

Wildlife Habitat

CONTENTS

Developing Wildlife Habitat Guidelines...3

Parameters and Considerations...3

Limitations and Assumptions...4

Benefits of Wildlife Habitat Guidelines...6

Rationale for Guidelines in Each Topic Area...7

Leave Trees and Snags...7

Coarse Woody Debris and Slash...10

Conifer Retention and Regeneration...11

Mast...14

Patterns of Cutting...16

Endangered, Threatened and Special Concern Species...18

Sensitive Communities and Sites, and Tree Species
at the Edge of Their Range...26

Wetland Inclusions and Seasonal Ponds...36

Riparian Wildlife Habitat...38

Additional Consideration: Legacy Patches...43

Selected Resources for Additional Information...47

TABLES

Table WH-1: Conifer Species and Examples of Use by Wildlife...13

Table WH-2: Examples of Mast-Producing Plants That Benefit
Wildlife in Minnesota...15

Table WH-3: Minnesota ETS Species To Be Concerned About
When Conducting Forest Management Activities...21-25

Table WH-4: Differences in Application of Guidelines Within and
Outside the Riparian Management Zone...41-42

Table WH-5: Decision Matrix for Legacy Patches on Mineral Soil
Uplands with Less Than 6 Inches of Peat...45-46

FIGURE

Fig. WH-1: Tree Range Maps...29-35

Developing Wildlife Habitat Guidelines

Parameters and Considerations

Wildlife defined: For purposes of these guidelines, wildlife is defined as all forms of life that are wild (including plants, animals and microorganisms). These guidelines consider only forest-dependent terrestrial and amphibious forms of wildlife in its recommendations.

Ten wildlife-related topics were considered in these guidelines:

- Leave trees and snags
- Coarse woody debris and slash
- Conifer retention and regeneration
- Mast
- Patterns of cutting
- Endangered, threatened and special concern (ETS) species
- Sensitive communities and sites, and tree species at the edge of their range
- Wetland inclusions and seasonal ponds
- Riparian wildlife habitat
- Additional consideration: Legacy patches

Other interrelated issues were considered during guideline development, including:

- Vertical structure of vegetation
- Variation of silvicultural systems
- Mimicking natural disturbance
- Old forest characteristics
- Lowland conifer communities
- Exotics and hybrids
- Forest type conversion

4 *Wildlife Habitat*

The original scoping process focused on mitigating wildlife impacts projected in the 1994 Generic Environmental Impact Statement Study on Timber Harvesting and Forest Management in Minnesota (GEIS). Additional issues beyond those covered in the GEIS were also considered. The intention is to provide practical, science-based (to the extent possible) voluntary guidelines to address significant issues and projected impacts, at least minimally, and to mitigate these impacts or prevent them from occurring.

Integration of wildlife guidelines with other guidelines addressing cultural resources, forest soils, riparian areas, visual quality, and water quality and wetlands helped resolve any differences in applicability among them. Other dimensions of forest management, such as forest health or recreation, were given less consideration during the development of wildlife habitat guidelines.

Limitations and Assumptions

“Essential” guidelines, rather than comprehensive: Certainly, much more can be done to enhance wildlife habitat or individual species than what is recommended within these guidelines. Furthermore, each management practice, including the option to do nothing on a site, will at once favor some species and disfavor other species. As a result, it is not practical to provide a comprehensive set of guidelines covering all possibilities for improving habitat in Minnesota forests. Instead, these guidelines cover the essentials for addressing site-level issues while deferring to other existing guidelines, publications or professional managers to provide direction to those whose objectives focus on wildlife management.

Guidelines and “additional considerations”: Some of the recommendations are based on less clear or emerging issues that may change with time. Such recommendations are included as “additional considerations,” such as legacy patches, which provide direction to landowners wishing to improve wildlife habitat. Thus, two classes of recommendations are provided: “guidelines” and “additional considerations.” Although both are voluntary in nature, the guidelines have higher priority and will also be more important to monitor over time.

Site-level guidelines with “landscape implications”: Wildlife habitat guidelines were drafted assuming that a practice has been selected for a particular site and that the guidelines should provide direction for someone applying that practice. Throughout the process, however, it was difficult to separate landscape-level and site-level issues. While many issues clearly fit into one level or the other, some fall into a gray area.

For wildlife, more than for other forest resources, what occurs on a site influences the surrounding landscape, and vice versa. While the guidelines focused on the site level as much as possible, some of the more important overlaps have been included as “landscape implications.” Landscape-level wildlife needs should be addressed through professional planning for individual properties and through cooperation among landowners and agencies within a landscape.

Overlapping benefits: Many of the wildlife habitat guidelines can be applied simultaneously. For example, leave tree clumps in clearcuts might also serve as rare species buffers or legacy patches, or they may provide mast production. These overlapping benefits may extend to other forest resources as well, such as for cultural resource protection.

