



Managing Biodiversity

4

Forest Operations Manual
The Conservation Forestry Program

Maintaining Biodiversity

CHAPTER

4

Biodiversity

Quality of Life

Economic

Ecological

Aesthetic

Recreational

4.1 The Nature Conservancy Philosophy

The Appalachian Mountains in Southwestern Virginia contain some of the most diverse ecosystems in the world; as noted in *Chapter 3*. The Clinch Valley alone has the highest concentration of rare species anywhere in the continental United States. The rich biological diversity of the area's freshwater streams, hardwood forests, and other communities merit specific consideration in any forest management planning.

The Conservation Forestry Program is committed to managing its lands in ways that preserve and enhance this biodiversity for a number of reasons. Biodiversity contributes to the overall quality of life in economic, ecological, aesthetic, and recreational terms. It can supply income from food, medicine, and other natural materials, keep the water clean, increase the aesthetic appeal of an area, provide educational opportunities, and help maintain a healthy ecosystem.



Moreover, because our understanding of ecosystems remains incomplete, preserving biodiversity allows us to “keep our options alive”. We cannot predict the consequences of losing even one species within the ecological web; when a species vanishes, other species that relied on it are weakened and ultimately threatened, which in turn weakens more species, and so on. Apart from such practical considerations, though, each species and each ecosystem has its own intrinsic value—it should be allowed to continue to exist because it exists now.

By taking a proactive approach to biodiversity protection, The Nature Conservancy hopes to keep more species from being added to the growing lists of endangered, threatened, and otherwise rare species around the globe. In highlighting this management priority, The Conservation Forestry Program has three distinct goals:

- To maintain the biodiversity of forested ecosystems that are currently in a relatively undisturbed state
- To restore biodiversity in disturbed or degraded sites and return them to a more natural state
- To protect all habitats under management from degradation



An **ECOSYSTEM** refers to the various species living in an area, the ecological processes that link them together, and the soil, air, and water that support these organisms and processes. Ecosystems can occur on any scale, from the very small, such as a spring, to the very large, such as a large valley.

4.2 Key Strategies

To protect biodiversity, Nature Conservancy managers will:

- Maintain or restore species composition across each property to best reflect the patterns of unmanaged, undisturbed sites
- Maintain or restore age and structural diversity among trees across each property
- Protect “legacy” trees in timber harvests (i.e. trees representing those that would normally survive a natural disturbance)
- Leave dead and downed wood on site
- Develop plans to control, and where possible eradicate, invasive exotic species
- Protect and restore forests along streams and rivers
- Prevent erosion and siltation in freshwater ecosystems
- Plant native vegetation to restore cover and prevent erosion
- Protect and preserve rare species and communities
- Create and protect wildlife travel corridors
- Establish forest reserves

4.3 Principles of Biodiversity

Biodiversity has become an increasingly important issue in land management, largely because of the rapid rates of extinction across the world. Extinction is, of course, a natural process: fossil records reveal that during certain periods of history, the number of species on the planet dropped dramatically. However, after every period of mass extinction, the earth takes tens of millions of years to recover as new species evolve. Many conservation biologists believe we are in the midst of another such episode, one being exacerbated by direct human impact. The current rate of extinction may be as much as 1000 times greater than the normal background rate of extinction; if so, it will take countless generations for the world to recover.

Managing for biodiversity means managing for all living organisms in order to conserve the full variety of life. Reed Noss believes that maintaining and recovering forest biodiversity is necessary for sustaining our forests into the future. Doing so requires forest management anchored in the principles of ecology. Sometimes called “ecological forestry”, this approach emphasizes natural patterns and processes within a stand and over the landscape. Any forest management activity (timber harvest, habitat development, re-vegetation, etc.) should occur within the limits of the natural disturbance patterns that occur without human intervention. Because our native species evolved under these patterns, maintaining or mimicking them as closely as possible offers the best protection against the loss of biodiversity.

