BIOLOGICAL DIVERSITY - IS VARIETY THE SPICE OF LIFE?

By Douglas C. Allen

Forestry and wildlife practitioners must manage and perpetuate for society a widening array of commodity and noncommodity natural resources. Pervading this responsibility is a commitment to conserve a healthy environment. The latter is not an easy task in its own right, but the challenge is magnified as our productive forest land base declines and human populations and their attendant demand on natural resources increase.

At this juncture, it is difficult to make many forest management recommendations that will enhance or sustain biological diversity, because we are ignorant of the interactions that occur between most species, and know little about the contributions that individual species make to a community. It is unlikely, however, that all species contribute equally to community structure and function. Eventually society will have to make some difficult choices; tradeoffs between human desires and the needs of other species or, more to the point, the needs of the assemblages of plants and animals that we call communities. We can minimize our regrets at some later date only if decisions are based on good science, good management practices, and an understanding of the economic, social and ecological trade offs associated with different decisions. In this regard, there is a tendency to think solely in terms of commodities — fur, feathers, wood products, or aesthetically pleasing organisms – "fuzzy" creatures and showy flowers. However, often the most important constituents of a community are "invisible" or unattractive, even repugnant, to most people. Insects, fungi, and bacteria, for example, represent a multitude of invertebrate and microbial agents that are important components of biological diversity. Many of these organisms function as key players in nutrient cycling, predator-prey relations, decomposition, and other vital community functions. The concern over biological diversity is legitimate. Relatively few life forms have a clearly defined economic value, but to varying degrees all species play a role in the structure and function within and between forest communities. Even in the absence of human disturbance, species will disappear. Paleontologists estimate that 99.9 percent of all species that have lived on earth, since its beginning some 4 billion years ago, are extinct. Today, however, the earth is losing species in forested systems, most especially in the tropics, at rates greater than ever before. This loss has many dimensions; ethical, economic, and ecological. The concerns are not felt equally by all nations, nor among peoples within a society. Humans will continue to place demands on forested systems and, in doing so, will continue to modify landscapes. These modifications must be done in a responsible way and with a better understanding of both species needs and the species interactions necessary to maintain healthy forest communities.

"We are a unique kind of animal, conscious, able to reflect on what we do, gifted in wondrous ways. But at the same time, we are tied tightly to the surrounding ecological system from which our talents, physical and psychological, are drawn. Ignorance of our source and, too often, disdain for it, lie at the root of humanity's major predicament. Politics and economics continue to centre on the individual and the collectivity, on free enterprise and social welfare, neglecting ecological necessities of a higher order. Neither philosophical liberalism championing liberty nor philosophical socialism championing equality will save us from ourselves. Human history will end in ecology or nothing." (2)

Biological Diversity - a definition

Biological diversity is a complex issue. It refers to the variety and abundance of species, their genetic composition, and the communities and landscapes in which they occur. It also refers to the variety of ecological structures, functions, or processes at any of these levels. Biological diversity occurs at spatial scales that range from local through regional to global.

While genetic diversity is a starting point in understanding the dimensions of the biological diversity issue, forest landowners can influence compositional and structural diversity most readily at two geographic scales; the stand and the forest.

Types of Diversity

Compositional diversity includes the commonly recognized species diversity, as well as genetic and community diversity. Maintaining genetic diversity is necessary to maintain the ability of a species to adapt to changing environments, and maintaining a variety of communities provides the habitats necessary for conserving diverse species.

Structural diversity pertains to the spatial arrangement of physical units. For example, at the stand level structural diversity can be characterized by the number of vegetational strata or size classes of trees. At the watershed level, this type of diversity is measured by the distribution of age classes.

Functional diversity represents variation in ecological processes; for example, predator-prey relations and nutrient cycling (the movement of nutrients, such as nitrogen, through interconnected geological, atmospheric and biological systems).

The Importance of Scale

Biological diversity is also a question of scale. The concept applies equally at the stand, forest, watershed, landscape, and global levels. Conceptually at least, biological diversity can be strategically preserved, conserved, or managed at all levels. However, the attributes of biological diversity change depending on the scale at which it is considered. Not only does this have biological implications, but social and political consequences as well. By appreciating the concept of scale, one can begin to understand the complexity of biological diversity issues, and the fact that different management strategies are required for different scales and species.

What the Private Landowner Can Do

What can a forest landowner in New York do to enhance biological diversity in a meaningful way? I certainly am not an expert on the subject, but with this admonition, I will offer my views on how each of you can help and why it is important to do so. **My theme centers on the idea that, in many instances, deliberate forest management will be the most effective tool at our disposal. Appropriate silviculture is not only key to developing healthy and productive forests from a commodity perspective, it also can be central to providing and maintaining diverse noncommodity values.**

At this point in time, we really have little scientific basis on which to make recommendations to manage for biological diver-

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sity at large geographic scales. Even if we had the information necessary to make reasonable prescriptions at watershed or landscape levels, implementation in most geographic regions would require an unprecedented degree of cooperation and planning between diverse ownerships and political jurisdictions. Above the forest level, we often lack both scientific understanding and appropriate institutional mechanisms. Our ability to maintain and perpetuate appropriate biological diversity becomes even more problematic when scientific and political questions must be addressed in the context of constitutional, and strongly held, property rights and the self-centeredness of human nature.

