should be permitted to burn in the following areas?

	Completely Agree	Generally Agree	Neither Agree Nor Disagree	Generally Disagree	Completely Disagree
22-a.) National parks	5	4	3	2	1
22-b.) Designated Wilderness areas of national forests.	5	4	3	2	1
22-c.) Non-Wilderness areas of national forests.	5	4	3	2	1
22-d.) Designated Wilderness areas of Bureau of Land Management lands.	5	4	3	2	1
22-e.) Non-Wilderness areas of Bureau of Land Management lands.	5	4	3	2	1
22-f.) National wildlife refuges.	5	4	3	2	1
22-g.) State-managed lands.	5	4	3	2	1
22-h.) Gallatin County	5	4	3	2	1

23.) To what extent do you agree that lightning-caused wildfires should be suppressed within the following Greater Yellowstone Ecosystem areas if they have the potential to burn onto private lands?

	Completely Agree	Generally Agree	Neither Agree Nor Disagree	Generally Disagree	Completely Disagree
23-a.) Within national parks.	5	4	3	2	1
23-b.) Within designated Wilderness areas of national forests	5	4	3	2	1
23-c.) Within non-Wilderness areas of national forests	5	4	3	2	1
23-d.) Within designated Wilderness areas of Bureau of Land Management lands.	5	4	3	2	1
23-e.) Within non-Wilderness areas of Bureau of Land Management lands.	5	4	3	2	1
23-f.) Within national wildlife refuges	5	4	3	2	1
23-g.) Within state-managed lands.	5	4	3	2	1
23-h.) Within Carbon County	5	4	3	2	1

Please answer the following questions pertaining to you:

24.) Please circle your age group. 18-24 25-35 36-45 46-55 56-65 66-75 76-85 86 and above

25.) Please circle your gender: Female Male

26.) How long have you lived in the town/area in which you received this survey ?
Please circle your answer: Less than one year 1-5 years 6-10 years
 11-20 years 21-30 years More than 30 years

27.) Please list any other communities in Montana, Idaho, or Wyoming in which you have lived. Also give the length of time you lived in that community.

Place(s): _____ Length(s) of time: _____

28.) How would classify your present residency in the town in which you received this survey?
Please circle one: full time half time quarter time

29.) How would you classify yourself?
Please circle all that apply: employed unemployed retired student

29-b.) If employed, what is your occupation? If not employed, skip to question 30.
Please check one occupation category:

☐ management	☐ healthcare	☐ farming/ranching
☐ business and financial operations	☐ protective services	☐ construction
☐ computer or engineering science	☐ food services	☐ installations, maintenance, and repair
☐ architecture	☐ building and grounds cleaning and maintenance	☐ production
☐ life, physical, and social science	☐ personal care and service	☐ transportation
☐ community and social services	☐ office and administrative support	☐ military
☐ legal	☐ fishing	☐ education, training, and library
☐ arts, design, entertainment, sports, media	☐ forestry	☐ homemaker
		☐ other (please list) _____

30.) What is the highest grade or year of school you have completed?
Please circle one: 9th grade or below 10th grade 11th grade 12th grade
 College: Freshman, Sophomore, Junior, Senior Masters Degree Doctorate Degree

31.) Do you consider your primary residence to be in the wildland-urban interface?
(Please refer to question number 18 for the definition of wildland-urban interface). Please circle one: Yes No

32.) Do you have a secondary residence or cabin *within* the Greater Yellowstone
Ecosystem that you would consider to be in the wildland-urban interface? Please circle one: Yes No

33.) Do you have a secondary residence or cabin *outside* of the Greater Yellowstone
Ecosystem that you would consider to be in the wildland-urban interface? Please circle one: Yes No

Thank you for all of your responses. Please refold the survey, place it in the self-addressed, stamped envelope that is provided, and mail it. If you have misplaced the envelope, please send your survey to:
The Department of Earth Sciences, Montana State University, Attn: Crystal Stanionis, P.O. Box 173480, Bozeman, MT, 59717.

