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## Feature Article:

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# The Greater Yellowstone Ecosystem: The Ecosystem Concept in Natural Resource Policy and Management

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The Greater Yellowstone Ecosystem (GYE) is a large biogeographic area defined as "the high mountainous region centered around Yellowstone National Park and surrounded by dry regions" (Congressional Research Service 1986a:342). Situated in northwestern Wyoming and adjacent parts of Idaho and Montana, the GYE consists of Yellowstone and Grand Teton national parks, seven national forests, three national wildlife refuges and lesser amounts of national resource lands, Bureau of Reclamation lands, state lands and private lands totalling over 14 million acres (Figure 1). A precise boundary of the GYE has not been delineated for policy, administrative or management purposes, despite the fact that the GYE is recognized as a unified natural system (e.g., Greater Yellowstone Coalition 1983, Congressional Research Service 1986a,b).

The notion that the GY area is biogeographically distinct can be traced to the earliest writings about the region. However, the specific use of the term "ecosystem" is new (Haynes 1880 cited in Hocker 1979, Camenzind 1985). The application of the ecosystem label to this region, absent from the scientific and popular literature 10 years ago, now is gaining currency as a resource management concept and represents a major innovation in natural resource policy. Evolving a well founded, scientifically-based ecosystem definition is expected to improve management in the region. Applying comprehensive management to the GYE requires a consistent policy base, appropriate administrative arrangements and an array of technical capabilities which have been only partially developed. This article briefly examines the origin and growing use of the GYE concept and its role in the growing policy debate about the region's future. It concludes with some thoughts for unifying policy and management in the GYE.

The term "ecosystem" was first used by Tansley (1935) to describe interactive systems of living things, together with their non-living habitats. Earlier, natural scientists had described the concept under many names (e.g.,

microcosm, Forbes 1881; naturkomplex, Markus 1926; holocoen, Friedrichs; biosystem, Thienemann 1939; all cited in Cox 1969). Odum and Odum's (1959) text, *Fundamentals of Ecology*, focused on ecosystems. Today, we recognize that "in its fundamental aspects, an ecosystem involves the circulation, transformation and accumulation of energy and matter through the medium of living things and their activities" (Cox 1969:3). Worldwide, systematic ecosystem analysis was undertaken in selected areas for the first time through the International Biological Program (Van Dyne 1969). The Leopold Commission (1962), established by the National Park Service, issued the "Leopold Report," which recognized the need to protect biotic communities and wildlife habitats; it also recognized that communities were dynamic in national parks. Influenced by the report, Houston (1971:651) addressed the ecosystem concept in the context of Yellowstone National Park and found a need for "an appraisal of ecosystem completeness" to ensure the maintenance of wild populations of ungulates that ranged widely outside park boundaries each winter. The first use of "Greater Yellowstone Ecosystem" was by Craighead (1979), who recognized that Yellowstone grizzly bears used about five million acres, of which only 2.2 million were in the park. He concluded that grizzly bear conservation required proper management throughout the entire grizzly bear ecosystem. More recently, the ecosystem concept was applied to Jackson Hole, just south of Yellowstone National Park, by Clark (1981) and the GYE concept was explored in general terms by Camenzind (1985). Explicit in recent applications of the concept to the GY area is recognition that policy, administration and management over this administratively fragmented region needs consistency and coordination to protect the system's integrity (Congressional Research Service 1986a,b).

## RECENT APPLICATIONS OF THE CONCEPT

After the late 1970's application of the GYE concept to grizzly bear conservation, the concept was extended to



other species and introduced in the public policy arena. Biologically, GYE application includes large birds and mammals—bald eagles, trumpeter swans, elk, grizzly bears and peregrine falcons. (Figure 2). Three examples illustrate this. First, the Greater Yellowstone Ecosystem Bald Eagle Working Team (1983:iv) recognized the GYE as a planning unit showing biological integrity and noted that "the Greater Yellowstone Ecosystem bald eagle population is one of the most significant populations in the Rocky Mountains." Second, Mattson and Despain (1985:1) concluded: "The continued existence of grizzly bears in the Greater Yellowstone Ecosystem is largely dependent upon the maintenance and improvement of suitable habitat in the face of increasing pressure for the development and recreational use of lands within the ecosystem." Third, ecological continuity of Yellowstone National Park and the southern boundary of the GYE was documented by Hoak et al. (1982), who noted that wolverines increased in western Wyoming after 1972 when Executive Order No. 11643 banned poisons for predator control on federal lands. A small wolverine reservoir in Yellowstone National Park rapidly colonized all mountainous areas adjacent to the park after the ban. These mountains are continuous with the park and current wolverine distribution helps define the ecosystem's boundaries.

In all cases where the GYE concept was employed, wildlife biologists found that Yellowstone National Park contained only part of the species' regional range and that Yellowstone National Park by itself was too small to sustain "viable" populations of these species. That legal boundaries of parks often do not correspond with biological boundaries necessary to maintain species, communities and ecological processes is well documented (e.g., Newmark 1985, 1986). In addition to the regional spatial requirements of numerous animal species, a more precise definition of the GYE for management purposes should include vegetation, watersheds and geological features.