However, there are steps that small landowners can take to enhance diversity at the stand and forest levels. For openers, lets consider forest insect pests at the smallest geographical scale, the stand, and with a view to maintaining forest health. This approach appeals to me for two reasons; I am comfortable talking about insects, and it is at the stand level that a landowner can most easily appreciate the hows and whys of enhancing biological diversity. Admittedly, my example provides a narrow view, and one of limited scale, but the principles can be applied more broadly.

For the most part, insect outbreaks materialize because 1) natural checks on population growth, such as predators and adverse weather, temporarily relax and insect numbers increase to the limit of their food supply, 2) human activities create ideal habitats for a native insect species, or 3) we inadvertently transport an insect from another continent (say Europe) where it has evolved in close association with a complex of checks and balances, to another continent (say North America) where the climate is suitable and food plentiful, but there are no effective (coevolved) natural enemies.

Observations by forest entomologists in many forest types over several decades suggest that diverse forests are often less susceptible to insect outbreaks, or less vulnerable to damage if an outbreak occurs, compared to relatively simple forests. Forest diversity is manifested in two ways; species composition (biological diversity) and stand organization (structural diversity). A forest that consists of a single species and one size class is often more susceptible to an outbreak and less resilient to disturbance than forests that are biologically and/or structurally more diverse, such as a collection of single species stands that consist of several size classes, or mixed species stands.

Susceptibility (i.e., the likelihood or risk of an outbreak) is determined by many factors, but certainly availability of suitable food and reduced populations of natural enemies are two important ingredients. Some forest pests are polyphagous (i.e., they are capable of feeding on a wide variety of hosts) but seem to do best on just two or three species, and many others are host specific. Additionally, a pest usually concentrates on only one or two size classes of the host. For example, the major pests of white pine seedlings are quite different from those encountered on saplings, and major problems of sawtimber size white pines are different still. A stand that is diverse structurally and compositionally presents more of a "challenge" to the pest, both in terms of the pest's ability to find a suitable host and the broader array of natural enemies that it often encounters under these conditions.

Economic opportunities, management objectives, or site conditions frequently may dictate that you perpetuate a relatively simple forest condition. Under these circumstances, one should be especially attentive to changes in pest activities, including the appearance of incipient damage, that may portend future losses.

Often insect outbreaks are triggered by external events over which the landowner has no control; for example, successive years of favorable weather that enhances insect survival, or mass immigration from a distant infestation. Under these conditions, forests characterized by diverse species and structure are often less likely to sustain significant damage. That is, they are more resilient to disturbance.

Different species of mammals, birds, amphibians, flowers, etc, also have different needs. In some instances, these needs are met at the stand level or even by an individual tree. Other species may have more "expansive" habitat requirements that can be addressed only at the forest, watershed, or landscape levels. Obviously, sustainability of these organisms may depend on the coordinated efforts of many landowners, because a single holding often is not adequate to accommodate their needs. **Current thinking indicates that emphasis in biological conservation should shift away from managing for single species in favor of maintaining healthy communities (i.e., managing for collections of interacting species). In most instances, this is viewed as a more prudent approach, both from economic and ecological perspectives.**

It would be futile to try and compile specific guidelines or a list of "hands on" management activities that a landowner can use to manage or enhance biological diversity. Each ownership has different objectives, opportunities and constraints. Additionally, species and community needs vary.

The following general recommendations seem like a good place to begin for most landowners who wish to address the diversity issue: **1)** retain and perpetuate as many different habitat types on the property (both aquatic and terrestrial) as is deemed practical; **2)** maintain natural forest cover types in large blocks rather than fragmenting into smaller blocks; **3)** incorporate a conifer plantation or two within hardwood types; **4)** maintain, where economically feasible, stands with multiple rather than single tree species; **5)** retain a mosaic of age (size) classes of trees or, where practical, multilayered (two-aged or uneven aged) stands; **6)** retain snags and tree species, such as beech or basswood, which often have little "commercial" value, but are important to wildlife; **7)** layout roads carefully to minimize erosion and, ultimately, the degradation of aquatic systems; and **8)** contact your local DEC office for assistance if you believe that your property contains a rare species or habitat.

Expropriation of property or diminishment of property rights certainly are not the answer to the biological diversity issue. Understandably, most landowners cling tenaciously to the inalienable character of these rights. I would suggest, however, that along with these rights goes a social responsibility that will intensify as the human population and its overall impact on the environment increases. One could argue that true "stewardship" includes a measure of altruism. In the long run, society may have to compensate landowners for actions perceived as altruistic (and more often than not costly) when environmental concerns become entangled with the issue of private right vs public good. Rights are established by law, responsibilities are not. Is it naive to think that we can cultivate a conservation generation? I hope not. For in its truest sense, "stewardship" should transcend boundaries and ownerships, and integrate public concerns with private desires.

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SUGGESTED READING:

1) Society of American Foresters. 1991. Biological Diversity in Forest Ecosystems. 52p. (5400 Grosvenor Lane, Bethesda, MD 20814, price-$10).

2) Rowe, Stan. 1990. Home Place - Essays on Ecology. NeWest Press, Edmonton, Alberta, Canada. 253p. ($15.)

3) Hunter, Jr., M. L. 1990. Wildlife, Forests, and Forestry. Prentice Hall, Englewood Cliffs, NJ. 370p. ($60.)

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