APPENDIX F

JACKSON, WYOMING COVER LETTER AND SURVEY

Department of Earth Sciences
Montana State University
P.O. Box 173480
Bozeman, MT 59717

February 18, 2003

Dear Jackson Area Resident:

As part of my graduate thesis research in the Earth Sciences Department at Montana State University, I am conducting a survey of residents in Bozeman and Red Lodge, Montana and Jackson, Wyoming. Your household has been chosen at random to participate in this survey.

This survey asks you about your knowledge, attitudes, and perceptions toward ecosystem management and wildfire within the Greater Yellowstone Ecosystem. Whether you know a lot, a little, or nothing at all about these issues, your participation in this survey is important to the overall success of my research. There are no right or wrong answers. The survey should take ten to fifteen minutes to complete and I have provided a self-addressed stamped envelope for you to return your completed survey. Please return the survey as soon as possible and before March 14, 2003.

I ask that the person in your household who fills out the survey be the adult (anyone 18 years or older) who most recently had his or her birthday. Please understand that year of birth plays no role in the choice, just the most recent date. All surveys will be kept confidential.

Let me stress again that your participation in this survey is very important—especially because you are in one of the few households being asked to complete this survey. After you complete and return the survey, your responses will be combined with other survey responses and analyzed. To encourage responses I am also offering one \$15 gift certificate to Main Event Books in Jackson. This gift certificate will be awarded at random to one Jackson area respondent.

If you wish to know the analysis results, or be notified as to whether a winner for the gift certificate has been chosen, please write to me at the Earth Sciences Department. You will also be able to access the results via <http://sun1.giac.montana.edu/giac.html>. Final survey results are anticipated to be ready for release by June 1, 2003.

Thank you for your participation.

Sincerely,

Crystal Stanionis
Graduate student in Earth Sciences—Geography
Montana State University

Perceptions, attitudes, and knowledge about ecosystem management issues in the Greater Yellowstone Ecosystem

The following questions are the only questions within this survey that will ask you for a written answer.

1.) Are you familiar with the following concept: "Greater Yellowstone Ecosystem"?

Please circle an answer:

Yes

No

If you answered yes, proceed to question 2.

If you answered no, proceed to question 3.

2.) How do you define the Greater Yellowstone Ecosystem? (Key words and/or phrases are fine.) After answering, proceed to question 3.

3.) Are you familiar with the following concept: "Ecosystem Management"?

Please circle an answer:

Yes

No

If you answered yes, answer question 4.

If you answered no, proceed to question 5.

4.) How do you define ecosystem management? (Key words and/or phrases are fine.) After answering, proceed to question 5.

Attention:

Please do not proceed until you have completed this page.

When instructed to proceed to question 5, please do so. Please note: you will find definitions that appear prior to question 5. Please read these definitions.

Please read the following definitions of the "Greater Yellowstone Ecosystem" and "ecosystem management." Please keep these definitions in mind while answering the remaining questions.

Greater Yellowstone Ecosystem:	Geographically, the ecosystem is a 19 million-acre area of distinctive geological and biological systems and similar social characteristics situated in Idaho, Montana, and Wyoming. The ecosystem includes Yellowstone National Park, Grand Teton National Park, six national forests, Bureau of Land Management lands, national wildlife refuges, state lands, and private lands. The ecosystem is commonly cited as a prime location for the application of ecosystem management.
Ecosystem management:	A type of land management that strives to maintain both ecological and social sustainability at various scales. Management goals include working with ecological boundaries as opposed to administrative boundaries, maintaining native ecological characteristics and processes, and promoting human use and occupancy that contributes to ecosystem sustainability.

Please continue answering survey questions, beginning with question 5.

Please circle your answer to the following questions.