Several scientific meetings have focused on the GYE theme. The Greater Yellowstone Coalition's scientific conferences, for example, examined a different aspect of the ecosystem each year. In 1986, biological diversity was the theme and, in 1987, elk conservation on Yellowstone National Park's northern range was examined. The Society of American Foresters' Intermountain Society meeting's 1986 theme was "Natural Resource Management Within The Greater Yellowstone Ecosystem." The meeting's proceedings were published in a special issue of *Western Wildlands* entitled "The Greater Yellowstone Ecosystem" in which views of researchers and administrators responsible for managing lands in the GYE were offered. The Wildlife Society Wyoming Chapter's (1986) annual meeting was also on "The Greater Yellowstone Ecosystem."

There are numerous applications of the GYE concept in the growing public policy debate. The Greater Yellowstone Coalition, formed in 1983, has a membership of more than 40 organizations and many individuals and is encouraging use of the GYE concept. The coalition has publicized the serious nature of the threats to the GYE, the problem of its fragmented and uncoordinated management and the opportunities to preserve and protect it (Greater Yellowstone Coalition 1984). The coalition believes that the GYE is not adequately protected by current policy and that significant cumulative effects on the ecosystem are mounting from road construction, logging, oil and gas drilling, geothermal drilling, ski areas, dams, mines, subdivisions and the poaching of wildlife (Greater Yellowstone Coalition 1986a).

The Greater Yellowstone idea has also been brought to the public's attention via popularized descriptions by Reese (1985) and others. Such widely distributed books fuel growing popular attention to the idea. In Reese's picturesque volume, he developed five themes: (1) Yellowstone National Park is a very special, and in some respects, a unique place; (2) the park is not an island, but rather exists in an ecological context called the Greater Yellowstone Ecosystem; (3) the entire Greater Yellowstone Ecosystem is an extraordinary national treasure—the largest, essentially intact ecosystem remaining in the temperate zones of the earth; (4) most resource management decisions in the GYE are made in a fragmented manner that does not recognize the entire area as a single ecological unit; and (5) the GYE is imperiled by activities and developments that pose imminent threats to its environmental integrity. These themes are at the heart of the policy debate, even though, in fact, GYE is not the largest "intact ecosystem" remaining.

The Wilderness Society recently used the GYE as an example of the need for and advantages of maintaining biological diversity in large wildland areas in the United States (Norse et al. 1986, The Wilderness Society 1987). The GYE, with its topographic variation, contains a diversity of species: more than 1,000 vascular plant species, more than 200 fungi, more than 160 nesting birds, at least 60 mammals and thousands of invertebrate species. Development results in fragmentation and isolation of the GYE from other wildlands, causing serious problems for its biota (see Harris 1984). Managing all the plant and animal communities on an ecosystem level is seen as the most efficient way to halt erosion of species/populations and the only way to protect one of "the largest wildland tract(s) in the conterminous U.S."

The Sierra Club (1986) recently examined the effects of oil and gas development in the GYE. It concluded that agency leasing policy conflicts with endangered species conservation in the region—especially grizzly bears—in



forests surrounding Yellowstone National Park.

The news media (e.g., Morgenthaler 1984, *New York Times*; Schmidt 1985, *Denver Post*; Heller 1986, *Jackson Hole Guide*; Chapman 1986, *Casper Star-Tribune*) are using the GYE concept more regularly, illustrating the changes human developments have brought to the ecosystem. These popular accounts (more than 40 articles on the GYE have appeared in local, regional and national newspapers in 1985 and 1986) have significantly contributed to clearer public understanding of the concept, of threats to conservation of the GYE and of legislative and agency activities. An eloquent argument for conserving the GYE was written by McNamee (1986), who concluded that the most significant obstacle to ecosystem-wide conservation of nature in the national parks is the disparity between official boundaries and biological ones.

#### POLICY AND ADMINISTRATION TRENDS

Several significant events in policy and administration have occurred in response to the growing public attention to the GYE. In Congress, the House Subcommittee on Public Lands and the Subcommittee on National Parks and Recreation held hearings on October 24, 1985 to provide a forum for numerous interest groups, organizations and agencies to respond to the idea of ecosystem management in the GYE. The hearings' purposes were threefold: (1) to examine the meaning and significance of the GYE, its natural, cultural and recreational resources and associated economic and environmental values; (2) to identify the various resource uses, their relative benefits and any potential conflicts among them; and (3) to review the strengths and weaknesses of the state and federal arrangements now in place for managing the ecosystem and its resources. Extensive testimony was taken on each of the three objectives.

The USDA Forest Service recognizes the GYE, but terms it the "Greater Yellowstone Area" (Tixier 1986). From the Forest Service's 1897 Organic Act to the 1976 National Forest Management Act, which expanded the agency's purview to ensure plant and animal diversity, there has been a steady growth in the service's authority and in its inclination to view its forest units in an ecosystem context. Under Forest Service administration, the GYE is currently split into three administrative regions and seven national forests. In response to recent congressional interest, the Forest Service announced the initiation of "Yellowstone Blueprint," a mapping project to merge data from each forest onto a single set of maps. This project is expected to be completed in 1987 and the extent to which it encompasses an ecosystem view will, no doubt, be scrutinized.