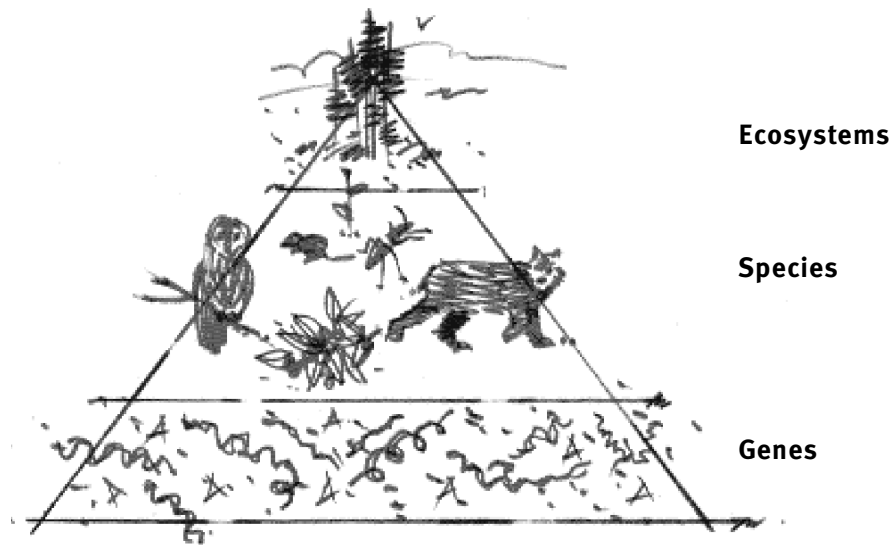
Managing for biodiversity also requires a large-scale perspective. The overall goal should be maintaining regional diversity rather than increasing local diversity, which requires forest managers to consider the impacts of management at the regional and landscape-levels, as well as on the property level.

Managers must also consider the landscape surrounding each forest ecosystem when planning. One of the major problems affecting the long-term sustainability of forests in the program area is the current level of unplanned forest management activities which are altering forest vegetation and creating homogenous, early successional habitat. As a result, forest managers should consider these properties as a whole and incorporate wildlife corridors, reserves, and other management areas (described in later sections) that help counter the effects of this trend.



MANAGING STANDS for BIODIVERSITY

At the stand level, several *factors* are critical to *preserving biodiversity*



Species Composition of the Forest Overstory: The trees in a given stand are inseparably linked to the rest of the species inhabiting the area; they supply and regulate resources such as food or light, provide structure, and affect processes such as nutrient cycles, disturbances, and understory productivity. And different trees, obviously, provide different resources and different influences, which in turn affect the number and kind of species a given forest can support.

Silvicultural approaches that mimic or help preserve natural (i.e. unmanaged) patterns of overstory species diversity can avoid disrupting the interactions between trees and other forest species, and so help minimize the impact of management activities.

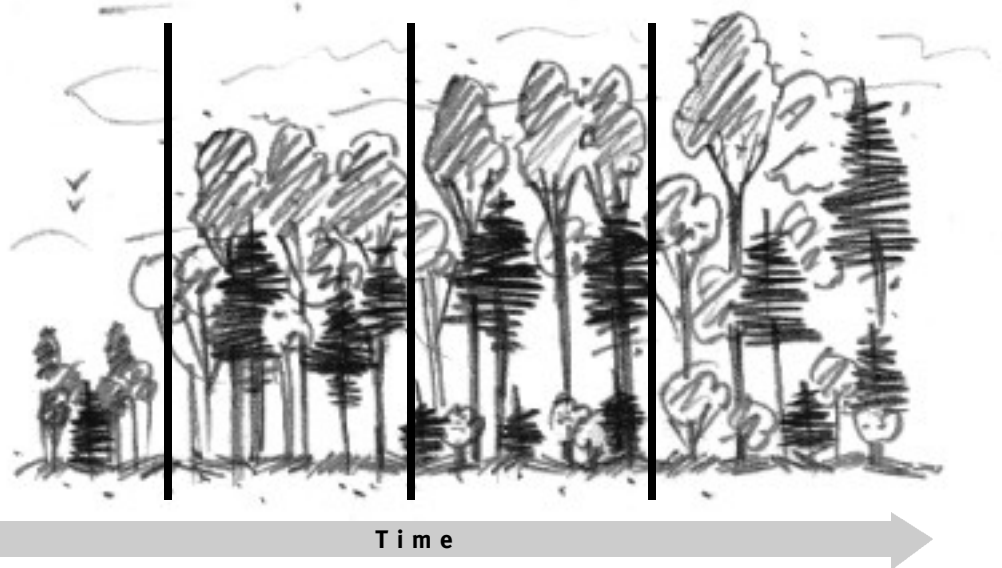
OVERSTORY

Supply & Regulate
Resources

Provide
Structure

Affect
Growing Process

Vertical Structure and Age Class: Vertical structure deals with the variation in tree height, while age class deals with the variations in tree age within a stand. Every ecosystem has its own typical patterns, and vertical structure becomes more complex as the number of generations present increases, though it also changes with successional patterns in some forests.



Like species composition, vertical structure and age class affect the animals and plants that occupy the microhabitats and microclimates created by that structure. Eastern forests tend to have a broad range of age classes present, primarily because they do not experience frequent large-scale, stand-replacing disturbance such as wildfires, but rather infrequent, partial, gap-creating ones such as ice storms. To help preserve this age and size diversity and mimic the natural patterns, forest management should remove single stems or small groups of trees through selective harvests, and avoid removing only the largest trees or otherwise uniformly reducing stand density.