5.) Is there currently one, multi-agency land use plan for the entire Greater Yellowstone Ecosystem?	Yes	No	Do not know
6.) Do the superintendents of Yellowstone and Grand Teton National Parks, along with the supervisors of the national forests surrounding the parks, meet to discuss ecosystem issues?	Yes	No	Do not know
7-a.) Have you read or heard about ecosystems prior to this survey? **If you answered yes, answer question 7-b and then proceed to question 8. **If you answered no, proceed to question 8	Yes	No	
7-b.) When you read or hear about ecosystems, do you generally think of humans as one component of the system?	Yes	No	Do not know

The following is a list of statements about management in the Greater Yellowstone Ecosystem (GYE). To what extent do you agree or disagree with each statement? Please circle the number that corresponds with your opinion.

	Completely Agree	Generally Agree	Neither Agree Nor Disagree	Generally Disagree	Completely Disagree
8.) The GYE is a concept that should not be considered in land use planning at the federal level.	5	4	3	2	1
9.) The GYE is a concept that should be considered in land use planning at the state level.	5	4	3	2	1
10.) The GYE is a concept that should not be considered in land use planning at the county level.	5	4	3	2	1
11.) A regional effort to plan land uses in the GYE may be an effective method of tackling environmental concerns in the area.	5	4	3	2	1
12.) The GYE should be managed according to ecosystem management philosophy. (Refer to the definition given above for guidance).	5	4	3	2	1

The following questions will ask you about facets of ecosystem management as they might pertain to management in the Greater Yellowstone Ecosystem (GYE). Please circle your answer to the next three questions:

- 13.) Imagine that you owned land in the GYE and that the entire GYE was being managed under the philosophy of ecosystem management. If such management placed limits on how you, a private property owner, could use your land, how acceptable would this be to you?

Completely acceptable Generally acceptable Generally not acceptable Completely not acceptable

- 14.) In general, would you like your county planners to take into more or less consideration the land use goals of neighboring federal land managers (such as the forest service, etc.)? More Less The same Do not know

- 15.) Would you support a GYE regional land use plan which predefined uses of land for the entire ecosystem (including predefined uses for all federal, state, and private lands)?

A great deal Some Only a little Not at all

The next three sets of questions will ask you about wildfires within the Greater Yellowstone Ecosystem (GYE). These questions are being posed to gauge knowledge and sentiment about wildfire occurrence in the GYE.

Please circle your answer to the following questions:

- 16.) Is wildfire a natural component of the GYE? Yes No Do not know

- 17.) Is Yellowstone National Park the only management area within the GYE where lightning-caused wildfires are permitted to burn? Yes No Do not know

For the following four questions, please circle the number that corresponds to your opinion.

- | | Completely
Agree | Generally
Agree | Neither Agree
Nor Disagree | Generally
Disagree | Completely
Disagree |
|---|---------------------|--------------------|-------------------------------|-----------------------|------------------------|
| 18.) GYE counties are sufficiently addressing community wildfire risk by requiring the clearing of brush and the utilization of proper construction materials by those who reside in the wildland-urban interface, commonly defined as where wildlands intermix with inhabited areas. | 5 | 4 | 3 | 2 | 1 |
| 19.) GYE county land-use planners should restrict development in the wildland-urban interface. | 5 | 4 | 3 | 2 | 1 |
| 20.) GYE counties should expect neighboring state and federal land managers to reduce fire risk on their respective lands so that risk to county residents is minimized. | 5 | 4 | 3 | 2 | 1 |
| 21.) All GYE lightning-caused wildfires should be suppressed. | 5 | 4 | 3 | 2 | 1 |

**If you circled the number 5 in question number 21, please skip to question number 24.

**If you circled numbers 4, 3, 2, or 1 in question number 21, please answer all of the questions that follow.

Please read the following questions and then circle the number that corresponds with your opinion.

22.) Imagine a lightning-caused wildfire in the Greater Yellowstone Ecosystem. Managers recognize that this wildfire will provide important ecological benefits. To what extent do you agree that such lightning-caused wildfires should be permitted to burn in the following areas?