Citing a tradition of cooperation among federal land agencies in the GYE, based on the establishment of the Greater Yellowstone Coordinating Committee in 1960, Forest Service chief Max Peterson in 1985 expressed a need for "complete coordination" of agency plans in the GYE and for increasing discussion about the concept, but within existing legal and regulatory processes.

A summary of the proposed Bridger-Teton National Forest Plan (3.5 million acres in the GYE) highlighted the integral nature of the Bridger-Teton in the GYE by specifying oil and gas leasing prohibitions, timber harvest reductions, grizzly bear management, fire management, road closures and other measures to protect the GYE's integrity.

The National Park Service recognized the GYE concept when it examined ecological effects of the Fishing Bridge recreation development on the Yellowstone grizzly and on ecological diversity (Yellowstone National Park 1986). The ecosystem approach is consistent with the evolution of park policy since Yellowstone's establishment in 1872. A statutory basis for ecosystem management in the park can be traced to the 1916 Park Service Organic Act, which required the service to go beyond its traditional mission of setting aside natural wonders as curiosities and actively to maintain and protect park resources, including wildlife (Elfring 1985). In 1984, Yellowstone National Park superintendent Robert Barbee delineated an "ideal Yellowstone Ecosystem" on a map which outlined a "logical protectorate" and a "logical biogeographical province" of about six million acres. In 1985, William Penn Mott, director of the National Park Service, called for the prompt development of a regional plan for the management of the GYE that would accomplish "total ecosystem preservation and management." And an official publication of Yellowstone National Park (1986:i) said: "The greatest challenge now facing managers in the greater Yellowstone ecosystem is integrating a variety of agency mandates and public needs in a way that will maintain the integrity" of the system.

A peripheral actor, the Bureau of Land Management, has demonstrated adaptability to GYE problem-solving by facilitating land exchanges to consolidate federal holdings in important areas in the GYE. The BLM is a main target of "reform" in the GYE—and on public lands nationwide—because it controls oil and gas leasing and development in national forests and because its leasing policy often conflicts with ecosystem-wide management considerations. The Sierra Club publication cited above focuses on this.

Opposition to managing the region on an ecosystem basis has been expressed by Wyoming's former governor, Ed Herschler, the Wyoming Heritage Society and local organizations that promote commercial uses of public



lands (Barron 1985, *Casper Star Tribune* 1986). The GYE idea became highly politicized when a resolution was introduced in the Wyoming legislature opposing any management changes that would affect natural resource development or multiple use management of the lands within the ecosystem (*Jackson Hole News* 1986).

There has been no formal response to the GYE concept by Idaho or Montana except through the ad hoc working groups that their wildlife biologists and administrators serve on to produce management plans for bald eagles. This limited agency collaboration to meet ecosystem-wide biological challenges, however, is an encouraging first step. But numerous problems remain. There is no formal method of coordinating state agency responses to the day-to-day management jobs in the GYE; duplication of effort by the states and federal agencies may be common; there is a lack of uniformity in specific program goals (e.g., bison and grizzly bear management); and there is a lack of uniformity in standards of performance for environmental protection (e.g., water and air quality).

County and town governments and chambers of commerce have begun to react to GYE policies affecting their perceived economic interests. The Teton County Commissioners and the chamber of commerce in Jackson, Wyoming, reacted strongly to the whole array of agency decisions (e.g., skiing, timbering, oil/gas, airport, elk) proposed in the draft Bridger-Teton National Forest Plan in 1986-87 generally favoring the application of the ecosystem concept. Contrariwise, the Cody, Wyoming, Chamber of Commerce opposed the proposed Fishing Bridge Campground closure in Yellowstone National Park—which was designed to protect grizzly bears—on grounds that closing the site would have a negative effect on the town's tourism.

Private land use in the GYE includes grazing and timbering. Grazing interests have been historically dependent on forest lands for summer grazing and for irrigation water. Most of the forests allow an annual harvest of 20 million to 30 million boardfeet of timber. Isolated private developments also occur throughout the GYE.

A number of policy and administrative trends seem evident: Growing application of the ecosystem concept in species-specific conservation programs attests to the concept's biological validity; growing recognition of the concept by conservation and other interest groups (e.g., chambers of commerce) attests to the concept's political validity; and emerging appreciation of these facts by agency administrators and policy-makers has led to considerable discussion about ecosystem-wide policy and administration.

Several administrative and legislative suggestions have been made to reconfigure agency administration and policy to facilitate ecosystem-wide policy and management consistency. One option includes appointment of a single interagency authority, a "director of the GYE," selected from existing personnel in the agencies or from outside. Another suggestion includes regrouping the seven national forests in the GYE into a single, new Forest Service administrative region. Legislation aimed specifically at unifying national parks and surrounding federal and non-federal lands into common ecosystem management units has been drafted and is in the discussion stage in Congress (Baucus 1986). But the agencies (e.g., the Forest Service) argue that ecosystem management is achievable without any alteration in existing administrative boundaries or legislative direction. There is considerable doubt by conservation organizations about this claim.

