

## **Benchmarks for Managing Ecosystems: Are Human Activities Natural?**

For conservation biologists one of the fundamental goals of managing ecosystems is to maintain or restore their natural structure and function (Noss & Cooperrider 1994). In ecological reserves we strive to attain this goal as completely as possible. Outside reserves we accept some compromise in reaching this goal—for example, by designing timber harvests to emulate natural disturbances. In both cases we have to decide on the benchmarks for designing and evaluating our management—in other words, the natural structures and functions that we seek to maintain, restore, and emulate. The most difficult part of this question often involves deciding what is natural.

In the context of conservation, “natural” might mean without human influence. Used in this way it is an antonym of adjectives such as “anthropogenic,” “cultural,” and “artificial.” This usage establishes a clear, simple dichotomy based on the idea that humans are a unique species. Some people, however, are uncomfortable with the idea that humans are not natural because they are not making distinctions based on the context in which a word is used. For example, these people might think, incorrectly, that describing humans as natural in contexts such as “she’s a natural athlete” means that human effects on ecosystems must also be natural. Even within the context of conservation some people are concerned that recognizing a dichotomy between nature and humanity will perpetuate abuses of nature. Conversely, some other people are primarily interested in being able to extract commodities from ecosystems without their activities being condemned as unnatural.

Ambiguities in the definition of “natural” are particularly evident in discussions of benchmarks for managing ecosystems in the Western Hemisphere because there are two distinct periods of human influence, one beginning roughly 12,000 years ago with colonization by Asian people across Beringia and a second beginning about 500 years ago with European colonization. When asked to choose a temporal benchmark for managing ecosystems, most conservation biologists in this hemisphere choose pre-European colonization. This decision implies that European management of ecosystems has

not been natural, but that Native American management was natural.

One argument that Native American activities (most notably setting fires) were natural emphasizes that species have had a very long time—12,000 years—in which to evolve in response to these manipulations. It is true that 12,000 years is 24 times longer than the period of European influence, but this is not a long period in evolutionary time. If we are concerned with the ability of species to evolve in response to human activities, one million years is a more relevant figure. One million years is a rough estimate of the average longevity of a given species (Jenkins 1992) and it suggests that species that have evolved in the western hemisphere will have experienced human influence during only a small portion of their existence.

Another argument is that Native American activities were natural because they lived with nature in a more harmonious fashion than Europeans have. Certainly the limited population density and technology of Native Americans mitigated their impact, but consider two points. First, some Native Americans (e.g., Aztecs, Incans, and Mayas) did live in dense populations that must have had profound impacts on local ecosystems. Dense populations probably existed elsewhere (e.g., the southeastern United States; Delcourt et al. 1986), but we tend to overlook these groups because they left few monumental structures or because they were decimated by diseases introduced by the earliest European explorers and had largely disappeared when later settlers arrived. Second, many biologists believe that hunting by Native Americans played a major role in the extinction of over 30 genera of large mammals, such as antelopes, mammoths, horses, and ground sloths (Martin & Klein, 1984). In contrast, the only large mammal extinctions attributable to European colonization (full species, not subspecies) were the loss of the Steller’s sea cow and the Caribbean monk seal. In short, whereas the overall ecological impact of Native Americans was much less than that of Europeans, it was significant in certain times and places.

How well do these two arguments apply in the East-

ern Hemisphere? First, the mismatch between the presence of humans and the average longevity of species is much less dramatic in some parts of the Eastern Hemisphere, notably in Africa, where hominids have existed for over 3 million years. In contrast, large portions of Eurasia were uninhabited by humans until roughly 12,000 years ago, and in New Zealand and Madagascar humans have been present for less than 2000 years (Schüle 1990). It is interesting that even in Africa, where hominids have probably been burning grasslands for at least 1.5 million years, some ecologists question the wisdom of perpetuating this regime (Savory 1988). Second, comparing the relative impact of different peoples returns us to the basic issues of population densities and technology. In the Eastern Hemisphere differences as pronounced as those between Native Americans and Europeans are not so evident; the intensity of impact exists along a continuum. This is obvious with population density; it is also true of technology once you accept the idea that a stone axe, handsaw, and chainsaw are just different points on a continuum of technology.

What would it mean for conservation if we were to exclude all human activities, even those of aboriginal peoples, from a definition of "natural?" On the positive side, it would no longer be possible for people who exploit ecosystems to argue that their actions are as natural as the action of any other species using its habitat. On the negative side, it might reinforce the rift between humans and nature. One could mitigate this problem by focusing on the relative ecological impacts of different human activities. From this perspective it is not important that human activities are not natural. The key issue is their effects, which would range from having no effect on an ecosystem (e.g., observing an ecosystem from an overlook) to having a dramatic effect, either negative (e.g., replacing the ecosystem with a parking lot) or positive (e.g., removing hazardous wastes). Similarly, one could think of ecosystems along a continuum from a pole where ecosystems are virtually free of human impact to the opposite pole where ecosystems are totally dominated by humans (i.e., urban and agricultural ecosystems; see World Conservation Union/United Nations Environment Programme/World Wildlife Fund 1991). Under this construct the general goal of conservationists would be to move ecosystems along the continuum toward the natural pole, recognizing that this would create a better world for all species and that we have moved so far toward one pole that the world is out of balance even from the perspective of human welfare.

