Yellowstone Ecosystem: "Win-Win" Solution

For once ecologists and economists agree—they say Yellowstone should be protected from logging and mining

HERE'S THE WAY THE BATTLE LINES USED TO be drawn in debates over fragile ecosystems and endangered species: ecologists versus economists. Take the spotted owl. Ecologists were outraged over the possible demise of this endangered species. Economists saw the bird as a distraction—they were far more worried about the thousands of jobs hanging in the balance in the Pacific Northwest. But those battle lines could be in the process of being redrawn, if what is happening at Yellowstone National Park is really the ecological wave of the future. Because at Yellowstone, economists and ecologists are lining up on the same side.

"This is a win-win situation," says Thomas Michael Power, economics professor at the University of Montana. "It's a case where working to protect the integrity of this ecosystem will also protect the long-term viability of the human economy there. In fact, continuing current policies of allowing mining and logging in the Yellowstone area could have serious negative impacts on the area's economy." Power's last statement could seem puzzling. After all, why should mining and logging—long local economic staples—hurt the regional economy? The answer is that the economy in the Yellowstone area has changed. Services and self-employment have replaced industry.

"The economic data show clearly that the driving forces in the Yellowstone area economy are retirement income and self-employment in the service sector," explains Power, "and you can bet that the great majority of people bringing all that retirement income into the area, and moving there to start new jobs, are doing so because they want to be someplace wild and beautiful, not because they like oil rigs and clear cuts."

Economists like Power conclude that continuing the status quo—promoting logging and mining at the expense of the environment—will wind up dooming not only the flagship species in the park, including grizzly bear, bison, bighorn sheep, pronghorn antelope, and elk, but also the local economy. And that has given a boost to those who believe human welfare and ecology aren't incompatible. But don't assume everything at Yellowstone is sweetness and light. The battle lines have been redrawn, but they haven't disappeared: Now ecologists and economists are facing off against the representatives of local industry, who want to preserve their sources of livelihood.

The new eco-econ coalition isn't built solely on economic data. In fact, there's recently been a flood of new biological research on the greater Yellowstone ecosystem, which encompasses 18 million acres, including Yellowstone and Grand Teton National Parks, seven national forests, three national wildlife refuges, and other federal, state, and local holdings. Some of that research was sparked by the spectacular fires in the summer of 1988, which devastated 1.3 million acres of Yellowstone National Park and the adjacent national forests. But some of it is the result of the fact that the greater Yellowstone ecosystem is the largest and most diverse web of species in the entire temperate zone.

And for that reason, Yellowstone occupies a special place for ecologists and those in the new discipline of conservation biology (*Science*, 31 January 1991, p. 20). Peter F. Brussard, head of the biology department at the University of Nevada, Reno, and a leading exponent of conservation biology, edited a series of papers on the Yellowstone ecosystem in a recent issue of the journal *Conservation Biology*.* Brussard stresses that "current land-use practices and governmental policies are having a large negative impact on the ecosystem that supports" the grizzly and the pronghorn antelope.

Brussard thinks the situation at Yellowstone is urgent. He notes that the area will never be the pristine wilderness it was when it became the world's first national park in 1872, "but it doesn't have to be to continue to support the widest range of biological diversity present in one place in North America. Humans and nature can coexist in the Yellowstone area, but not if current policies don't change, and change soon."

A similar point of view is represented in more than a dozen studies from both biologists and social scientists that were commissioned by the Greater Yellowstone Coalition, an umbrella organization representing a wide range of citizen interests in the area.

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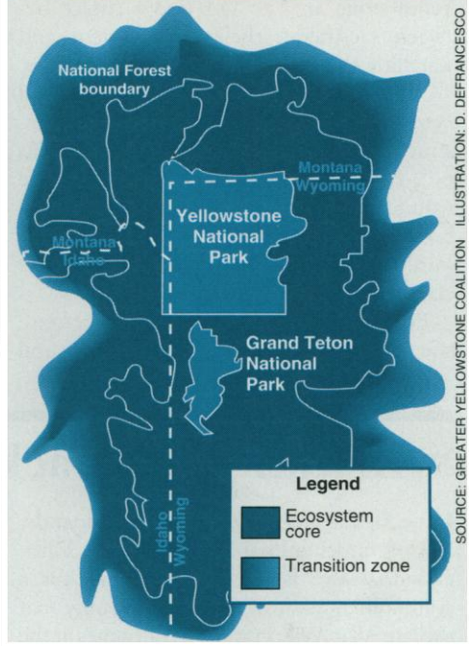

SOURCE: GREATER YELLOWSTONE COALITION ILLUSTRATION: D. DEFRANCESCO

Where the antelope play. *The Yellowstone ecosystem—18 million acres supporting more biodiversity than any other region in the temperate zone—has recovered from the fires of 1988, but now faces a challenge from mining, logging, and ranching.*

"What we want to do is get enough solid data to develop an integrated ecosystem management plan that will keep the Yellowstone area a wonderful place to live for both humans and wildlife," says Dennis Glick, director of the Coalition's Greater Yellowstone Tomorrow project.

In one of those studies, economist Power looked at how the region's economy has changed in the past two decades. Perhaps the most surprising finding was that the economy based in the greater Yellowstone ecosystem has shifted from relying heavily on extractive industries—logging, mining, oil pumping, and ranching—to one based on providing local services. "Residents of the area are increasingly employing themselves by taking in each others' wash and scratching each others' backs," says Power. Moreover, job growth in the 1980s came solely from self-employment, particularly in recreation-oriented activities.