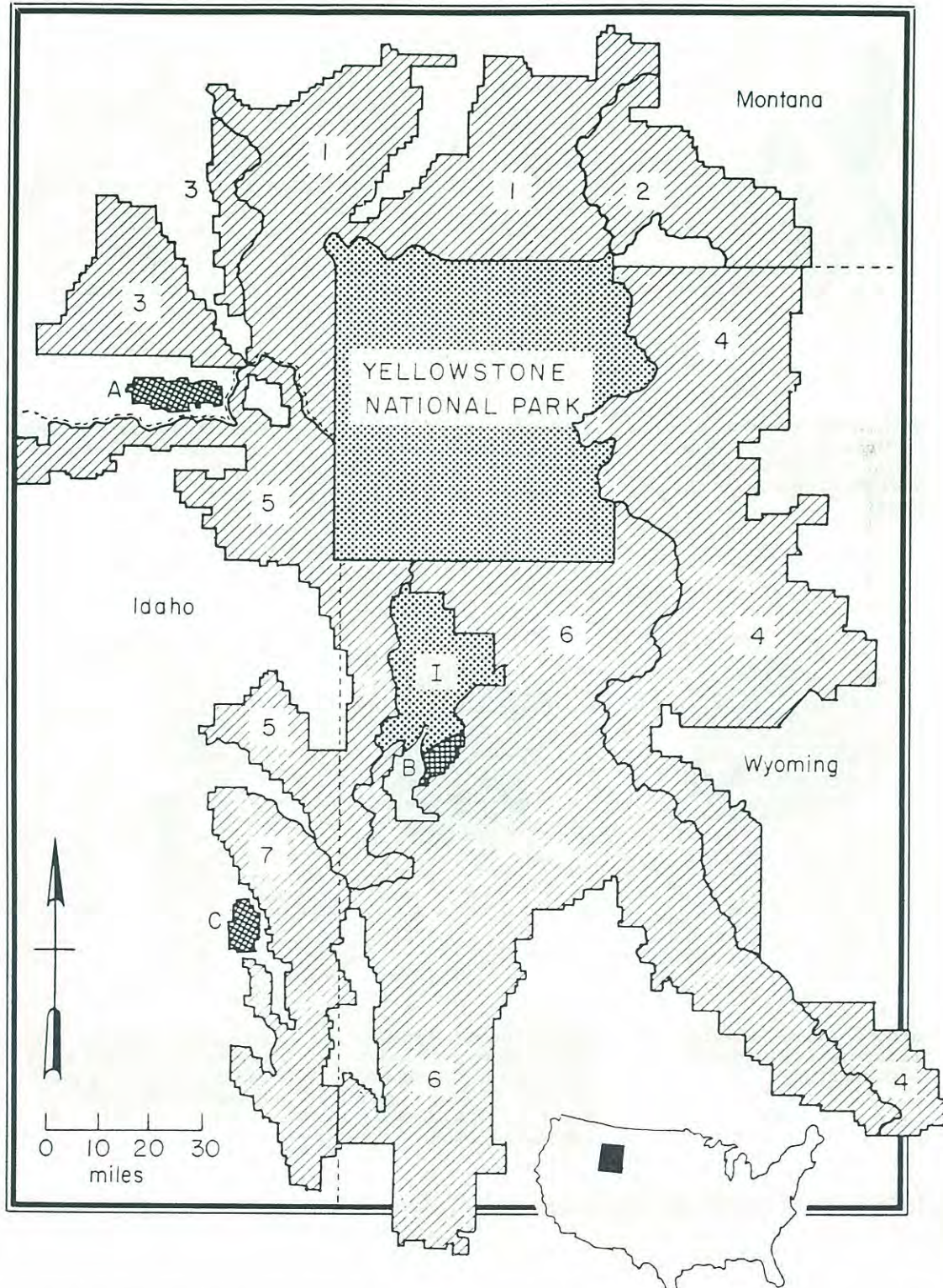
An increasing number of local, regional and national interests, organizations and agencies are acting and reacting in the growing GYE policy debate. Originally used biologically, the concept and its implications are now much more visible scientifically, publicly and in legislative and administrative circles. Proponents and opponents are often vehement in their views. As a consequence, the GYE policy arena has become more "politicized" than in earlier years (Lindblom 1980, Brewer and deLeon 1983, Tixier 1986). Nowhere is this clearer than in the policy debate over management of the northern Yellowstone elk herd (Despain et al. 1986).

#### **POLICY EVOLUTION PERSPECTIVE**

For the Greater Yellowstone Ecosystem concept to become more useful and effective through consistent policy, administration and management, several additional steps are required. First, further clarification of the ecosystem concept applied to the GYE is needed and is best accomplished through increased professional and public policy dialogues. Second, the inherent capabilities and limitations of all agencies for formulating, implementing and evaluating ecosystem-wide policy and management should be thoroughly examined. And third, scientific techniques to manage the GYE need to be developed, including establishing thorough data bases, conducting inventories and monitoring programs following Hollings' (1978) adaptive management philosophy.

A sound theoretical and technical basis of the GYE concept would help meld the currently fragmented ad hoc "ecosystem" management efforts into a common policy, administrative and management vision. We propose that ecosystem management is management of natural resources using systems-wide concepts to ensure that all plants and animals in the ecosystem are maintained at viable levels in native habitats and that basic ecosystem





**Figure 1.** A map of the Greater Yellowstone region showing major administrative units. These units do not coincide with actual biological boundaries of the ecosystem. I = Grand Teton National Park. A-C = National Wildlife Refuges. 1-7 = National Forests.



