**Book Reviews** 

## The Future of Yellowstone

The Greater Yellowstone Ecosystem. Redefining America's Wilderness Heritage. ROBERT B. KEITER and MARK S. BOYCE, Eds. Yale University Press, New Haven, CT, 1991. xx, 428 pp., illus. \$45.

The Greater Yellowstone area consists of about 16 million acres of land in Wyoming, Montana, and Idaho. Yellowstone and Grand Teton National Parks form its core; its periphery includes parts of six national forests, two national wildlife refuges, additional public land administered by the Bureau of Land Management, and numerous private holdings. To emphasize the area's ecological cohesiveness, it is increasingly being referred to as the Greater Yellowstone Ecosystem (GYE).

It is often claimed that the GYE is the largest relatively intact natural ecosystem in the contiguous 48 states. Much of the area, however, is administered under the philosophy of "multiple use," where mining, ranching, and timber harvest are legitimate activities on public lands; and decades of management blunders in the parks such as predator control, overprotection of elk, overbuilding of highways and visitor areas, and an inconsistent fire policy have left many wondering just how intact the GYE really is. On the other hand, the 2.5 million or so annual visitors to Yellowstone National Park are treated to many natural wonders, including geothermal features, waterfalls, sweeping mountain panoramas, and wildlife in profusion. Huge herds of elk and bison are always to be found; and the more observant visitor can usually see pronghorn, deer, moose, and maybe even a bear or two. There is definitely a lot here worth saving.

The questions are, What should be saved. and how should this be accomplished? Preservationists want to save it all. They feel that the natural processes that dominated the region in pre-settlement times should be allowed to reign as before. Wolves should be reintroduced to restore the original complement of natural predators on the ungulates, and naturally ignited fires should be allowed to burn unchecked. Nature should take its course, and people should interfere with this course as little as possible. Exploitationists see the area as a rich storehouse of resources to be harvested. Mountain meadows should be grazed by cattle; mineral and petroleum resources should be extracted from the ground; timber should be cut on

the most profitable rotation. Nothing should interfere with the orderly processing of the annual visitor bonanza, and elk produced in the parks should be killed by hunters, not wolves.

These views are reflected to some extent in the different mandates of the major land management agencies in the GYE-the National Park Service and the Forest Service. The Park Service is supposed to protect the parks' resources for future generations. To do this, it more or less follows a policy of "natural regulation," which allows wildlife populations to wax and wane with a minimum of interference and naturally ignited fires to burn as long as human life and property aren't threatened. But ungulate populations tend to grow large enough to overgraze their ranges and spill out of park boundaries, potentially spreading brucellosis (a disease that infects cattle) in the process. And fires, particularly during dry years, have a regrettable tendency to burn out of

> Scenes from Yellowstone. [From The Greater Yellowstone Ecosystem]

control and destroy economically valuable timber and private property outside of park boundaries. The Forest Service, on the other hand, operating on the principle of multiple use, encourages grazing, timber harvest, oil and gas exploration, motorized recreation, and other activities that are generally incompatible with preservationist goals. When any of these activities are carried on anywhere near park boundaries they interfere in one way or another with the Park Service's mandates of resource protection and visitor enjoyment.

The first section of *The Greater Yellow-stone Ecosystem* introduces and elaborates on the problems that result from the collision of preservationist and exploitationist philosophies. Duncan Patten takes a stab at defining the GYE, and co-editor Keiter outlines the problems. John Craighead, a long-time critic of Yellowstone's wildlife management policy, provides his perspective. Lockhart







"A conceptual model of the flows and interactions among many of the major components of the Greater Yellowstone Ecosystem." [From Duncan T. Patten's paper in *The Greater Yellowstone Ecosystem*]

and Sax discuss various legal aspects of public land management, and Budd expresses the fear that coordinated management in the GYE will spell the end of multiple use. O'Toole presents a plan for using recreation fees as incentives to limit timber harvest in the national forests.