The other new factor in the region's

economy was the 43% increase in what Power calls "footloose income"—investment and retirement income. "This is money that follows its recipient and is not tied to employment opportunities," says Power, "and it can leave the area just as easily as it arrived." One telling statistic concerning the footloose dollars was that while wages and salaries in the area fell by almost $80 million a year from 1978 to 1987, investment and retirement income soared by $240 million a year.

Power argues that residents of the greater Yellowstone area do not face a choice between sacrificing their environment and watching their economy go down the tubes. "A new, more stable economy has developed here that depends not on the ongoing destruction of the area's unique natural systems but, rather, on their preservation." People won't retire or move to Yellowstone or start businesses, he argues, if clear-cutting, strip-mining, and over-grazing degrade the ecosystem's natural beauty.

Ecologists couldn't agree more—because the same policies that preserve natural beauty would help sustain endangered species like grizzlies, pronghorn antelopes, and elk. What those species need, say the biologists, are unified, ecologically sound policies from state and federal agencies, overcoming contradictions such as the fact that hunting is prohibited in the national parks but is allowed in the neighboring national forests. What the animals need, says Joel Berger, a biologist at the Smithsonian Institution's Conservation and Resource Center who has studied local wolf populations, is one governmental body overseeing management of the entire ecosystem that ignores political boundaries in favor of ecological limits.

Perhaps surprisingly, given the infighting that characterizes most bureaucracies, the agencies involved agree. Last year managers of the U.S. Forest Service, the Park Service, and the Fish and Wildlife Service, along with their state counterparts, developed a comprehensive set of coordinated management goals that the Greater Yellowstone Coalition and many environmental organizations applauded. That plan, called "Vision for the Future" was abandoned, however, in the face of intense lobbying by regional livestock, timber, mining, and agricultural interests.

"We opposed the Vision document because it attempted to set forth a land-use plan that takes the preservation philosophy that the National Park Service has toward Yellowstone Park and apply it to nonmanagement areas outside the park," says Gary Langley, director of the Montana Mining Association, an opponent of management coordination plans. "Basically, they're trying to turn the whole Greater Yellowstone area into one big protected place." The Wyoming legislature went so far as to pass a resolution asking Congress to order the Interior and Agriculture Departments to withdraw the document.

Dennis Glick has harsh words for the groups that scuttled the management plan. "What they want is business as usual," he says, "but business as usual is going to have an adverse effect on all who live here—humans and wildlife." And in their efforts to forestall those adverse effects ecologists and economists are—for once—on the same side of the divide. ■ JOSEPH ALPER

"African Eve" Backers Beat a Retreat

Is the African ground getting shaky under the feet of mitochondrial Eve? Could be. Mitochondrial Eve is the popular name for a common ancestor of modern humanity that the late Allan Wilson and his colleagues at the University of California at Berkeley announced they had found in 1987. The Wilson team claimed that by analyzing DNA from the energy-producing organelles called mitochondria, which are purely maternally inherited, they had traced the maternal lineage of all humans back to a single woman who lived in Africa about 200,000 years ago.

But that claim wasn't received with a quiet murmur of consensus. In fact, it kicked up a storm of controversy. Some paleoanthropologists argued that the finding couldn't be right—the fossil record, they said, ruled out a common ancestor more recent than a million years ago. Others criticized the group's methods for DNA analysis, their choice of study subjects, and their means of finding and dating the tree's roots.

Last September, the group published a followup paper in *Science* dealing with many of the methodological criticisms. That paper seemed to nail the African Eve hypothesis more firmly into place. Now, however, several of those newly hammered nails have been pulled out—and the root of the human tree has been thrown open to question once again.

Two technical comments in this issue of *Science* (page 737)—one co-authored by Mark Stoneking, a key member of the Wilson team—and an article in press in *Systematic Biology*, by a team led by David Maddison of Harvard, undermine the *Science* paper by showing its conclusions to be statistically flawed. "We're not saying...that [the origin] is definitely non-African, but rather that you can't tell," says Harvard anthropologist Maryellen Ruvolo, one of the authors of the *Systematic Biology* paper.

The new critiques focus on a central issue in all the mitochondrial Eve studies: how to build a reliable family tree from variations in mitochondrial DNA (see box on facing page). The underlying principle is straight forward. You simply examine the nucleotide sequences of several regions of the DNA from a wide variety of people, then calculate the relatedness of those individuals by seeing how similar the sequences are. That sounds simple, but even with small numbers of people and DNA sites, it requires decisions that can be made only by sophisticated computer analysis. And with 100 people or more—the size of the samples used by the Wilson group—the analysis can take weeks of main-frame computer time.

Radical skepticism. *Alan Templeton doubts mitochondrial DNA analysis can identify the root of the human family tree.*

The Wilson team used a program written by David Swofford, a systematist with the Illinois Natural History Survey in Champaign. The program, PAUP, or Phylogenetic Analysis Using Parsimony, strives to find the most "parsimonious" tree—a tree that traces everyone's lineage back to a common ancestor with a minimum number of mutations along the way. That "shortest path" is considered most likely to reflect what happened during evolution. Unfortunately, PAUP doesn't often offer just one most parsimonious tree for each sample. Indeed there may be millions of equally good trees. After each computer run a number of possible trees pop out—and it's up to the researchers to decide how many computer runs to do, and how many hundreds or thousands of trees to ask the computer to save after each run for later analysis.

The Wilson group drew its conclusions after looking at 100 trees from only a single