

# BIOLOGICAL DIVERSITY AND WILDLIFE HABITAT CONSIDERATIONS IN MANAGED FORESTS



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## INTRODUCTION

Options abound for promoting the conservation of biological diversity (*biodiversity*) and contributing to *wildlife habitat* in managed forests. Interest among land managers for incorporating such practices in their operations has increased noticeably over the past decade. During the *Sustainable Forestry Initiative® (SFI) Biodiversity Workshops* held in 1998 and 2001, it became evident that SFI® program participants and other interested landowners would benefit from a concise, organized document discussing *biodiversity* considerations and *wildlife habitat* in managed forests.

However, it is beyond the scope of this publication to list every consideration available to forest managers or to cover their application for all forest types and geographies. Suggestions in this publication can provide a framework to assist forest managers in developing policies, plans, management actions, and monitoring systems for *biodiversity* conservation and *wildlife habitat*. SFI program participants are committed to improving the performance of their own operations, setting new standards for the forest industry, and promoting those practices to other forest landowners.

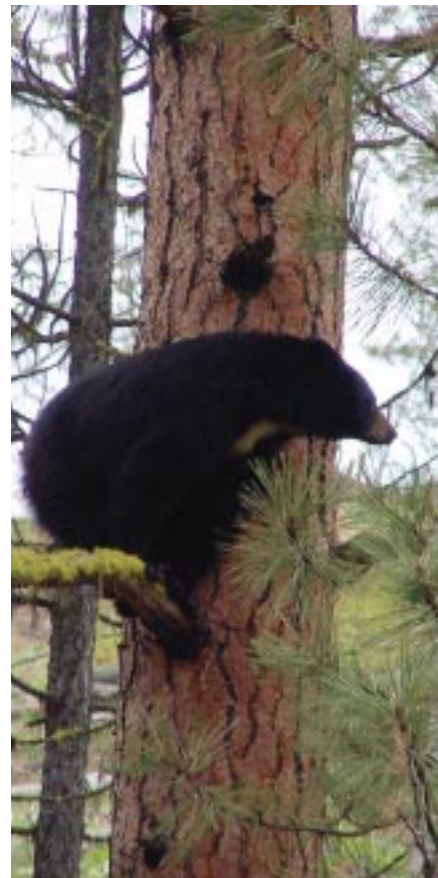
**NOTE: The general planning process and management options presented here are for information only. They are neither requirements nor specific expectations of the SFI Standard (SFIS) 2005-2009 Edition and shall not be used to audit compliance with the SFIS.** The SFIS and SFI Audit Procedures and Qualifications, which establish requirements and expectations, are under the sole authority of the Sustainable Forestry Board.

## UNDERSTANDING DIFFERENCES AND SIMILARITIES BETWEEN WILDLIFE HABITAT AND BIODIVERSITY CONSERVATION

It is important to understand the similarities and differences between providing *wildlife habitat* diversity and conserving *biodiversity*. Wildlife habitat is a place where populations of plants and animals live and obtain food, water and shelter. Some species require only one or a few specific habitat types, while others require a more complex combination



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or arrangement of habitat types across a landscape. A diversity of habitat types helps ensure that the potential for a wide range of plants and animals is present. Habitat diversity can be planned and promoted through specific management practices targeted at individual or groups of species. Management aimed at promoting habitat diversity in a managed forest may also increase the potential to maintain or improve biodiversity.

Biodiversity is simply defined as the variety of life (including diversity of species, genetic diversity and diversity

of ecosystems) and the processes that support it. Although many factors are related to biodiversity, landowners can contribute to the *conservation* of biodiversity by providing a diversity of habitats. More direct efforts to conserve biodiversity typically include the *protection* or management of *rare* animals, plants and communities, as well as special features and unique sites. Yet, in some instances, maintaining uncommon representative species or communities may require less habitat diversity in a specific location, rather than more.



# A GENERAL PLANNING PROCESS

To address wildlife habitat and conservation of biodiversity, it is important to develop and use an effective planning process. The following steps are significant components of a general planning process, including:

- 1) Conducting an assessment.
- 2) Establishing broad resource goals and landowner objectives.
- 3) Developing and implementing a plan.
- 4) Monitoring and adjusting the plan.

Plans are dynamic strategies that should be evaluated and updated periodically. Monitoring and evaluating the impacts of management practices aimed at promoting wildlife habitat and conserving biodiversity allows for adjustments and modifications of plans over time. This adaptive management approach continually improves and modifies plans based on a combination of practical experience, in-the-field monitoring and results, and the incorporation of the *best available scientific information* available from new and emerging research.

## Conducting an Assessment

Before defining goals and developing specific management objectives, it is important to make an overall assess-

ment of the land and existing conditions. This important step establishes a baseline of information useful for identifying management possibilities, while comparing and documenting progress of selected wildlife habitat and biodiversity goals over time. An assessment can rely heavily on information (e.g., cover or habitat type, age and composition of *forest stands*, stand history and condition, *silvicultural* practices, and other forest information) frequently available in the landowner's *inventory* or map system. Other accessible information, such as web-based resource data (e.g., photography/imagery, species lists, habitat descriptions, conservation priorities and other infor-

mation) may also be used. In some cases, in-the-field assessments may be needed to clarify and identify features not found in inventory systems or distinguishable by remote methods.

Assistance from outside experts is often available to help determine wildlife habitat and biodiversity features on the land. Some organizations (e.g., NatureServe, State Natural Heritage Programs in the U.S., Provincial Conservation Data Centers in Canada, and natural resource agencies) are willing to share data on the occurrence and distribution of rare species and communities, threatened and endangered species, species at risk, and special or unique sites. An assessment



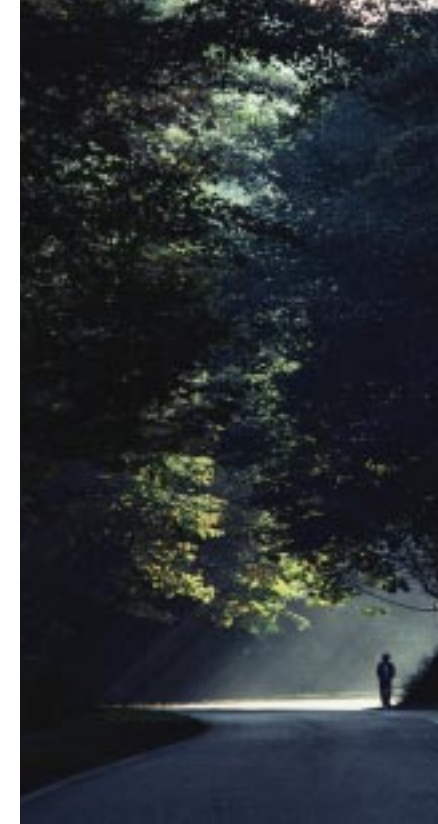
should identify and document existing biological and physical features that support unique wildlife habitat and contribute to biodiversity conservation. It may take several iterations through the planning process, including the assessment phase, to eventually identify reasonable management targets and measures of wildlife habitat and biodiversity.