	Completely Agree	Generally Agree	Neither Agree Nor Disagree	Generally Disagree	Completely Disagree
22-a.) National parks	5	4	3	2	1
22-b.) Designated Wilderness areas of national forests.	5	4	3	2	1
22-c.) Non-Wilderness areas of national forests.	5	4	3	2	1
22-d.) Designated Wilderness areas of Bureau of Land Management lands.	5	4	3	2	1
22-e.) Non-Wilderness areas of Bureau of Land Management lands.	5	4	3	2	1
22-f.) National wildlife refuges.	5	4	3	2	1
22-g.) State-managed lands.	5	4	3	2	1
22-h.) Gallatin County	5	4	3	2	1

23.) To what extent do you agree that lightning-caused wildfires should be suppressed within the following Greater Yellowstone Ecosystem areas if they have the potential to burn onto private lands?

	Completely Agree	Generally Agree	Neither Agree Nor Disagree	Generally Disagree	Completely Disagree
23-a.) Within national parks.	5	4	3	2	1
23-b.) Within designated Wilderness areas of national forests	5	4	3	2	1
23-c.) Within non-Wilderness areas of national forests	5	4	3	2	1
23-d.) Within designated Wilderness areas of Bureau of Land Management lands.	5	4	3	2	1
23-e.) Within non-Wilderness areas of Bureau of Land Management lands.	5	4	3	2	1
23-f.) Within national wildlife refuges	5	4	3	2	1
23-g.) Within state-managed lands.	5	4	3	2	1
23-h.) Within Teton County	5	4	3	2	1

Please answer the following questions pertaining to you:

24.) Please circle your age group. 18-24 25-35 36-45 46-55 56-65 66-75 76-85 86 and above

25.) Please circle your gender: Female Male

26.) How long have you lived in the town/area in which you received this survey ?
Please circle your answer: Less than one year 1-5 years 6-10 years
 11-20 years 21-30 years More than 30 years

27.) Please list any other communities in Montana, Idaho, or Wyoming in which you have lived. Also give the length of time you lived in that community.

Place(s): _____ Length(s) of time: _____

28.) How would you classify your present residency in the town in which you received this survey?
Please circle one: full time half time quarter time

29.) How would you classify yourself?
Please circle all that apply: employed unemployed retired student

29-b.) If employed, what is your occupation? If not employed, skip to question 30.
Please check one occupation category:

☐ management	☐ healthcare	☐ farming/ranching
☐ business and financial operations	☐ protective services	☐ construction
☐ computer or engineering science	☐ food services	☐ installations, maintenance, and repair
☐ architecture	☐ building and grounds cleaning and maintenance	☐ production
☐ life, physical, and social science	☐ personal care and service	☐ transportation
☐ community and social services	☐ office and administrative support	☐ military
☐ legal	☐ fishing	☐ education, training, and library
☐ arts, design, entertainment, sports, media	☐ forestry	☐ homemaker
		☐ other (please list) _____

30.) What is the highest grade or year of school you have completed?
Please circle one: 9th grade or below 10th grade 11th grade 12th grade
College: Freshman, Sophomore, Junior, Senior Masters Degree Doctorate Degree

31.) Do you consider your primary residence to be in the wildland-urban interface?
(Please refer to question number 18 for the definition of wildland-urban interface). Please circle one: Yes No

32.) Do you have a secondary residence or cabin *within* the Greater Yellowstone Ecosystem that you would consider to be in the wildland-urban interface? Please circle one: Yes No

33.) Do you have a secondary residence or cabin *outside of* the Greater Yellowstone Ecosystem that you would consider to be in the wildland-urban interface? Please circle one: Yes No

Thank you for all of your responses. Please refold the survey, place it in the self-addressed, stamped envelope that is provided, and mail it. If you have misplaced the envelope, please send your survey to:
The Department of Earth Sciences, Montana State University, Attn: Crystal Stanionis, P.O. Box 173480, Bozeman, MT, 59717.

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