A **STAND** is a contiguous group of trees sufficiently uniform in age class distribution, composition, and structure, and growing on a site of sufficiently uniform quality, to be a distinguishable unit.



Legacy Trees: Legacy trees are those that would typically be retained on a site after harvesting or would survive a natural disturbance such as a fire or hurricane creating a biological legacy. Leaving representatives of these types of trees adds age and structural diversity to a stand; in addition, as legacy trees die, they provide large cavities and large downed woody structures that offer habitat for a broad range of species.

Dying, dead, and downed trees: Because dying and dead trees serve as seedbeds for other plants, habitat for animals, and storage sites for carbon and nitrogen, they should remain where they are in the forest. In hardwood forests, live trees with decay are particularly important to many animal species; these live cavity trees, along with logs and snags, should be left in place during timber harvests to maintain the dead wood resource.



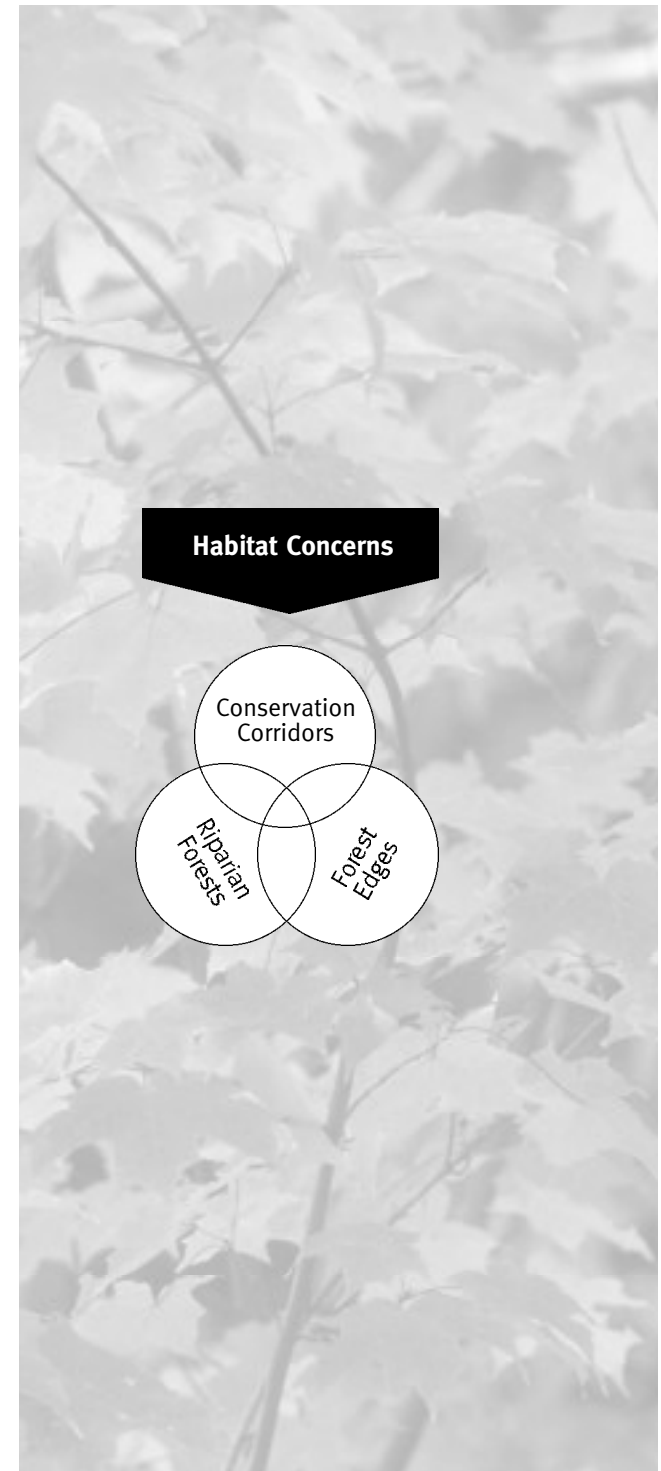
Exotic Plant Species: Invasive exotic plants negatively impact native biodiversity by 1) occupying the habitat of native plants, wildlife, or insects; 2) changing natural ecological processes such as plant succession; 3) changing the frequency and intensity of natural fires; and 4) disrupting native plant-animal associations such as pollination, seed dispersal, and host-plant relationships. As a result, forest managers should work to control, and where possible, eradicate exotic plant populations, using mechanical, or even chemical, control measures where appropriate. Examples found in southwest Virginia include: Pawlonia, Ailanthus, kudzu, Japanese honeysuckle, purple loosestrife, multi-flora rose, and several species of privet.