During and after the assessment process, landowner goals, objectives and opportunities for promoting wildlife habitat and conserving biodiversity can be developed and clarified. An assessment may also reveal management changes that are needed before certain landowner objectives can be met.

## Establishing Broad Resource Goals and Landowner Objectives

For clarification, goals are broad statements of intent that provide general guidance and direction to a plan. Landowner objectives are specific actions aimed at accomplishing goals. A significant distinction is that landowner objectives are measurable, which is important when developing *metrics* (measures) that document progress and success.

A first step is to develop a *policy*, which is a written commitment, to promote wildlife habitat and conserve biodiversity with clearly-stated, short- and long-term goals and objectives. When developing a policy, the major issues and considerations for wildlife habitat and biodiversity can be identified and prioritized internally or with input from outside experts.



External sources of input can vary from consultants, university faculty, staff ecologists and natural resource agency recommendations, to a more formalized process involving structured committees of stakeholders, special interest groups and conservation organizations. As management actions are developed to address pertinent issues, other information (e.g., species occurrence, critical *habitat* needs and other available scientific evidence) may be helpful in refining goals and landowner objectives. For ownerships in areas covered by regional *biodiversity* or conservation plans, the goals, species inventories, recommended actions and other relevant information from those plans also may be considered.

After significant issues and opportunities pertaining to wildlife habitat and biodiversity are identified, priorities for each may be assigned based on importance and achievability. For example, suppose that a lack of mature, forested *riparian* habitat for Neotropical

## Examples of Features Easily Identified During an Assessment

### BOUNDARIES:

- Property
- Land-Use/Cover Types
- Hardwood, Coniferous and Mixed Forests
- Wetlands and Water Sources (rivers, streams and ponds)
- Farmland, Residential and Other Developed Areas

### MAN-MADE FEATURES:

- Roads and Trails
- Fences and Ditch Banks
- Houses and Buildings
- Utility Rights-of-Way
- Easement Areas

### NATURAL FEATURES AND SPECIAL SITES:

- Soil Type(s)
- Steep Slopes and Ridges
- Seeps, Springs, Natural Meadows and Glades
- Rock Outcrops and Talus Slopes
- Caves
- Waterfalls
- Archaeological, Cultural and Historic Sites

migratory birds has been identified as a high-priority concern in a watershed plan developed by a bird conservation organization in cooperation with a state Department of Natural Resources.

Landowner A owns several forested tracts within the watershed that total more than 10,000 acres and contain multiple streams. Landowner B owns several tracts totaling about 3,000 acres on upland forest sites within the watershed. Landowner B's tracts contain few streams. Landowner A has a significant opportunity to contribute to efforts that provide forested riparian habitat through *Streamside Management Zones* and may consider this an appropriate long-term goal. Landowner B, on the other hand, has only a limited opportunity to provide mature riparian habitat and may consider this goal to be less relevant to their ownership.

However, both landowners have opportunities to promote wildlife habitat and conserve biodiversity in the water-

shed by providing *snags* for primary cavity excavators and other cavity-dependent wildlife. Short-term actions for both might include retention of existing snags during and after harvest and *regeneration*. Long-term actions might include retention of living trees that could become snags as the forest matures on recently-harvested areas. Retention of decadent trees and considerations of snag resources within streamside zones could also address issues of snag density and distribution across the forest *landscape*.

#### Developing and Implementing a Plan

The next step is to develop a detailed plan that outlines specific actions to meet habitat and biodiversity goals and objectives, and incorporate these into the overall forest management plan. The usual foundation of a plan is a *land classification* system that separates large geographic areas into

landscapes and management units or forest stands. A landscape is a *spatial* mosaic of ecosystems, landforms and plant communities across a specified area. Landscapes typically are land areas characterized by similar biogeoclimatic conditions that influence site potential and similar historical disturbance regimes that influence vegetation structure and species composition. Landscapes are large enough to ensure a range of habitat conditions for naturally-occurring plant and animal communities.

Management units are a portion of a forest under one ownership, usually contiguous and composed utilizing various other indicia, depending on the goals and objectives of the land owner. Units may have similar characteristics such as vegetation, stand composition, soils, topography, *productivity* and other features. They may be classified as a coniferous forest, hardwood stand, swamp, riparian forest, field or other distinctive areas.

Because of their uniqueness, units can often be identified from aerial photographs, maps and other remote sensing tools. Generally, management recommendations are similar for areas classified as the same type of unit. A forest stand is a contiguous group of trees sufficiently uniform in age-class distribution, composition and structure. Stands usually grow on sites of sufficiently uniform quality to be distinguishable.

Landscapes and management units may be evaluated for existing and potential contributions (through protection or management) to wildlife habitat and biodiversity. Management prescriptions

should relate directly to the broad resource goals and landowner objectives already established for wildlife habitat and biodiversity and to the characteristics (e.g., vegetation, soil type and capabilities, unique areas and other features) and response potential of sites. This process should be based on the best available scientific information and consultation with wildlife and natural resource experts. A timetable and schedule can be developed for implementing management recommendations. Consideration may be given to timing, costs and the potential for each practice to contribute to wildlife habitat and biodiversity, as well as the likelihood to complement or conflict with ongoing timber management operations.

#### Monitoring and Adjusting the Plan

Metrics are important tools for measuring and monitoring progress toward retaining and promoting wildlife habitat and conserving biodiversity, and for identifying improvement opportunities. Metrics selected by landowners need to relate back to the landowners' specific objectives and the characteristics of their ownership and geographic region.

Metrics also should be cost-effective and focus on a limited number of important, measurable features of the forest. For example, simple metrics, such as the number or density of regeneration areas with snags and retention trees, might be sufficient to establish a baseline of information to document progress toward a goal of increasing snag resources. These measures can be



refined over time by specifying a desired size (e.g., diameter or height) or tree species known to produce quality snags preferred by cavity-dependent wildlife.