The next section deals with the impacts of the 1988 fires. Knight introduces the issues, and Varley and Schullery defend Yellowstone's fire policies. Minshall and Brock examine the impacts of the fires on stream ecosystems; Brown explores the issue of prescribed burning; and Van Dyke *et al.* conclude that prescribed burns are good for elk. An interesting aside by Lopoukhine describes how the U.S. reaction to the 1988 fires has influenced fire policy in Canada.

Aspects of wildlife ecology are covered in part 3. Boyce starts it by defending the "natural regulation" policy. Coughenour and Singer decide that overgrazing is all a matter of definition, whereas Chadde and Kay provide some fairly convincing evidence that an overabundance of elk has strongly impacted at least one plant community in Yellowstone Park. Merrill and Boyce hypothesize that summer range may be just as important to elk dynamics as winter range, and the brucellosis problem is explored by Thorne et al. The final chapter in this section presents paleoecological data that suggest that all the human-induced perturbations of Yellowstone's vegetation in the last century still fall within the range of fluctuations that have occurred naturally within the last 15,000 years or so.

The wolf issue is discussed in part 4. Mech answers the objections posed to reintroduction, and Singer shows that the prey base is adequate to support wolves without severely affecting ungulate populations. Ream *et al.* describe the dynamics of a naturally colonizing wolf population in the Glacier National Park area, and Bath explores public attitudes about wolf reintroduction.

The final section, by the editors, speculates on the future of the GYE. They believe that the GYE is more valuable in its natural state than as a landscape fragmented by development and extensive human settlement. In order for it to return to a more natural state they favor a second-generation version of natural regulation, called "natural process management," to be applied to the area as a whole. Natural process management would allow fire, predation, ungulate dispersal, and disease to transcend jurisdictional boundaries and proceed throughout the entire GYE with a minimum of human interference. This implies, of course, that multiple use would be greatly diminished or eliminated throughout the region.

Though all of us who love wilderness and whose hearts are thrilled by a falcon's stoop or a coyote's call would love to see this happen, my guess is that it never will. The multiple-use philosophy is thoroughly ingrained in the minds of westerners (and their elected representatives). Large numbers of people who live in the Greater Yellowstone area depend upon extractive industries for their livelihoods. Converting a ranching, logging, and mining economy to one based on tourism and recreation is offered as a solution to the latter problem, but this is much more easily said than done. Cleaning motel rooms is not considered equivalent employment to a high-paying job in a lumber mill. Moreover, tourism and recreation are far from gentle in their effects on the natural environment, particularly when these activities involve millions of people every year.

If something of worth will be preserved in the Greater Yellowstone for future generations, it is going to result from the people who live there realistically reconciling exploitationist and preservationist goals. The national forests and their users will have to recognize that multiple use does not mean using every square mile of land for every allowable activity and that they have a responsibility to provide a reasonable buffer from most of these activities around the parks. For their part, the parks' supporters are going to have to realize that more, rather than less, management will be required to preserve the GYE's species, communities, and some of its natural processes.

The editors, who are clearly committed to natural process management, would probably disagree. Nevertheless, they have assembled a book that explores a reasonably healthy variety of views on a complex subject, and *The Greater Yellowstone Ecosystem* is certainly a far more reasoned statement of the management dilemma than its recent predecessor, Alston Chase's *Playing God in Yellowstone* (Atlantic Monthly Press, 1986).

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## **Gravitation Theory**

Lectures on Non-perturbative Canonical Gravity. ABHAY ASHTEKAR. World Scientific, Teaneck, NJ, 1991. xx, 334 pp., illus. \$86; paper, \$48. Advanced Series in Astrophysics and Cosmology, vol. 6.

One of the most significant goals of present-day theoretical physics is to develop a quantum theory of gravitation that corresponds classically to general relativity. Research to this end has been actively pursued during the past 25 years and mainly has divided into two approaches.

The first approach, in effect, breaks up the space-time metric into a background metric (usually taken to be flat) and a part that is treated as an ordinary quantum field in this background metric. This type of approach usually encounters the following two serious problems: (i) divergent expressions usually occur in perturbation theory and cannot be eliminated by renormalizations; and (ii) the most interesting questions concerning strong field behavior are very difficult even to formulate—much less answer—because of the essentially perturbative nature of the approach. Indeed, since the background metric is not, by itself, physically measura-