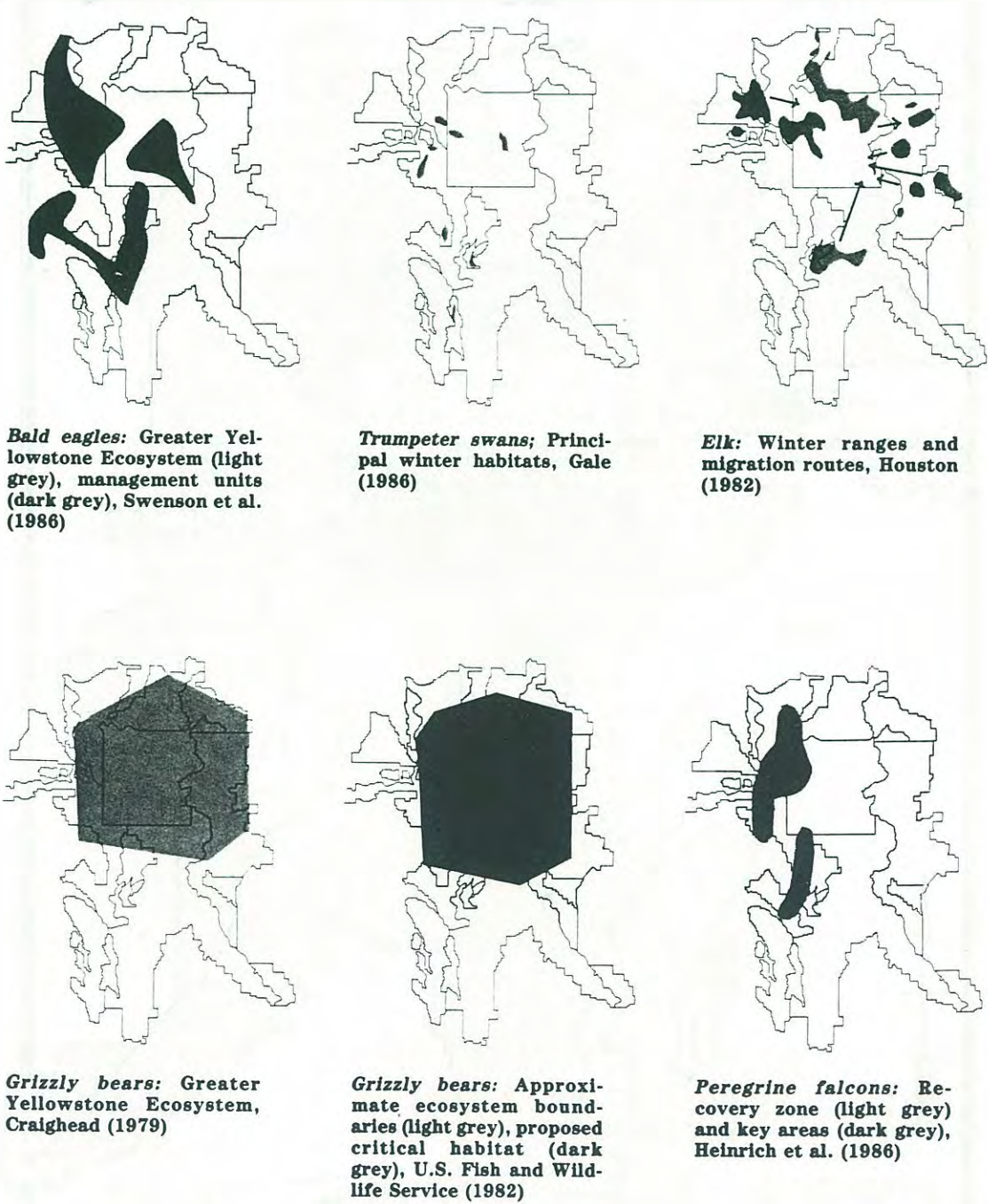


Figure 2. Examples of the Greater Yellowstone Ecosystem concept in application to single species conservation.



processes (e.g., nutrient cycling) are perpetuated indefinitely (Clark 1986).

There are fundamental ambiguities in the way the ecosystem concept is traditionally used. As O'Neill et al. (1986:3) discussed, "Like elephants, ecosystems can be viewed as many perspectives. Our conclusions are biased by the way we observe ecosystems." More inquiry into the way we observe ecosystems, especially the time and spatial scales we use and the level of organization we invoke, are needed before the concept can fulfill its on-the-ground conservation potential (Major 1969, O'Neill et al. 1986). This will come about through expanded biological application of the GYE concept to region-wide plant and wildlife management. It is becoming increasingly obvious that, in order to conserve the region's grizzly bear and bald eagle populations, for example, only region-wide policy, organization and management will suffice. It is expected that the ecosystem concept in natural resource policy, administration and management will continue to grow in the Greater Yellowstone region and elsewhere, largely because of its value biologically and because it is being demanded by an increasingly ecologically aware citizenry. Furthermore, human cultures and economies, if they are to be sustainable for more than the short-term, must integrate themselves into a healthy ecosystem.