During the planning process, it is important to establish reasonable metric targets and expectations for success. It is not necessary for a landowner to strive for a maximum level or a narrow range of a specific level of impact to meet wildlife habitat and biodiversity goals within individual forest stands or across forested landscapes. A more realistic approach may be to develop expectations of success within a relatively broad range of impact (e.g., 35% to 60%), or above or below a target threshold (e.g., less than 25%).

Landowners may want to establish broad ranges or readily achievable thresholds for metrics early in the planning process, then narrow the range or

move the threshold as monitoring capability increases and landowner objectives and metrics are refined. Metrics may also be applied to some portion of an ownership, rather than an entire ownership, or for some period of time, rather than indefinitely. Pilot projects and demonstration areas may be appropriate first steps toward development and evaluation of candidate metrics. At a minimum, metrics should provide the opportunity to monitor the trends of forest managers across ownership and over time.

For illustration and to stimulate further thinking, examples of metrics for wildlife habitat and biodiversity are listed in Appendix 1. Forest managers and planners, if they choose, can use these examples to develop their own set of metrics specific to local conditions and ownership objectives.



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## FOREST STANDS AND LANDSCAPES

Opportunities for providing wildlife habitat and conserving biodiversity can occur at stand and landscape levels. The potential flora and fauna at the forest stand or landscape level varies by area and ecological region. As a result, any forested landholding has its own capacity for providing wildlife habitat and contributing to biodiversity. The expression of this potential is largely influenced by diversity in pattern, composition, age and structure of forest stands.

In turn, these attributes are mainly influenced by the combined effects of site characteristics, disturbance and succession (i.e., the subsequent development of the forest). Site characteristics (e.g., geology, soils and topography) interacting with disturbances (e.g., fire, wind, forest pathogens and forest management) create a variety of forest patterns, compositions and structures over time. Plant and animal species tend to increase or decrease in their abundance according to the habitats created by these interactions.

### Potential Management Options

Many options are available for improving wildlife habitat and biodiversity in managed forests. However, not all options are appropriate or feasible on every forest stand or across all forested landscapes. It is important to select management options that offer the greatest opportunities for promoting wildlife habitat and conserving biodiversity while fulfilling other land ownership objectives. Some of these options include, but are not limited to, conserving wildlife habitat and biodiversity by:

1. Managing stand-level habitat features.
2. Promoting *aquatic* and riparian areas.
3. Managing landscape features.
4. Conserving rare species and communities.
5. Protecting special sites.
6. Developing partnerships with natural resource agencies and conservation organizations.



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# STAND-LEVEL FOREST MANAGEMENT CONSIDERATIONS

Stand-level management involves identification and management of important habitat features during the growth and harvest of a forest stand. When a goal for stand-level management is to improve wildlife habitat features and promote biodiversity through the use of silvicultural practices, objectives may include:

- 1) Promoting vertical diversity and structure.
- 2) Increasing snags, snag recruitment and down woody material.
- 3) Protecting and retaining important wildlife habitat features.
- 4) Conserving native tree and plant communities.

- 5) Retaining and promoting *mast* production for wildlife.
- 6) Protecting and managing aquatic and riparian areas.

## Promoting Vertical Diversity and Structure in the Forest Stand

*Vertical structure* is defined by the vegetative layers from ground level to tree canopy. Management can increase vertical diversity in forest stands by opening closed forest canopies during selective timber harvests, which stimulates growth of a multi-canopied stand. Another alternative for increasing canopy layers is to retain standing trees or shrubs during final timber harvest. Vertical structure has been related to the

diversity of songbird species found in forest stands, and is also an important habitat component for many species associated with older and *natural forests*.

## Potential Management Options

1. Retain some trees during *final harvest*, especially those with cavities and structural deformities. These trees often enhance habitats in intensively managed forest stands.
2. Retain understory trees or shrubs, as either individuals or in dumps, to accelerate development of vertical habitat structure.
3. Use thinning to increase structural diversity in forest stands. This will result in greater understory plant diversity and a greater range of tree sizes.
4. Use selective timber harvests to open closed canopies or provide advanced regeneration.

## Increasing Snags, Snag Recruitment and Down Woody Material in the Forest Stand

Snags, green trees (for future snag recruitment) and down woody materials (logs and large limbs) are important wildlife habitat features. Snags and green trees provide foraging sites for insect-eating birds and cavities for nesting or denning wildlife. The usefulness of snags often depends on the

cavities created by woodpeckers. In this manner, woodpeckers play a role as *keystone species* by providing habitats for secondary cavity users.

Reptiles, amphibians, small mammals, insects, fungi and other wildlife utilize dead woody material for food and cover. Decaying woody material also returns nutrients to the soil and helps retain site productivity. Management can be designed to promote dead woody materials, snags and green trees.

## Potential Management Options

1. Leave some snags and *green recruitment trees* during timber harvest (if they do not present a safety hazard). Snags of all sizes are usable by wildlife. Providing a range of tree sizes or number of snags will contribute habitat for a variety of species.
2. Avoid removal of existing down woody materials, especially large logs and stumps.
3. Focus attention of down woody debris, snags and green recruitment trees in areas where trees are retained during harvest.
4. Utilize cull logs or logging debris from landings to meet dead wood objectives.
5. Apply leave-tree management practices to riparian areas as a means to provide snags, green trees and dead wood.
6. During *timber stand improvement*, selectively create *snags* by topping, girdling or herbicide injection of candidate trees.

## Native Tree and Plant Communities

Native tree and plant species within stands contribute to vegetation and wildlife diversity. Many wildlife species have strong associations with certain



plant communities, such as the endangered red-cockaded woodpecker in mature longleaf pine forests, and certain amphibians in bottomland hardwoods. Many native habitats require frequent management. For example, in many regions *prescribed fire* is an important tool for managing diversity of understory plant communities and associated animal species.

## Potential Management Options

1. Identify and map ecologically important natural communities.
2. Identify management actions required to maintain native habitats in the desired condition.
3. Avoid road and landing construction that would negatively impact rare plant communities.



