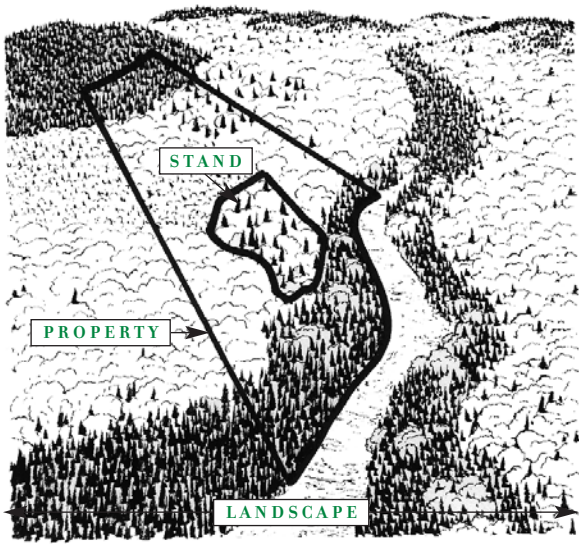
# Sustaining the Ecological Integrity of the Managed Forest

## PRINCIPLES AND PRACTICES FOR THE NORTHEASTERN FOREST REGION

THE FORESTS OF THE Northeast range from suburban woodlots of oak and pine to vast industrial timberlands of spruce, fir, and northern hardwoods. Across the region these forests provide valuable goods and services, including timber for furniture, home building and paper, diverse and extensive wildlife habitat, abundant clean water, and open space for recreation. Sustaining forestry into the future will require careful maintenance of the ecological system that is the source of these benefits. This guide is intended as a brief introduction to the concepts of maintaining forest ecosystem integrity and highlights practices that foresters, landowners and loggers can apply to help ensure the long term viability of the Northeastern forest.

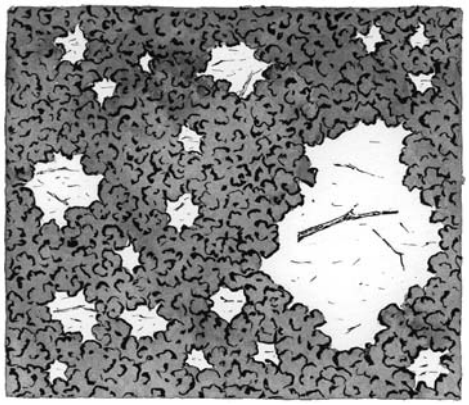
## DEFINITIONS *and* CONCEPTS

**Ecosystems** are interacting assemblages of organisms and their physical environment. The ecosystem concept can be applied at various scales. For example, a rotting log is considered to be an ecosystem, as is the forest in which the log is located. A **landscape** is a mosaic of ecosystems and landforms across a defined area. **Ecological Integrity** is the ability of an ecosystem to support and maintain **biological communities** (assemblages of species) comparable to those found in unmanaged or relatively undisturbed habitats of the region. Ecological integrity includes both organisms as well as the physical elements of the ecosystem (soils, air, water, etc.) and ecological processes, such as forest succession and nutrient cycling within the forest. The concept of ecological integrity can be applied at various scales, for example within individual **stands** (a unit of forestland delineated on the basis of tree species composition, size, age, etc.), within a larger landscape such as a local watershed, or across a larger geographic region. The diversity of stand types and ages at the landscape scale greatly affects the biological diversity within a forest.




*Consider the relationship between stand, property, and landscape scales as well as ecological site or habitat types when managing a forest.*

A forest managed with light partial cuts over a long time period (e.g., more than 100 years) is likely to have a high level of ecological integrity. This type of cutting emulates natural disturbances that are most common in this region, such as death of individual trees due to blowdown or disease. Areas managed more intensively, such as clearcuts and plantations, are more likely to have a lower level of ecological integrity. However, factors such as clearcut size, percentage of organic material removed, how well the harvest mimics a natural disturbance such as a large blowdown, the number of clearcuts in the area, the frequency of clearcutting on a given site, and the ability of the natural forest to recover all affect ecological integrity.



*Harvesting that creates gaps in the forest canopy can be used to maintain most native forest communities.*

## PRINCIPLES *for* SUSTAINING ECOLOGICAL INTEGRITY

- **Manage the entire ecosystem, not just the trees.** Traditional forestry has focused on managing individual stands to produce a crop of trees for harvest. To be successful at maintaining the ecological integrity of the forest, it is essential to manage the stand and surrounding forest as an interdependent system of plants, animals, soils, water, and atmosphere.
- **Manage both structures that are important to biological communities (e.g., large dead trees) as well as ecological processes**,such as the natural succession on a site from shade-intolerant trees to old growth.
- **Think long term**, not 10 or 20 years but the maximum life of a tree — hundreds of years.
- **Integrate management across all scales,** the stand, the property, and the landscape.
- **Ecological considerations increase with harvest intensity.** Threats to ecological integrity grow as harvest area, frequency and volume of biomass removed per harvest increase. Thus, the need to provide adequate mature forest habitat, maintain connectivity between habitats, protect sensitive habitats, and apply other Recommended Management Practices increases with harvest intensity.