The first step in managing an ecosystem is to identify management goals and to establish tentative boundaries. Management of the GYE, we suggest, should include the following goals:

(1) Maintenance of all existing plant and animal populations and restoration of species which have been eliminated by man. This will produce a structurally complete ecosystem, protect native habitats and ensure adaptable, viable populations.

(2) Monitoring of major ecological processes via air and water quality, vegetative dynamics and wildlife populations. This will provide a continuous reading on the health of the ecosystem and tell us how to correct problems as they arise.

(3) Integration of long-term sustainable human economies within the constraints of (1) above. This will provide significant opportunity for economic development of the ecosystem through scenic, recreational, wildlife and small-scale, natural-resource-extraction-based economies (e.g., horse logging). Debate on boundary definitions is underway (e.g., The Wilderness Society 1986).

The benefits of ecosystem management are obvious. It conserves plants and animals and all life processes. It ensures a strong foundation for a sustainable natural resource base. It ensures human economies that depend on

that base. In the case of the GYE, it ensures preservation of the aesthetic, recreational, economic, social and cultural values of the region. Finally, it preserves a world-class ecosystem for the benefit of current and future generations.

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## REFERENCES

- Barbee, R. D. and J. D. Varley. 1984. The paradox of repeating error: Yellowstone National Park from 1872 to Biosphere Reserve and beyond. Paper presented at Conference for Managers of Biosphere Reserves, Great Smoky Mountains National Park, November 27-29, 1984. 4pp.
- Barrett, G. W. 1985. A problem-solving approach to resource management. *BioScience* 35:423-427.
- Barron, J. 1985. Herschler raps Yellowstone idea. *Casper Star Tribune*. Casper, Wyoming. October 29, 1985.
- Baucus, M. 1986. National Parks Interagency Management and Coordination Act of 1986, 99th Congress, 2nd session, discussion draft, May 12, 1986.
- Brewer, G. and P. deLeon. 1983. Foundation of policy analysis. The Dorsey Press, Homewood, Illinois. 476pp.
- Camenzind, F. J. 1985. Yellowstone ecosystem. *Park Science: A Resource Management Bulletin*. 5(2):12-14.
- Casper Star Tribune*. 1986. Group opposes greater Yellowstone ecosystem. Casper, Wyoming. January 18, 1986.
- Chapman, B. 1986. Drilling still likely in B-T grizzly habitat. *Casper Star-Tribune*, December 5, A5, 12.
- Clark, T. W. 1981. Ecology of Jackson Hole, Wyoming: a primer. Paragon Press, Salt Lake City, Utah. 110pp.
- Clark, T. W. 1986. The ecosystem-economics connection in northwestern Wyoming's future. Presented at Wyoming Outdoor Council Annual Meeting: Public Land Management and Western Communities. June 13-15, Lake Lodge, Yellowstone National Park, Wyoming. 19pp.