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### Mast Production for Wildlife

Mast is the fruit of trees, shrubs and vines and is classified as hard (e.g., acorns) or soft (e.g., wild grapes). Many species of wildlife utilize mast-producing trees and plants for food throughout the year. Forest management practices can greatly influence the type and availability of mast. For example, practices that retain and promote a variety of hardwoods in managed coniferous stands enhance hard mast production and availability for wildlife. Soft mast production can be promoted by creating openings and gaps within stands to encourage production of herbaceous plants and shrubs that are important fruit producers for wildlife.

### Potential Management Options

1. Train field personnel to identify mast-producing trees, shrubs and vines important to wildlife.
2. Mark mast-producing trees to prevent damage during silvicultural operations.
3. Release trees that produce mast for wildlife from competition by injecting lower-quality trees with herbicides or by cutting.
4. Manage for a mixture of oak species, such as the red and white oak groups, to ensure consistent acorn production. The best mast production comes from healthy, vigorous trees with large trunk diameters and well-developed crowns.
5. Maintain or establish mast-producing trees, shrubs and vines.

### Aquatic and Riparian Management

Aquatic and riparian areas are some of the most productive sites for wildlife habitat and biodiversity across the landscape. These sites include areas in and adjacent to streams, lakes, wetlands and isolated wetlands (e.g., vernal pools, seeps, springs and ponds). Management efforts focused on aquatic and riparian areas will serve to protect and conserve water quality, aquatic biodiversity, soil productivity and plant diversity. In some cases, these areas offer management opportunities to promote terrestrial wildlife habitat and biodiversity. For example, many riparian areas are comprised of natural forest with multiple canopy layers and excellent

vertical diversity. These features can be maintained and promoted using selective timber harvests.

Vegetative structure and diversity can also be enhanced in wetlands using management practices and disturbances that encourage early *successional* habitats. Goals consistent with many landowner objectives will often improve riparian areas for wildlife habitat and biodiversity. Objectives may include:

- 1) Protect riparian function by maintaining bank stability, stream shading (where needed) and recruitment of large woody debris to stream channels.
- 2) Maintain or increase riparian forest composition.
- 3) Retain isolated wetland features and function.
- 4) Minimize run-off and sediment inputs into streams and wetlands.

### Potential Management Options

1. Identify and map riparian and wetland systems.
2. Define stand boundaries using floodplains, topography, vegetative communities or other natural site characteristics.
3. Minimize equipment operations in Streamside Management Zones (SMZs).
4. Retain in-stream structural components. Maintain stream temperatures beneficial to local aquatic diversity.
5. Minimize stream crossings and adhere to *Best Management Practice (BMP)* guidelines when constructing crossings.
6. Conserve isolated wetlands during silvicultural operations.



# LANDSCAPE-LEVEL FOREST MANAGEMENT CONSIDERATIONS

A general goal for landscape-level forest management is to contribute to spatially and *temporally* diverse landscape patterns. To achieve this goal, some forest landowners seek to promote across the landscape a diversity of forest conditions (e.g., age, structure and species composition) and habitat connectivity to facilitate movements of plants and animals. Landscape management sometimes involves voluntary cooperation with other willing landowners to address objectives of mutual interest.

Size, shape and distribution of timber harvests affect the availability of various habitat types and the diversity of conditions across managed forest landscapes. Using a variety of sizes and shapes for harvest openings (patches) promotes spatial habitat diversity (both horizontal and vertical diversity) across the landscape.

When developing plans for the number and size of openings in managed stands, managers may wish to consult historical records of natural openings for their locale. The size, frequency and spatial distribution of natural disturbances (e.g., wildfire, weather damage, treefall gaps, and insect and disease damage) and land features (e.g., riparian zones and



topography) may also be used to define forest opening characteristics.

Managing age or structural differences among adjacent forest stands is another method to promote *horizontal habitat diversity* in managed forest landscapes while also achieving a sustained yield of forest products. Various plant and wildlife species are associated with different stages of forest succession and may require more than one habitat type during their lifecycle.

Balancing forest age or structural classes and their juxtaposition provides a variety of forest types, vegetation successional stages and other habitat types important to wildlife. Future timber harvests and forest regeneration efforts can be planned to increase the variety of differences in ages or structural characteristics of adjacent stands and to

increase horizontal habitat diversity across the forest landscape. The goal is not necessarily to maximize differences in age or structural class adjacencies, but to provide for a range and diversity of habitat conditions.

The impact of a management prescription on biodiversity conservation and wildlife habitat depends on a number of factors. Wildlife and biodiversity responses often change as the forest successional stages evolve. While large openings created by timber harvests may increase the availability or quality of habitat for many species, habitat quality will likely decrease for others that are dependent on mature forest stands. Some landowners retain permanent or semi-permanent strips or *patches* of unharvested forest in large openings to improve habitat values in large harvest

units for affected species, connect similar habitats, and promote plant diversity and wildlife habitat across the landscape.

Other connectivity features—such as SMZs and other landscape linkages (e.g., roadways, utility rights-of-way, hedgerows, fence lines and recreational greenways)—can be designated and managed as special units to interconnect large blocks of forested habitat or protected areas. For many reasons, riparian areas offer opportunities for creating a system of permanent interconnecting *corridors* across the landscape. Retaining connectivity features within a shifting mosaic of forest stands requires a good bit of planning and forethought.

Sometimes, multiple landowners within a landscape may wish to address wildlife or biodiversity objectives of mutual interest. In such cases, voluntary collaborative management can help willing landowners promote wildlife habitat and conserve biodiversity on a large scale or across mixed ownerships.

During collaborative planning, the landscape could be evaluated using remote sensing tools (e.g., aerial photographs and soil maps) to identify opportunities for conserving important continuous habitats or meeting other objectives across ownerships. For example, habitat connectivity involving riparian forests and watersheds may be a high priority. Other possible considerations for adjoining landowners are age and structure of the adjoining stands, habitat patch size, and the creation or management of older and natural forest conditions.

## Potential Management Options

1. Create frequency distributions for attributes such as harvest unit sizes, stand structural classes or stand ages.
2. Use irregular shaped harvest units when striving to increase *edge* and *ecotone habitat*.
3. Use *retention strips* or patches when harvesting large stands.
4. Where feasible and appropriate, use small *patch* or *selective cutting* to create openings of early *successional habitats* in riparian and natural stands, and to promote *regeneration* of shade-tolerant tree species favored by *wildlife* for food (e.g., hard or soft *mast*) or cover (e.g., den formation).
5. A variety of age and canopy height differences between adjacent stands promotes habitat diversity.
6. Maintain riparian forest in older age classes.
7. Use SMZs, corridors and retention strips to increase differences in age and tree species of adjacent stands. These sites can be managed as multi-aged, mixed-tree species stands.
8. Riparian forests, SMZs and natural forests

may be retained as permanent connectivity features across the landscape. Objectives for more comprehensive or site-specific wildlife habitat or biodiversity outcomes associated with riparian areas may lead to habitat management efforts that go beyond basic Best Management Practices required to protect water quality, such as wider than normal recommended SMZs, or providing openings next to streams and other water bodies that would normally be left in tree cover.