MANAGING LANDSCAPES for BIODIVERSITY

At the landscape level, forest managers should consider three primary habitat concerns to help maintain biodiversity: conservation corridors, riparian (i.e. streamside) forests, and forest edges.

Conservation Corridors: Habitat fragmentation that isolates species, communities, and landscapes seriously threatens biodiversity in the region. Conservation corridors that link habitat “islands” to one another offer one important proactive measure against this threat. These corridors vary in size and purpose, from smaller wildlife corridors, which allow animals to move across their range, to landscape linkages large enough to enable a complete range of ecosystem processes to operate and allow plants and smaller animals to move between larger areas over a period of generations.

Practically, the Conservation Forestry Program may only be able to work on smaller-scale corridors, creating and managing wildlife corridors that allow animals to move freely. In the short term, such corridors are a necessary minimum for maintaining the populations of area-sensitive species. Wherever possible, forest managers will establish such corridors for target species, relying primarily on riparian management zones along perennial, intermittent, and ephemeral streams.



Riparian (Streamside) Forests: A riparian area is the area alongside a stream, creek, or other freshwater area. Streamside forests are a unique ecosystem in their own right, and they contribute significantly to both upland and aquatic systems. Because they are so critical to biodiversity, particularly in the southern Appalachians, forest managers will create Riparian Management Zones to protect these areas from forestry-related disturbances, and to restore them whenever necessary. Examples of bird species that depend on this habitat include Louisiana waterthrush, Swainson's warbler, and Acadian flycatcher.

Forest Edges: A forest edge, as the name suggests, marks an abrupt transition between two relatively different ecosystems, at least one of which is a forest. Natural forests often include recognizable edges that correspond to physical changes in topography, hydrology, or substrate (bedrock), or that mark the boundaries of a large disturbance such as a hurricane or a fire. These natural edges are typically ragged and gradual. In contrast, the borders of agricultural fields, clearcuts, and other edges created by human intervention are often more abrupt, longer, and cut across complex landscapes without regard to natural features. Some wildlife, particularly popular game species such as deer or quail, benefit from forest edges. But edge habitat is incompatible with the needs of many other species, and excess edge can actually threaten diversity within the forest cover. As a result, forest managers should try to reduce the length of edge created by a harvest by planning cuts so as to leave irregularly shaped areas of uncut forest, rather than creating narrow peninsulas of forest.



ESTABLISHING FOREST RESERVES

A **forest reserve** is a protected area that, at a minimum, is taken out of timber production. No harvest operations are allowed in reserves, but they may be actively managed to control invasive exotic species, implement prescribed burns, or take other steps needed to maintain forest health and function.

By providing unharvested areas, forest reserves help protect the full range of biodiversity in the forest, including ecosystem processes, and they provide different aesthetic and recreational appeal than sites managed for timber production. Importantly, they also play a crucial role as reference sites or benchmarks that forest managers can use to evaluate the effects of forest management in other areas.

Choosing reserves to best benefit biodiversity is a complex process that involves the entire landscape rather than simply individual stands or areas. An effective system of reserves should represent the full range of ecosystems and landforms in a region and include corridors between reserves. In order to achieve this, forest managers must also create reserves in areas that would ordinarily be managed primarily for timber. These areas are typically at lower elevations and occur on more fertile land, and so represent an important dimension of the landscape that are not usually reserved because of their high timber value and easy access.





RESTORING DEGRADED or DISTURBED ECOSYSTEMS

In damaged areas, the most effective way to restore biodiversity is through restoration ecology, which attempts to return a damaged ecosystem such as a native wetland, prairie, or riparian forest, to a desired “natural” state prior to intensive human disturbance.

Within the program area, the areas most in need of restoration are often riparian areas, which have suffered damage both from past harvest operations and from unrestricted grazing, where cattle have degraded stream banks and prevented tree reproduction. As long as the damage has not significantly changed the water flows or land formations, these areas can usually be restored relatively quickly and successfully through selectively replanting key species, thinning species that have “taken over” or become too densely populated, removing exotic vegetation, restricting timber harvesting, and restricting cattle access.

In addition, forest managers may also work to restore stands with limited diversity, such as abandoned agricultural fields that are now predominantly one species such as yellow poplar, eastern redcedar, black locust, or other pioneer species. These restoration efforts will focus on managing overstory species, understory species, vertical structure, exotic species, microbes, wildlife, and dead/downed trees, as described in *Managing Stands for Biodiversity*, above.

4.4 Related Management Practices

Applying the strategies listed in Section 4.2 and adequately protecting biodiversity involves a broad range of practices, including:

- ☛ Developing a management plan that takes biodiversity into account (see Chapter 7)

