JUNE 1987 Vol. 4, No. 8

ENDANGERED SPECIES

Technical Bulletin Reprint School of Natural Resources The University of Michigan

MAINTAINING BIOTIC DIVERSITY IN NATIONAL FORESTS: The Necessity for Large Blocks of Mature Forest

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Ever since forest managers began planning for wildlife, their strategy has been to create openings and edge conditions in forests to favor a few selected species that thrive in those conditions and are particularly desired by hunters. Indeed, the term "wildlife" has become practically synonymous with "game animals." Fortunately for foresters, the requirements of many game animals conform well with timber harvest activities. However, non-game wildlife is often affected as well and sometimes adversely so. A new model for wildlife conservation is now emerging due to increased understanding of the needs of a wider array of plants and animals.

The Role of Scale

Central to the problem of conserving biotic diversity is an understanding of the role of scale. Conditions which lead to maximizing local diversity within a habitat (alpha diversity) may lead to a decrease in diversity if applied throughout a large area. The diversity of a large area is the total (or gamma) diversity resulting from diversity both within and between habitats. Thus for large land management areas like a national forest, it would be a mistake to sacrifice gamma diversity by over-replicating one habitat type because it is particularly diverse. Yet this has been the centerpiece of "game management" strategies for many years: the intentional creation of "edge" in order to locally increase the number of favored species. Although old growth forest is not necessarily more diverse than second growth as is sometimes

mistakenly presumed (Middleton and Merriam 1985), if there are plants and animals that depend on mature forests for long term survival, then old growth forests are an important element in maintaining the overall diversity of the National Forests.

Ecologists and foresters are becoming increasingly concerned with the degradation of habitat for species that require less disturbed conditions. The cumulative effects of road building, timber harvests, and intentional creation of openings for game have fragmented most forest lands into relatively small areas of mature vegetation embedded in a matrix of younger forest. Biological communities are dynamic and permeable and respond to events at and outside their boundaries. Whenever one type of vegetation (in this case mature forest) is isolated as a relatively small patch, both small size per se (area effects) and an increased edge/area ratio (edge effects) can lead to deterioration of the biotic community.

The area of a habitat clearly influences the species that can be maintained within it. Animals with large home ranges and/or relatively narrow habitat requirements are especially sensitive to area and become scarce or disappear from isolated patches of forest. Perhaps it is less obvious that other animals with smaller home ranges and even sedentary plants also require minimum areas of suitable habitat. This is partly because numbers of organisms are not static over time. Natural fluctuations due to environmental variance and random changes in plant and animal survival and reproduction occur constantly and imply that a large enough population of

Forest Planning

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the organisms (usually called its "minimum viable population" or "MVP") must be present in an area to ensure continued presence despite these factors.

One alternative means of preventing local extinctions is to maximize the likelihood of recolonization from similar, nearby areas. Biologists find that this immigration is becoming less likely for many organisms in our fragmented landscapes and that biological preserves need to be large enough to be self-sustaining.

Island Biogeography

The exact effects of area and isolation on survival are currently the object of much study under the rubric of "Island Biogeography," a set of ecological principles that relates size and isolation of areas (including habitat "islands" such as mature forest) to the number and kinds of species that can be supported indefinitely in those areas (MacArthur and Wilson 1967; Harris 1984; Newmark 1987). The analogy of nature preserves to islands, however, has been criticized. Nature preserves may not be strictly analogous to islands because of impacts from surrounding land. This may point to the need for even larger areas for effective preservation. (Eternal External Threats, Janzen 1983, 1986).

Even where the analogy holds, research on fragmentation of natural areas is a difficult problem because organisms persist in an area for varying periods of time after habitat conditions required for long-term maintenance are gone and the population is doomed. For example, the survival of adult individuals in a population does not necessarily mean that these individuals can successfully reproduce under present conditions. The lag between habitat degradation and complete disappearance of the organisms (called the "relaxation time") may be quite long and lead to unwarranted optimism about the ability of small areas to maintain viable populations. Edge effects at small scales are well known: increased light levels and decreased humidity are common problems of small woodlots surrounded by agricultural land. It is now becoming evident that edge effects significant to many species occur at previoulsly unanticipated scales. Such edge effects have been demonstrated to occur over tens of thousands of acres, even when older forest is embedded in younger growth. The result often involves animals from the disturbed matrix adversely affecting plants and animals adaped to undisturbed habitat.

In the Great Lakes region, for example, increased herbivory by deer has contributed to a serious decline in regeneration of once important forest community members such as Eastern Hemlock and Canada Yew (Anderson & Loucks 1979; Frelich & Lorimer 1985). Similarly, the increase in nest predation and parasitism by birds and mammals favored in the disturbed forest matrix has caused a decline in breeding populations of migratory songbirds. Studies show that the rate of predation declines significantly with increased forest area (Brittingham and Temple 1983; Wilcove 1985).