9. Manage selected stands on a longer rotation to create mid- to late-successional forest conditions. Features that can be encouraged include diverse tree species composition, large trees, large snags and downed logs. The landowner may retain some canopy gaps and dead wood created from disturbances.
10. Explore potential partnerships with other property owners within the landscape where there may be mutual advantage for management of common areas or habitat diversity.



### Rare Species and Communities

Rare plants and animals (endangered and threatened species, *critically imperiled* and *imperiled* species, species of concern, and uncommon species) and their habitats may be important components of a forest landscape. In managed forests, these species and their associated communities may deserve special attention and often depend on specific habitat conditions at the local level.

It is important to understand the habitat characteristics and needs of rare plants and animals in order to protect or conserve their occurrence. In some cases, sensitive plant and animal communities may need complete protection

from silvicultural operations. Other species, like fire-dependent or shade-intolerant plants, may require management efforts, such as prescribed fire, overstory management or other disturbances for maintenance. Landowner objectives may include:

- 1) Identify, locate, protect and monitor rare species and communities.
- 2) Retain and promote habitats, mitigating or minimizing negative impacts on rare species and communities.
- 3) Identify agencies or organizations with technical expertise and participate in cooperative research and management programs directed toward protecting rare species and habitats within their current range.

### Potential Management Options

1. Cooperate with NatureServe, Natural Heritage Programs, Conservation Data Centers, natural resource agencies or conservation organizations to evaluate *forestlands* for rare plants, animals, communities and special habitat features.
2. Document the location of *rare* plants, animals and communities, preferably using a *Geographical Information System (GIS)*.
3. Identify site characteristics (e.g., soil types and topography) associated with known occurrences of *rare* plants, animals and communities to aid in determining potential occurrences elsewhere.
4. Develop management strategies for identifying, protecting or conserving threatened and endangered species, rare plants, animals and communities.
5. Train field personnel to identify and protect rare plants, animals and communities that may occur across the landscape.



### Special Sites

Special sites are unique areas of ecological, geological, cultural or historic importance that are uncommon in managed forests. Because of their rarity and unique features, special sites may offer valuable contributions to biodiversity conservation in managed forests. Rare plant and animal communities often are associated with ecologic and geologic special sites. Examples include granite and rocky outcrops, cliffs, caves, glades and other unique areas. Examples of cultural or historic sites, which also are frequently associated with special habitat characteristics, are Indian mounds, battlefields and burial sites.

Landowner objectives may include:

- 1) Retain the ecological and biodiversity functions associated with special sites.
- 2) Identify, locate and archive records

of special sites on their forest ownership.

- 3) Protect and retain the uniqueness of special sites through the development of guidelines, policies and employee/contractor training.

### Potential Management Options

1. Train field personnel to identify special sites and the unique features or species associated with them.
2. Document the location of special sites, preferably using GIS techniques.
3. When planning forest management or other land-use activities in the vicinity of cultural or historic special sites, consult with state historical and archeological agencies for information on appropriate protection measures.
4. Develop policies for identifying and protecting special sites (e.g., springs, talus slopes, caves, sink holes, rock outcrops, cliffs and other unique areas).

# PARTNERSHIPS WITH AGENCIES AND ORGANIZATIONS

Many landowners have limited resources to direct towards biodiversity conservation. This factor can be mitigated by leveraging existing resources with organizations interested in biodiversity conservation or wildlife habitat development. Many diverse partnerships have developed between landowners, local conservation organizations, and state, provincial or federal natural resource agencies. Often these interested groups are willing to assist with technical support for assessing the occurrence of rare species or special

sites of ecological, geological, cultural or historic significance.

In addition, some organizations may be interested in playing a role in assisting landowners in the design and implementation of management practices that benefit a species or special site, while enabling the landowner to meet land management objectives. Such assistance may include thinning forest stands, conducting prescribed burns, collaborating in research and technology development, sharing information, and providing educational material and building structures (e.g., fencing or bars to protect caves, nesting boxes for

animals and passages for fish). Aside from the obvious benefits for biodiversity and wildlife, partnerships help local communities gain an understanding of the unique character of their surrounding forest, and help other landowners learn new practices to meet their ownership objectives.

## Management Options

1. Develop relationships with potential partners and explore potential collaboration.
2. Highlight successful partnerships and conservation projects in the media.

## Where to Find Assistance

**FOREST INDUSTRY LANDOWNER ASSISTANCE PROGRAMS AND COMPANY FORESTERS & BIOLOGISTS.** Many forest product companies have developed *forestry* and wildlife programs that provide technical and sometimes cost-sharing assistance to private non-industrial forest landowners. Contact state forestry commissions for listings of companies that provide landowner assistance.

**NATIONAL ASSOCIATION OF CONSERVATION DISTRICTS.** There are nearly 3,000 conservation districts, one in almost every county in the United States. Conservation districts assist local citizens and conserve land, water, forests, wildlife and other natural resources. Contact state and district offices or visit the web site at [www.nacdnet.org](http://www.nacdnet.org).

**NATURESERVE.** NatureServe represents an international network of biological inventories – also known as natural heritage programs or conservation data centers – operating in all 50 U.S. states, Canada, Latin America and the Caribbean. NatureServe not only collects and manages detailed local information on plants, animals and ecosystems, but also develops information products, data management tools and conservation services to help meet local, national and global conservation needs. Contact NatureServe or state heritage programs (also known as conservation data centers in Idaho and Canada) at [www.natureserve.org](http://www.natureserve.org).

**USDA COOPERATIVE STATE RESEARCH, EDUCATION AND EXTENSION SERVICE AND PARTNER UNIVERSITIES.** Information, educational publications, videos and programs on forest and wildlife management and biodiversity conservation. Contact regional, state or county offices, or visit the web site at [www.crees.usda.gov](http://www.crees.usda.gov).