Returning to the specific issue of benchmarks for managing ecosystems, the clearest, least ambiguous one is that of no human influence. This fits well with the goal that most ecological reserves should be managed to minimize human influence as much as possible. This goal has three important caveats. First, minimizing human influence does not mean ceasing all human activities in a

reserve. As Noss and Cooperrider (1994) emphasize, removing the influence of past human activities may require substantial work. Furthermore, low-intensity recreation is an inextricable use in almost all reserves.

Second, this objective assumes no particular benchmark in time. Conservationists often refer to restoring an ecosystem to its condition before it was colonized by technologically advanced people. Choosing this particular time makes no sense: in the face of climate change we are always dealing with a moving target.

Third, it is not necessary to minimize human influence in all reserves. In some, the explicit goal could be to maintain certain types of human influence that no longer exist outside of reserves. Management based on this idea is widespread in Europe, where reserve managers often undertake traditional forms of land management (e.g., coppice harvesting; Green 1989), and this could mean restoration of Native American burning regimes in some North American reserves or parts of reserves. In Europe many rare insects and plants depend on this type of reserve management.

Outside of ecological reserves, by definition, the goals of managing ecosystems must accommodate some economic activities such as fisheries and livestock grazing. When designing these activities and evaluating how much they will influence an ecosystem, it makes little sense to muddy the waters by blindly trying to incorporate the objectives of aboriginal people. For example, if you were trying to design a burning regime that provides forage for livestock and that is reasonably close to the lightning-based fire regime, it may not be sensible to try to mimic the burning regimes of aboriginal peoples. Their objectives for burning may have been totally different from yours—for example, driving game toward waiting hunters or removing cover that might conceal attacking tribes. If their objectives were similar to yours, however (perhaps avoiding infrequent catastrophic fires by removing fuel with frequent small fires), then perhaps you could learn from their management and emulate it. The key is that we do not blindly accept the management practices of other people as sacrosanct just because they were here first. Also, the need to understand the full impact of management outside of reserves highlights the need for reserves where all human influences are minimized, not just the influences of modern people.

In summary, using the word "natural" to mean "without human influence" in the context of conservation would help to define clear benchmarks for managing ecosystems both inside and outside ecological reserves. These benchmarks would not be colored by arbitrary value judgements that praise activities by one group of people as natural and condemn activities by other people as unnatural. If we consider all human activities to be unnatural, we can focus on the primary issue: designing management practices that will move ecosystems closer to their natural structure and function. Outside of

ecological reserves this requires fulfilling an array of human needs as well. It we can learn how to do this from the traditions of aboriginal peoples, so be it, but solutions that are completely modern creations are also valid.

### Acknowledgments

I thank Aram Calhoun, Rick Knight, David Lindenmayer, and David Sanger for reviewing the first draft; John Craig, David Lindenmayer, and Ed Minot for some Australasian perspectives; and the U.S. Forest Service for organizing the workshop on ecosystem management which catalyzed this essay. Maine Agricultural and Forest Experiment Station Paper No. 2008.

### Malcolm Hunter, Jr.

Department of Wildlife Ecology, University of Maine, Orono, ME 04469-5755, U.S.A.

### Literature Cited

- Delcourt, P. A., H. R. Delcourt, P. A. Criddlebaugh, and J. Chapman. 1986. Holocene ethnobotanical and paleoecological record of human impact on vegetation in the Little Tennessee River Valley, Tennessee, U.S.A. *Quaternary Research* 25:330-349.
- Green, B. H. 1989. Conservation in cultural landscapes. Pages 182-198 in D. Western and M. Pearl, editors. *Conservation for the Twenty-first Century*. Oxford University Press, New York.
- Grumbine, R. E. 1994. What is ecosystem management? *Conservation Biology* 8:27-38.
- Jenkins, M. 1992. Species extinction. Pages 192-233 in B. Groombridge, editor. *Global biodiversity: Status of the Earth's living resources*. Chapman & Hall, London.
- Martin, P. S., and R. G. Klein, editors. 1984. *Quaternary extinctions*. The University of Arizona Press, Tucson.
- Noss, R. F., and A. Y. Cooperrider. 1994. *Saving nature's legacy*. Island Press, Washington, D.C.
- Schüle, W. 1990. Landscapes and climate on prehistory: Interactions of wildlife, man, and fire. Pages 273-318 in J. G. Goldammer, editor. *Fire in the tropical biota*. Springer-Verlag, Berlin. (UNEP).
- World Conservation Union/United Nations Environment Programme/World Wildlife Fund 1991. *Caring for the earth*. UNEP, Gland, Switzerland.