Adding to the problems encountered when too much reliance is placed on small areas for preservation is the possibility of catastrophic disturbance. Small-scale disturbances such as treefalls are part of the dynamics of any natural community. Larger-scale disturbances like fires or blowdowns are common over a longer time span and must also be accounted for in natural area management. Studies of presettlement forests in Wisconsin suggest that at any one time 17% to 25% of Wisconsin's northern woods were recovering from windthrows (Canham & Loucks 1984). In 1977, Wisconsin lost its largest remaining stand of virgin forest to windthrow. Natural areas must be large enough to retain internal sources for recolonization following disturbance. This "minimum dynamic area" (Pickett and Thompson 1978) is determined both by the potential size of disturbances and by the biological characteristics of the organisms affected.

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Endangered Species Technical Bulletin Reprint

A forum for information exchange on endangered species from

The School of Natural Resources
The University of Michigan
Ann Arbor, Michigan 48109
(313) 763-3243

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Annual Subscriptions for the *Endangered Species Technical Bulletin Reprint* are $15.00 (Canada: $18 US) Send check or money order (made payable to: The University of Michigan) to:

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The University of Michigan
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Implications for Forest Management

Clearly, small patches of pristine vegetation such as Research Natural Areas (the Forest Service's land classification category that includes small (50-100 ha.) tracts of exemplary natural communities) will not suffice to maintain many sensitive species for the long term. Although no one knows with any precision how large protected blocks must be, in the Great Lakes region, areas of at least 20,000 ha. in a single large block may be necessary to provide sufficient habitat and to minimize edge effects. Areas of 40,000 ha. may even prove to be more appropriate when more data on MVP's, extinction, colonization rates, and edge effects become available.

This, however, need not imply great losses to forest economic productivity. There is no shortage of disturbed forest in most of North America. Hence, an intensification of timber harvest on non-protected areas (i.e. the majority of the remaining timber base) may be acceptable. This is exactly what we have proposed for the Chequamegon and Nicolet National Forests of Wisconsin: not a decrease in harvest levels, but a "zoning" of the forests so that 100% of the logging activities and traditional wildlife management occur on 80% of the land. This is fully compatible with the multiple use mandate of the Forest Service, which specifically states that not all forest lands should be used for all purposes. We have proposed specific "Diversity Maintenance Areas" using guidelines derived from general ecological principles (e.g. minimizing the edge/area ratio) and site-specific concerns such as "embedding" currently protected but small reserves and rare plant sites.

In this way, rather than having a homogeneous patchwork of disturbed lands and ineffective small old-growth stands, true biological diversity can be maintained by providing sufficient habitat for all kinds of plants and animals. The common but specious "ecology vs. economics" argument can be sidestepped by wisely planning the spatial distribution of forest activities for the benefit of all.

This article is extracted from the "Statements of Reason", documents written in response to the Chequamegon and Nicolet Forest Plans. These Statements (800 pgs.) provide a much fuller exposition of the above concerns, and may be obtained at cost from the authors:

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Dear Readers,

This month the Reprint *is undergoing a changing of the guard. Pamela Eaton has completed her master's degree in the School of Natural Resources and will be moving on to work in Washington D.C. Her work in developing the Reprint Program has been greatly appreciated and will undoubtedly help to make my job easier in the coming year.*

As the new editor/manager of the Reprint, *I plan to follow Pam's lead by focusing on issue oriented articles as well as those pertaining to particular species. For the coming year, I am planning articles on topics such as the history and reauthorization of the Endangered Species Act, reintroduction of extirpated species, and global climate change and its effect on habitat.*

I am excited about future prospects for the reprint and invite your comments and suggestions. Feel free to contact me through the mail or by phone. I look forward to your input.

Kathryn Kohm
Reprint Editor

July/August Issues Combined

The U.S. Fish and Wildlife Service will not be publishing its regular May issue of the Endangered Species Technical Bulletin. Rather, they plan to publish a combined May/June issue to be distributed to their readers at the end of June.

As a consequence, we will be combining the July and August issues of the *Reprint* to follow the publication schedule set for the white pages. This double issue will be distributed at the end of August. The normal publication schedule will resume in September.

Resources

Future Meetings:

The 4th World Wilderness Congress/ MAB Symposium: "World Conservation: A Call for a New Initiative" will be held at Fort Collins, Colorado September 11-18. It is planned as "the most stimulating event to address worldwide conservation issues in many years". For more information, write: MAB Bulletin, OES/ENR/MAB, Department of State, Washington, D.C. 20520.

New Publications:

Pickett, S.T.A. and White, P.S. (eds.) 1985. *The Ecology of Natural disturbance and Patch Dynamics.* Academic Press, Orlando, Florida. 472pp.

Although it is not intended to be inclusive, this book provides an excellent overview of the scope and range of research concerning environmental perturbations and patch dynamics

U.S. Joins Wetland Convention

The United States joined the 40-nation "Convention on Wetlands of International Importance Especially as Waterfowl Habitat" in April. The Treaty, popularly known as the "Ramsar Convention," sets wetlands conservation as an international goal and encourages member countries to designate significant wetlands within their borders for a worldwide list of areas valued for their biological and other scientific features. Already, nearly 49 million acres of wetlands in 344 locations throughout the world have been designated.

Resource information was provided by Jane Villa-Lobos, Smithsonian Institution

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