**U.S. FISH & WILDLIFE SERVICE.** Limited technical, educational and sometimes cost-sharing assistance. Programs include the Partners for Fish and Wildlife Program, the Cooperative Endangered Species Conservation Fund, and private land programs such as the State and Tribal Wildlife Grants, Private Stewardship Grants, and the Landowner Incentive Program Grants. Contact regional, state or district offices, or visit the web site at [www.fws.gov](http://www.fws.gov).

**USDA FOREST SERVICE STATE AND PRIVATE FORESTRY.** Forest and wildlife management educational materials. They also provide technical assistance for the Forest Land Enhancement Program, Forest Legacy Program and several others. Contact regional, state or district offices, or visit the web site at [www.fs.fed.us](http://www.fs.fed.us).

**USDA NATURAL RESOURCE CONSERVATION SERVICE.** Technical, educational and financial assistance through field offices, where they work directly with individuals, communities, and state, local and tribal governments. Programs include the Wildlife Incentives Program, Wetland Reserves Program and Conservation Reserve Program. Contact the local county office or visit the web site at [www.nrcs.usda.gov/programs/](http://www.nrcs.usda.gov/programs/).

**STATE WILDLIFE AGENCY.** Technical guidance, wildlife educational materials, and in some cases, cost-sharing for select wildlife habitat management practices. Contact state or district offices or visit the web site at <http://offices.fws.gov/statelinks.html> for state contacts.

**STATE FORESTRY COMMISSION.** Technical guidance and forestry educational materials. Administers programs for forest, soils and wildlife conservation. Contact state or county offices.



**PRIVATE CONSERVATION ORGANIZATIONS.** A variety of conservation organizations or initiatives provide educational, technical and cost-sharing assistance, including American Fisheries Society, Bat Conservation International, Ducks Unlimited, Longleaf Alliance, National Tree Trust, NatureServe, National Fish and Wildlife Foundation, National Wild Turkey Federation, Partners in Flight, Partners in Reptile and Amphibian Conservation, Quail Unlimited, Quality Deer Management Association, Rocky Mountain Elk Foundation, Ruffed Grouse Society, The Wildlife Society, The Nature Conservancy, Wildlife Habitat Council and the Wildlife Management Institute. For a list of conservation organizations that provide assistance, contact your state/provincial wildlife agency, department of natural resource office, or state/provincial forestry commission.

**PRIVATE NATURAL RESOURCE CONSULTANTS.** Provide technical and management assistance for developing and implementing wildlife and forest management plans. Organizations that help locate consultants providing educational resources include American Forest Foundation, Tree Farm System, American Forests, Association of Consulting Foresters, Forest Resources Association, National Woodlands Owners Association, The Wildlife Society and the Society of American Foresters. Contact state forestry commissions and wildlife agencies for a list of registered or certified consultants.

### **For More Information**

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The participants of the Sustainable Forestry Initiative program are fully committed to promoting biodiversity conservation and enhancing wildlife habitat on their own and other forest lands. For more information about sustainable forest management for biodiversity and wildlife, the SFI program, and continuing efforts to help protect the environment, visit the SFI program website at [www.sfiprogram.org](http://www.sfiprogram.org).

### **Suggested Readings**

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National Council for Air and Stream Improvement, Inc. (NCASI). 2003. *Wildlife and Biodiversity Metrics in Forest Certification Systems*. Technical Bulletin No. 857, Research Triangle Park, N.C. National Council for Air and Stream Improvement, Inc.

National Council for Air and Stream Improvement, Inc. (NCASI). 2004. *Managing Elements of Biodiversity in Sustainable Forestry Programs: Status and Utility of NatureServe's Information Resources to Forest Managers*. Technical Bulletin No. 885, Research Triangle Park, N.C. National Council for Air and Stream Improvement, Inc.

Sustainable Forestry Initiative, Inc. 2002. *Enhancing Wildlife Habitats Through Sustainable Forest Management: Sustainable Forestry Initiative Program*. Sustainable Forestry Initiative, Inc. Arlington, VA.

Hunter, M.L., Jr. 1990. *Wildlife, Forests, and Forestry – Principles of Managing Forests for Biological Diversity*. Prentice Hall.

Hunter, M.L., Jr. (editor). 1999. *Maintaining Biodiversity in Forest Ecosystems*. Cambridge University Press.

Patton, D.R. 1992. *Wildlife Habitat Relationships in Forested Ecosystems*. Timber Press, Inc.

Sustainable Forestry Initiative, Inc. 2005. *2005-2009 Edition Sustainable Forestry Initiative (SFI) Program Standard*. Sustainable Forestry Initiative, Inc. Arlington, VA.



# GLOSSARY

*The following definitions apply to italicized words in this publication.*

**American Forest & Paper Association (AF&PA):** AF&PA is the national trade association of the forest, paper and wood products industry representing more than 220 companies and related associations that engage in or represent the manufacture of pulp, paper, paperboard and wood products. The forest products industry accounts for approximately seven percent of total U.S. manufacturing output, employs 1.5 million people, and ranks among the top ten manufacturing employers in 42 states.

**aquatic habitat:** areas where water is the principal medium and that provide the resources and environmental conditions to support occupancy, survival and reproduction by species associated with water.

**best management practices (BMPs):** a practice or combination of practices that is determined by a state or local government, or other responsible entity, after problem assessment, examination of alternative practices, and appropriate public participation, to be the most effective and practicable (including technological, economic and institutional considerations) means of conducting a forest management operation while addressing environmental considerations.

**best available scientific information:** available factual information (that is generally accepted by the broad scientific community), including, but not limited to, peer-reviewed scientific information obtainable from any source, including government and non-governmental sources, which has been verified by field testing to the maximum extent feasible.

**biological diversity (biodiversity):** the variety and abundance of life forms, processes, functions and structures of plants, animals and other living organisms, including the relative complexity of species, communities, gene pools and ecosystems at spatial scales that range from local to regional to global.

**certification:** independent verification of conformity to a standard. SFI program verification by an independent third party is certification.

**conservation:** 1. *protection* of plant and animal *habitat*. 2. the management of a renewable natural resource with the objective of sustaining its *productivity* in perpetuity while providing for human use compatible with sustainability of the resource.

**final harvest or clearcut:** a method of timber harvest and *regeneration* that removes all mature trees and produces a fully exposed microclimate for the development of a new age class of trees.