- Conant, F., P. Rogers, M. Baumgardner, C. McKell, R. Damsmond and P. Reining. eds. 1983. Resource inventory and baseline study methods for developing countries. American Association for the Advancement of Science, 1515 Massachusetts Ave., N.W., Washington, D.C. 539pp.
- Congressional Research Service. 1986a. Issues surrounding the Greater Yellowstone Ecosystem, pp. 337-372. *in* Committee on Interior and Insular Affairs, House of Representatives. Oversight Hearing on Greater Yellowstone Ecosystem. U.S. Government Printing Office, Washington, D.C. 697pp.
- Congressional Research Service. 1986b. Greater Yellowstone Ecosystem: an analysis of data submitted by federal and state agencies. Committee on Interior and Insular Affairs, House of Representatives. Oversight Hearing on Greater Yellowstone Ecosystem. U.S. Government Printing Office, 67-551. Washington, D.C. 210pp.
- Cox, G. W. ed. 1969. Readings in conservation ecology. Appleton-Century-Crofts, Meredith Corp., New York. 595pp.
- Craighead, F. C., Jr. 1979. Track of the grizzly bear. Sierra Club Books, San Francisco, California. 261pp.
- Despain, D., D. Houston, M. Heager and P. Schullery. 1986. Wildlife in transition: man and nature on Yellowstone's northern range. Roberts Rinehart, Inc. Publishers, Boulder, Colorado. 142pp.
- Elfring, C. 1985. Wildlife and the national Park Service, pp. 280-305 *in* R. L. Di Silvestro, ed. Audubon Wildlife Report 1985. National Audubon Society, New York.
- Greater Yellowstone Coalition. 1983. Progress Report. 127 West Main St., P.O. Box 1874, Bozeman, Montana. 6pp.
- Greater Yellowstone Coalition. 1984. Progress Report. 127 West main St., P.O. Box 1874, Bozeman, Montana. 5pp.
- Greater Yellowstone Coalition. 1986a. Greater Yellowstone challenges 1986: an inventory of management issues and development projects in the Greater Yellowstone Ecosystem. 127 West Main St., P.O. Box 1874, Bozeman, Montana. 216pp.
- Greater Yellowstone Coalition, 1986b. A model for information integration and management for the centennial ecosystem. 127 West Main St., P.O. Box 1874, Bozeman, Montana. 184pp.
- Greater Yellowstone Ecosystem Bald Eagle Working Team. 1983. A bald eagle management plan for the Greater Yellowstone Ecosystem. Wyoming Game and Fish Department, Cheyenne. 84pp.
- Harris, L. D. 1984. The fragmented forest: island biogeography theory and the preservation of biotic diversity. University of Chicago Press, Chicago, Illinois. 211pp.
- Heinrich, B., B. Oakleaf, D. Flath and W. Melquist. 1986. A cooperative proposal for reintroduction of peregrine falcons in adjacent areas of Idaho, Montana and Wyoming. Unpublished Report. 13pp.
- Heller, J. 1986. Lead shot ban requested to help trumpeter swans. *Jackson Hole Guide*, December 4, A1, 2.
- Hoak, J. H., J. L. Weavaer and T. W. Clark. 1982. Wolverines in western Wyoming. *Northwest Science* 56(3):159-161.
- Hocker, P. M. 1979. Yellowstone: the region is greater than the sum of its parks. *Sierra Magazine*. July/August:8-12.
- Hollings, C. S. 1978. Adaptive environmental assessment and management. John Wiley & Sons, New York. 364pp.
- Houston, D. B. 1971. Ecosystems of national parks. *Science* 172:648-651.
- Houston, D. B. 1982. The northern Yellowstone elk. MacMillian Publishing Co., New York. 474 pp.
- Jackson Hole News*. 1986. Turner, Jensen at odds over Yellowstone resolution. Jackson, Wyoming, March 5, 1986.
- Leopole, A. S. 1962. Study of wildlife populations in national parks. Reprinted in Reports of the Special Advisory Board on Wildlife Management for the Secretary of the Interior, 1963-1968. Wildlife Management Institute, Washington, D.C.
- Lindblom, C. E. 1980. The policy-making process. Prentice-Hall, Inc., Englewood Cliffs, New Jersey. 131pp.
- Major, J. 1969. Historical development of the ecosystem concept, pp. 9-22. *in* G. M. Van Dyne. ed. The ecosystem concept in natural resource management. Academic Press, New York. 341pp.
- Mattson, D. J. and D. G. Despain. 1985. Grizzly bear habitat component mapping handbook for the Yellowstone Ecosystem. National Park Service and U.S. Forest Service, Unpublished Ms. 35pp.
- McNamee, T. M. 1986. Putting nature first: a proposal for whole ecosystem management. *Orion Nature Quarterly* 5:4-15.
- Morgentahaler, E. 1981. The Yellowstone Ecosystem and its seasons provide for all manner of life. *New York Times*, December.
- Mott, W. P. 1985. Remarks. Before Greater Yellowstone Coalition, June 8, Yellowstone National Park, Lake Hotel. 13pp.
- Newmark, W. D. 1985. Legal and biotic boundaries of Western North American Parks: a problem of congruence. *Biological Conservation* 33:197-208.
- Newmark, W. D. 1986. Mammalian richness, colonization and extinction in Western North American National Parks. Ph.D. thesis. University of Michigan, Ann Arbor, Michigan. 172pp.
- Norse, E. A. et al. 1986. Conserving biological diversity. The Wilderness Society, Washington, D.C. 116pp.
- Odum, E. P. and H. T. Odum. 1959. Fundamentals of ecology. W. B. Saunders Co., Philadelphia, Pennsylvania. 546pp.
- O'Neill, R. V., D. L. DeAnglelis, J. B. Waide and T. F. H. Allen. 1986. A hierarchical concept of ecosystems. Princeton University Press, Princeton, New Jersey. Monographs in Population Biology. 23:1-253.
- Peterson, R. M. 1986. The Greater Yellowstone area—a time for coordinated management. Presented before Greater Yellowstone Coalition, May 31, Yellowstone National Park, Lake Hotel. 9pp.
- Reese, R. 1985. Greater Yellowstone: the national park and adjacent wildlands. *Montana Magazine*, Helena, Montana. 104pp.
- Schmitz, G. 1985. Yellowstone's boundaries, nature's needs at odds? *Denver Post*, December 1, 1985.
- Sierra Club. 1986. Yellowstone under siege: oil and gas leasing in the Greater Yellowstone Region. Sierra Club, Washington, D.C. 28pp.
- Swenson, J. E., K. L. Alt and R. L. Eng. 1986. Ecology of bald eagles in the Greater Yellowstone Ecosystem. Wildlife Monograph 95:1-46.
- Tansley, A. G. 1935. The use and abuse of vegetational concepts and terms. *Ecology* 16:284-307.
- The Wilderness Society. 1986. Defining and delineating the boundaries of ecosystems. 1400 Eye St., N.W., Washington, D.C. Working paper. Unpublished. 6pp.
- The Wilderness Society. 1987. Management directions for the