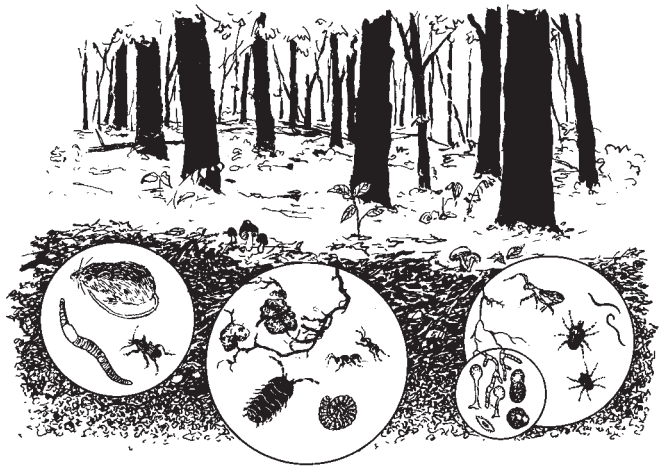
# Recommended Mar

**1. Maintain the natural structure and productive capacity of the soil.** Decaying leaves and twigs along with the underlying mineral soil are the source of most plant nutrients and provide habitat for a great diversity of organisms. Improper use of logging equipment can cause soil compaction and erosion, while clearcutting and herbicide use lead to decay of organic matter, leaching of nutrients, and loss of water-holding capacity. Whole-tree harvesting (removal of all limbs and twigs) has been associated with increased soil acidification on certain sites. Leave tree limbs in the forest when harvesting and use whole-tree clearcutting only as a last resort. Use skidders and other heavy equipment prudently to minimize soil compaction, rutting, and damage to root systems and regeneration.

**2. Use harvesting practices that are similar to the natural disturbance regimes of the forest.** Under natural conditions, small-scale gaps in the forest created by individual tree death and the blowdown of small groups of trees occur frequently in our region; these openings provide light and space for new trees and other plants to become established. Large-scale catastrophic disturbances that result in an entirely new stand, such as hurricane, blowdown, and fire, are relatively rare. Because natural forest composition is a function of this disturbance pattern, management based primarily on light partial harvests occasionally interspersed with small clearcut patches will favor native forest communities.

**3. Use management to stimulate the growth of species and structures that would naturally develop within stands over time.** Because much of the northeast was cleared for agriculture or heavily harvested in the past, our landscape is dominated by relatively young stands of simple structure (less than 100 years is relatively young in ecological terms). As stands develop over time, herbaceous plants, shrubs, and seedlings of shade-tolerant trees become established. Thin stands early in the development process to encourage stable root systems that will minimize risk of blowdown and stimulate growth of canopy trees while fostering the development of a more complex understory. Thin at various levels of intensity within the stand to mimic natural variability. Use the selection method of silviculture to create small patches of regeneration within stands. If using even-aged methods (shelterwood or clearcut), retain snags, den trees, and patches of trees with good growth potential within the harvest area. These patches will allow plants and animals to recolonize the harvest area and will provide varied structure within the new stand.

**4. Understand forest growth as it applies to each ecological site type.** Ecological site types are defined by geographic location, climate, soils and hydrology. Each ecological site type typically has a natural community that will develop over time in the absence of significant disturbance. Tree species will grow on a wide range of site types, but usually reach optimum productivity on one or two site types. Management plans should identify both existing forest cover types and ecological site types. Management that encourages the forest type best adapted to



*The forest floor provides habitat for a great number and variety of soil organisms that cycle nutriets essential for forest growth.*

# nagement Practices

*Management can be used to promote the vertical structure and species diversity that develops within stands over time.*

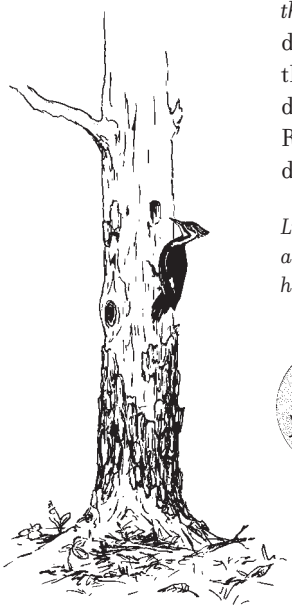
that site will be most effective at conserving ecological integrity while maximizing productivity.