**corridor:** a link between isolated habitats that serves as a travel route for *wildlife*. *Corridors* can be *Streamside Management Zones*, forested strips connecting separated *habitats*, or brushy fencerows and ditch banks running through an open area.

**critically imperiled:** a plant or animal community, often referred to as G1, that is globally extremely *rare* or, because of some factor(s), is especially vulnerable to extinction. Typically, five or fewer occurrences or very few remaining individuals (<1,000), acres (<2,000), or linear miles (<10) exists.

**ecotone:** the zone of transition between two (or more) plant communities that shares the characteristics of both communities.

**edge:** an area where one *habitat* type meets and blends with another.

**even-aged forest:** a forest that contains trees approximately the same age and size.

**forest health:** the perceived condition of a forest derived from concerns about such factors as its age, structure, composition, function, vigor,



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presence of unusual levels of insects or disease, and resilience to disturbance.

**forestry:** the profession embracing the science, art and practice of creating, managing, using and conserving forests and associated resources for human benefit, and in a sustainable manner to meet desired goals, needs and values.

**forest stand (stand):** 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 distinguishable.

**forest unit (unit):** a portion of a forest under one ownership, usually contiguous and composed of a variety of forest stand types.

**forestland:** land at least 10 percent stocked with trees.

**geographical information system (GIS):** an organized collection of computer systems, personnel, knowledge and procedures designed to capture, store, update, manipulate, analyze, report and display the forms of geographically referenced information and descriptive information.

**green recruitment trees:** living trees that provide cavities or denning

sites for *wildlife*, or may be recruited as *snags* in succeeding timber rotations.

**habitat:** 1. a unit of environment. 2. the place – natural or otherwise (including climate, food, cover and water) – where an individual or population of animal or plants naturally or normally lives and develops.

**horizontal habitat diversity:** change in forest or other vegetation types across the *landscape*.

**imperiled:** a plant, animal or community, often referred to as G2, that is globally *rare* or, because of some factor(s), is very vulnerable to extinction or elimination. Typically, six to 20 occurrences, or few remaining individuals (1,000 to 3,000), acres (2,000 to 10,000), or linear miles (10 to 50) exist.

**indicators:** specific *metrics* that provide information about an organization's *forestry* and environmental performance that can be used to assess conformance to the *SFIS* objectives and performance measures.

**inventory:** 1. a set of objective sampling methods that quantify the spatial distribution, composition and rates of change of forest parameters within specified levels of precision for management

purposes. 2. the listing of data from such a survey.

**keystone species:** 1. *wildlife* species that are able to alter their *habitat* or environment to meet their needs (e.g., beaver). 2. a species that increases or decreases the diversity of a system; these species are competitively superior species.

**land classification:** the process of generating and applying land strata that are sufficiently homogenous in their physical, vegetative and development attributes.

**landscape:** 1. a spatial mosaic of several ecosystems, landforms and plant communities across a defined area irrespective of ownership or other artificial boundaries and repeated in similar form throughout. 2. an area of land characterized by: a) similar biogeodimatic conditions that influence site potential; b) similar historical disturbance regimes that influence vegetation structure and species composition; and



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c) large enough to ensure the range of *habitat* conditions for naturally occurring communities is provided (except for a few mega fauna with large spatial needs).

**late successional forest:** forest condition occurring when mature trees become the dominant vegetation in a forest.

**legacy tree:** trees that have distinct features (or value) that have survived catastrophic natural events such as fire or *wind throw*.

**logging debris (slash):** the residue, such as treetops and branches, left on the ground after a timber harvest or accumulating as a result of storm, fire, girdling or delimiting.

**mast:** the fruit of trees or shrubs that can be either hard (nuts) or soft (berries).

**metrics:** measurements used to assess progress in the implementation of landowner objectives. An example may be the average number of snag trees remaining per acre after harvest.

**natural forests:** remnants or residuals of *forest stands* that mimic the structure and composition as maintained by historical disturbance regimes.

**older forests:** forests with trees older than 40 years.

**patch:** an opening in a *forest stand* created by natural events or by timber harvest.

**policy:** a written statement of commitment to meet an objective or to implement a defined program, or plan to achieve an objective or outcome.

**protection:** maintain the status or integrity, over the long term, of identified attributes and values, including management where appropriate, and giving consideration to historical disturbance patterns, fire risk and *forest health* when determining appropriate *conservation strategies*.

**prescribed fire (prescribed burn):** the use of controlled, low intensity

fire as a timber and *wildlife* management tool.

**productivity:** the inherent capacity of a particular site or ecosystem to produce a crop or tree stand (e.g., based on volume or height).

**rare species and communities:** few individuals or occurrences due to natural reasons or influenced by human activities.

**reforestation (regeneration):** the re-establishment of forest cover either naturally or artificially.

**retention strips (also known as leave strips):** linear strips of forest left after timber harvest that connect adjacent forested areas. These strips serve to break up large openings created by final timber harvests.

**riparian:** related to, living or located in conjunction with a wetland, on the bank of a river or stream, or at the *edge* of a lake or tidewater.

**selective harvest (or cutting):** a method of timber harvest that removes individual or groups of trees from a *forest stand*.

**silviculture:** the art and science of controlling the establishment, growth, composition, health and quality of forests and woodlands to meet the diverse needs and values of landowners and society on a sustainable basis.

**snag:** a standing dead tree. *Snags* provide perches, denning and nesting cavities, and insect-feeding sites for *wildlife*.

**spatial:** having to do with the location and shape of features across the landscape.

**streamside management zone (SMZ):** bands of vegetation adjacent to streams and rivers left intact after timber harvests to prevent erosion and maintain water quality and *wildlife habitat*.

**succession:** the natural process of one community of plants gradually supplanting another community over time.

**sustainable forestry:** practicing a land stewardship ethic that inte-

grates *reforestation*, managing, growing, nurturing and harvesting of trees for useful products with the *conservation* of soil, air and water quality, *biological diversity*, *wildlife* and *aquatic habitat*, recreation and aesthetics.

**Sustainable Forestry Board (SFB):** chartered as an independent body in July of 2000 to oversee development and continuous improvement of the Sustainable Forestry Initiative (SFI)<sup>®</sup> Program Standard, associated certification processes and procedures, and program quality control mechanisms.

**Sustainable Forestry Initiative<sup>®</sup> (SFI) Program:** structure, responsibilities, practices, procedures, processes and time frames set by the SFI Program for implementing, maintaining and improving sustainable forest management.