- National Forests of the Greater Yellowstone Ecosystem. 1400 Eye St., N.W., Washington, D.C. 34pp plus appendices and maps.
- Tixier, J. S. 1986. The Greater Yellowstone Ecosystem: an introduction to an area and its issues. *Western Wildlands* 12:2-6
- U.S. Fish and Wildlife Service. 1982. Proposal for grizzly bear critical habitat. Unpublished Ms. 8pp.
- Van Dyne, G. M. 1969. Ecosystems, systems ecology and systems ecologists, pp. 21-50. *in* G. W. Cox, ed. Readings in conservation ecology. Appleton-Century-Crofts, New York. 595pp.
- von Droste zu Hulshoff, B. and W. P. Gregg, Jr. 1985. Biosphere reserves: demonstrating the value of conservation in sustaining society. *Parks* 10(3):2-5.
- Westman, W. E. 1977. How much are nature's services worth? *Science* 197:960-964.
- Westman, W. E. 1985. Ecology, impact assessment and environmental planning. John Wiley and Sons, New York. 523pp.
- Yellowstone National Park. 1984. Fishing Bridge and the Yellowstone Ecosystem. A Report to the Director of National Park Service, Washington, D.C. 151pp.
- Yellowstone National Park. 1986. Statement for management. National Park Service, D152-a, Mammoth, Wyoming. 54pp.

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## Changing Landscapes

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The Renewable Natural Resources Foundation has expanded its ranks by one with the addition of the American Society of Landscape Architects. These landscape planning and design professionals bring to the consortium a unique group of people who have an abiding interest in the changing landscape. In the interest of enlightening the RNRF membership about the landscape architecture profession and its purposes, and how pursuit of these purposes serves to strengthen efforts to achieve mutual goals of conservation and replenishment of the land's renewable resources, the following observations are offered.

The first question one might have regarding landscape architects and the RNRF is "What common interests are there that will bring the two groups together?" There are many, but perhaps the most basic is a reverence for the landscape itself. Landscapes have many different meanings for people. Therefore, a working definition is perhaps the first order of business. Landscapes are those spaces possessing a degree of permanence with the natural features, life forms and human inhabitants that occupy them.

Conceptually, landscapes are more than the sum total of their separate parts. Landscapes are a complex combination of intangible values that lie within our minds and tangible elements that lie within the spaces we occupy, travel through and look across. The tangible elements are most familiar to us all. A grove of trees, a tumbling brook or a green velvet drumlin may come to mind. A corner cafe, a shrubby riverbank or a rundown ball field might also be representative of our definition of landscapes.

We associate with these landscapes a set of values that gives worth not only to the environment itself, but to the people and events that live or occur within them. These values, perhaps more so than the tangible elements, penetrate a person's awareness and remain in his memory.

These environmental settings, then, become reference points or bench marks in an individual's personal trek through life. Similarly, this association of value formation, within a setting has an influence on individual growth and behavior. Some socio-biologists suggest that human be-



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Paper Number:

1. Clark, T. W., and D. Zaunbrecher. 1987. The Greater Yellowstone Ecosystem: The ecosystem concept in natural resource policy and management. *Renewable Resources Journal* 5(3):8-16.
2. Barmore, W. J., Jr. 1987. The distribution and abundance of ungulates in the northern Yellowstone ecosystem in pristine times and today. Talk presented at the Greater Yellowstone Coalition's Scientific Conference on The Northern Yellowstone: Issues and Alternatives for Ecosystem Management. Lake Hotel, Yellowstone National Park, May 29, 1987.
3. Clark, T. W. 1986. Professional excellence in wildlife and natural resource organizations. *Renewable Resources Journal* 4(2):8-13.
4. Clark, T. W. 1986. The ecosystem-economics connection in northwestern Wyoming's future. Paper presented at Wyoming Outdoor Council Annual Meeting: Public Land Management and Western Communities, Lake Lodge, Yellowstone National Park, June 13-15, 1986.
5. Clark, T. W. 1985. Wyoming grizzly bears: 150 years of journal, oral history, and newspaper accounts (ca. 1800-1950). Paper presented at Grizzly Bear Conference, sponsored by Murie Audubon Society, Casper, Wyoming, May, 1985.
6. Clark, T. W. 1987. Black-footed ferret recovery: a progress report. *Conservation Biology* 1(1):8-11.
7. Clark, T. W., E. Anderson, C. Douglas, and M. Strickland. 1987. *Martes americana*. Mammalian Species No. 289:1-8.
8. Clark, T. W. Organizing for endangered species recovery. Paper presented at Wildlife Management Directions in the NW through 1990, NW Section meeting, The Wildlife Society, Sheraton Hotel, Missoula, Montana, April 2-5, 1985.
9. Clark, T. W. 1987. Restoring balance between the endangered black-footed ferret (*Mustela nigripes*) and human use of the great plains and intermountain west. *Journal of the Washington Academy of Sciences* 77(4):168-173.



10. Clark, T. W., and S. R. Kellert. In Press. Toward a policy paradigm of the wildlife sciences. *Renewable Resources Journal*.
11. Laundre, J. W., T. W. Clark, and D. P. Streubel. 1987. Behavior, ecology, and conservation of mountain lions in fragmented habitat. A progress report for the 1986-1987 field season, Idaho State University, Pocatello, ID.
12. Clark, T. W., and J. R. Cragun. In Press. Organization and management of endangered species programs. In *The management of viable populations: theory, applications, and case studies*. B. A. Wilcox, P. F. Brussard, and B. Marcot, eds. Island Press, 1988.