**5. The goal of management should be to have the majority of the forest in mature and relatively-mature stands of long-lived species.** Management should encourage late-successional species such as sugar maple, beech, hemlock and red spruce, long-lived species of intermediate shade tolerance including white pine, red oak, and yellow birch, and associated species with high commercial value such as white ash and black cherry. While early-successional stands and short-lived species such as balsam fir, red maple, poplar, and paper birch provide important habitats and forest products, these should not predominate at the landscape scale.

**6. On every acre, leave a few trees to grow old and die.** Live cavity trees and dead trees of all sizes are especially critical to a great number of fungi, invertebrates, mammals, and birds. For the most part our forests are composed of young, relatively small trees, but many animals are dependent on large decaying and dead trees. These trees provide valuable habitat when standing alive or dead. After falling to the ground, large decaying logs provide habitat for a whole new community of organisms. Loggers may be required to remove standing dead trees for safety purposes; if so the trees should be left on the ground to decay.

**7. Identify permanent no-harvest areas where ecological processes can proceed unimpeded.** Unmanaged forest reserves cover only a small percentage of the landscape, and on private lands they are virtually non-existent. Even small no-harvest areas provide an ecological refuge within the managed forest, and no-harvest areas provide an experience for human visitors that is not possible in a managed forest. They can also serve as research areas and reference sites against which the effects of management can be compared. Reserve locations should be representative of the ecological land types found on the ownership and/or located to protect highly sensitive areas. Mark these areas on the ground and in the management plan. Permanent protection in the form of a conservation easement is the best way to assure that reserves and managed forests are treated appropriately in the future.

**8. Consider and manage the various scales at which species and communities occur on the landscape.** Do not attempt to maximize the number of species on every acre. However, within each stand use the preceding practices and more specific guidelines (see references) to develop the forest structures and species that are best adapted to the site. On a small ownership, consider the balance of age classes and stand types across the property as well as the landscape context within which the property is located. For example, a property surrounded by young forests or agricultural areas might be managed exclusively for older-forest values, whereas a forest surrounded by mature forests might be managed to include more early-successional habitat.



**9. Avoid forest fragmentation.** Management roads, clearcuts, and plantations can create barriers to movement of animals within their home range and limit dispersal of plants and animals to new habitats across the landscape. Always try to provide connectivity between forest habitats and avoid isolating sensitive habitat features such as those listed below. The risk of habitat fragmentation will be minimized by using uneven-aged management techniques and maintaining a landscape dominated by mature and relatively-mature stands.

**10. Learn to identify and manage sensitive and/or unusual natural areas.** These include areas such as stream corridors, vernal pools, seeps and springs, enriched hardwood sites, rare plant and animal habitat, old growth stands, and deer wintering areas. Many of these areas have been identified by state wildlife agencies and natural heritage programs. These areas provide specialized habitat for certain species and thus must be managed carefully to conserve their value to landscape biodiversity. *Biodiversity in the Forests of Maine* provides a thorough discussion of special habitats found throughout the Northeast as well as detailed recommendations for the other Recommended Management Practices described above.

*Live cavity trees, standing dead trees, and downed logs are important habitat features.*

# CONCLUSION

OUR ABILITY TO MAINTAIN the ecological integrity of the forest is limited by our knowledge of ecosystem science. However, we have yet to broadly apply what we already know. The preceding principles and practices provide a framework of ecological considerations on which to base forest management, but by no means provide all the answers. Landowner objectives, ownership size, and economic constraints must also be factored into the process. Careful assessment of where the forest has come from, its current condition, surrounding landscape context, and potential response to management are essential. There are no fixed rules and formulas in ecology; tempering these suggestions with on-the-ground observation, monitoring, and judgment on the part of loggers, landowners, and foresters will be necessary.

## Additional References

FOR MORE SPECIFIC GUIDELINES on managing forest biodiversity, the following references are suggested:


*Applied Ecosystem Management on Non-industrial Forest Land.* W.B. Leak, et. al. 1998.USDA Forest Service, General Technical Report NE-239. *Fiber 3.0: An Ecological Growth Model for Northeastern Forest Types.* D.S. Solomon et. al. 1995. USDA Forest Serice General Technical Report NE-204. *New England Wildlife: Management of Forested Habitats.* R.M. DeGraaf et. al. 1992. USDA Forest Service General Technical Report NE-144. Available from US Forest Service Publications Division, 359 Main Road, Delaware, OH 43015. Fax (614) 368-0152

*Biodiversity in the Forests of Maine: Guidelines for Land Management.* C.A. Elliot, editor. 1999. UMCE Bulletin #7147. University of Maine Cooperative Extension Service, Communications Office, 5741 Libby Hall, and Orono, ME 04469-5741; 800-287-0274 (within Maine) or 207-581-3269

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## Credits


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