**SFI<sup>®</sup> Standard (SFIS) 2005-2004 Edition:** SFI principles, objectives, performance measures and indicators that detail the requirements program participants must comply with to make progress toward the goals of sustainable forest management. The SFIS can be found at [www.aboutsfb.org](http://www.aboutsfb.org).

**temporal:** having to do with change over time (e.g., the change of a forest from an early successional meadow to a mature forest).

**thinning (timber or forest):** removing a portion of trees in a forest to reduce crowding and provide better growing conditions for the remaining trees.

**vertical habitat diversity (or vertical structure):** levels of forest plant growth ranging from the ground level (fungi, grasses and herbs), mid-level (woody shrubs and small trees), to the top level or canopies of mature trees.

**wildlife:** includes marine and freshwater aquatic animals, and terrestrial and avian fauna.

**wildlife and timber stand improvement practices:** methods of removing trees that are inferior for timber production and low in quality for *wildlife*. Poor trees are either removed by cutting, girdling or injection of a herbicide.

# APPENDIX 1

These metrics are intended solely as examples that may be considered by a forest landowner, not as a finite set of criteria that a landowner must incorporate to be in conformance with the SFI Standard.

## I. Stand-Level Forest Management Actions to Enhance Wildlife Habitat

### A. Promoting Vertical Diversity and Structure Between and Within Stands

1. Percentage or area of forest managed as uneven-aged stands, Streamside Management Zones, wildlife or biodiversity management areas, special geologic features, etc.
2. Percentage or area of closed canopy stands thinned on an annual basis.
3. Number or area of key habitat components such as hardwood or mast tree clumps, mature or legacy trees, or canopy gaps retained during timber harvest.
4. Age class distribution.
5. Other

### B. Enhance or Retain Stand Level Wildlife Habitat Components

1. Average number of snags and cavity trees per acre retained on timber harvest sites.
2. Volume of down material or number of down logs left on site.
3. Number of timber harvest sites with redistribution of woody debris.
4. Area of riparian stands in specific rotations that favor some wildlife component.
5. Identification of key wildlife features – old house sites, rock outcroppings, seeps or springs, etc.
6. Number and type of training sessions for field foresters and other management and procurement personnel on identification and retention of wildlife habitat components.
7. Other.

### C. Mast Production for Wildlife

1. Number of mast-producing tree species retained during

harvest and management operations.

2. Number and type of training sessions for field personnel on identifying and retaining mast-producing trees, shrubs and vines important to wildlife.
3. Number of mast-producing trees or clumps of mast producing trees left after harvest.
4. Other

### D. Wildlife Habitat Enhancement Activities

1. Number of acres or percentage of timber type prescribed burns on an annual basis.
2. Acres treated with herbicides to enhance wildlife habitat during stand establishment, release or mid-rotation competition control.
3. Number and type of activities to control or eliminate exotic or invasive plant or animal species.
4. Other.

## II. Landscape-Level Management

### A. Distribution of Timber and Habitats Across a Landscape.

1. Land classification system or timber type map that shows percentage of ownership by forest types. System may also incorporate measures of management intensity and wildlife and biodiversity relevance (e.g., Streamside Management Zones, natural stands, plantations, wildlife areas, special sites and rare plant communities).

### B. Size, Shape and Distribution of Timber Harvests

1. Number of harvest plans and acres covered in plans that incorporate wildlife habitat considerations into design and layout.
2. Number of biologists or ecologists that review harvest plans and incorporate wildlife considerations prior to harvest.



3. GIS system, mapping system or other methodology to help design and implement irregularly shaped timber harvests.

#### C. Forest Age Structure and Adjacency in the Landscape

1. Percentage of stands adjacent to final harvests.
2. Percentage or area of forest managed as uneven-aged stands, Streamside Management Zones, wildlife or biodiversity management areas, etc.
3. Percentage or area of stands thinned to promote understory development.

#### D. Aquatic and Riparian Management

1. Percentage or area of forest managed as Streamside Management Zones, riparian areas, non-forested wetlands, aquatic habitats, etc.
2. Documented compliance with state and federal Best Management Practices.
3. Number and acres of Streamside Management Zones that incorporate wildlife and biodiversity objectives.
4. Number of water bodies, riparian zones and non-forested wetlands.
5. Amount and types of in-kind support for research that address BMP effectiveness (or management) and protection of aquatic systems, including flora and fauna components of those systems.
6. Number of foresters and other forest management and procurement personnel trained in BMPs, SMZs, and aquatic habitat and biodiversity components.

#### E. Rare Species and Communities

1. Documentation of compliance with all legal requirements of the Endangered Species Act or Species at Risk Act.
2. Documentation and management plans for all federally listed plant and animal species that occur on the forest ownership.
3. Documentation and management plans for known viable occurrences of G1 and G2 species and communities that occur on the forest ownership.
4. Survey and inventory for federally listed species and viable occurrences of G1 and G2 species and communities on the forest ownership.

5. Number of employees in management and harvesting operations that are trained in identification and conservation of rare and unique biological communities, including federally listed G1 and G2 species and communities.
6. Existence of database or forest inventory that identifies/maps known locations of federally listed G1 and G2 species and communities.

#### F. Outreach and Partnership Activities

1. Number of acres covered by cooperative management agreements with external third parties to promote habitat diversity and other wildlife and biodiversity considerations on forest ownership.
2. Number of partnerships or projects ongoing with external third parties during a given annual period.
3. Number of partnerships with conservation organizations – such as NatureServe, State Heritage Programs or Conservation Data Centers – that assist in identifying viable occurrences of G1 and G2 species and communities on forest ownership.
4. Amount of financial or in-kind research support that enhances wildlife habitat and furthers the conservation of biological diversity on forest ownership.
5. Methodology in place to transfer and incorporate research results into field operations.
6. Number of projects with landowners to improve landscape-level wildlife habitat or conservation of important biodiversity elements (e.g., riparian management on a watershed that crosses multiple owners).

#### G. Special Sites

1. Number of sites identified with unique geologic, ecologic, cultural or historic significance on forest ownership.
2. Number of special sites and acres identified on forest ownership.
3. Field personnel trained on special site identification and management.
4. Number of management plans in place for identified special sites.
5. Agreements with external third parties that assist in identifying and managing special sites on forest ownership.



***Growing Tomorrow's Forests Today®***

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