Recognizing practicality issues: In implementing the wildlife habitat guidelines, users should be mindful of the practicality of guidelines, recognizing the additional cost and effort needed to implement them. For example:

- Application of guidelines may result in increased time for design, administration or execution of forest management activities.
- Trees may be withdrawn from harvest availability for the short or long term, decreasing potential revenue.
- Retention of various structural habitat components (such as snags and down logs) may reduce expected tree regeneration or lead to increased mortality or pest damage in some cases.

Guidelines and additional considerations have been developed for 10 topics, which have been integrated into the overall forest management activity guidelines in Part 3. The benefits and rationale for these guidelines follow for each of the 10 wildlife-related topics.

Benefits of Wildlife Habitat Guidelines

Benefits apply mainly to the wildlife habitat on a site, but improved habitat may indirectly lead to a better-functioning ecosystem and therefore improved overall productivity of the site in the long run. Implementation of guidelines for wildlife habitat:

- Provides for wildlife requiring perches, tree cavities and bark-foraging sites through retention of suitable leave trees and snags on a site during forest harvesting and timber stand improvement.
- Provides cover, food or growing sites for certain amphibians, reptiles, mammals, birds, invertebrates, fungi and green plants through retention or creation of coarse woody debris and slash during forest management.
- Ensures diversity of wildlife habitat through the retention and regeneration of conifers for food, nesting and cover in mixed deciduous/coniferous stands.
- Provides for adequate mast production from trees and shrubs as food for wildlife.
- Provides site-level wildlife habitat requirements by using a variety of sizes and shapes of harvest areas.
- Increases awareness of endangered, threatened and special concern species and manages forests to maintain or enhance existing populations of these species.
- Increases awareness of sensitive communities and sites and maintains or enhances them where they are found.
- Provides for perpetuation of most of the genetic diversity within tree species, as well as maximization of the potential for tree species to shift their geographic ranges in response to possible rapid climatic changes.
- Provides site-level wildlife habitat features for terrestrial species associated with wetland inclusions and seasonal ponds within forests.
- Provides site-level wildlife habitat features for riparian obligate terrestrial species.
- Maintains the biological continuity of a harvested site.

Rationale for Guidelines in Each Topic Area

Leave Trees and Snags

Purpose: To provide for wildlife requiring perches, tree cavities and bark-foraging sites through retention of suitable leave trees and snags on a site during forest harvesting and timber stand improvement.

Rationale, Background and Benefits

In Minnesota, some 40 birds, 29 mammals, and several reptiles and amphibians use snags. The major issue for cavity-dependent wildlife and timber harvesting is whether some suitable trees and nest cavities remain for these species following logging or timber stand improvement.

Retention of leave trees and snags during timber harvesting provides habitat for wildlife requiring perches, tree cavities and bark-foraging sites as the surrounding forest regenerates, by mimicking natural disturbances to some degree. Leave trees and snags may also provide unique niches and microsites for a variety of plants, especially within retained clumps or as individuals fall over with time and begin to decay. Soil conditions will also benefit.

The fundamental idea is to retain some structure for snag- and cavity-dependent species on a site or maintain the potential to produce such structure as a stand grows and develops.

Ecoregion Applicability

One issue indirectly tied to ecoregions is openland/brushland management. Such habitats may require felling of all stems to reproduce open conditions.

8 Wildlife Habitat



Both snags (standing dead trees) and leave trees (live trees retained on a site) provide for wildlife requiring perches, tree cavities and bark-foraging sites. *Photo courtesy of Potlatch Corporation*

Another issue in agriculture/forest interfaces is nest parasitism by cowbirds. Timber harvests in forests adjacent to agricultural areas may require clear-felling of all stems along edges.

Regarding a preferred mitigation strategy to retain more trees with cavities, the GEIS states: “This mitigation should be applied over all Minnesota ecoregions, but for mammals it may be especially critical within the range of the gray squirrel, projected to be heavily impacted under all harvest scenarios.”

Landscape Implications

Although these guidelines address site-level recommendations for snags and leave trees, the contribution of an individual site should be considered in the context of the surrounding landscape. Many of the cavity-dependent species being addressed have home ranges larger than the typical harvest unit, so planning for their needs requires a broader look, both spatially and temporally, at the larger forest community.

If suitable habitat exists surrounding a given harvest site to maintain populations of these species, then leave trees may not be as critical on that site. However, if harvests are likely in the adjacent habitats, then the trees left on the initially harvested sites become more important as the surrounding forest regenerates. Consideration must be given to the time it takes for a regenerating stand to produce trees of adequate size and degree of decay to provide suitable structure.

Consider reducing leave tree and snag requirements on harvest sites adjacent to agricultural lands (especially pastures) to reduce nest parasitism by cowbirds and nest predation. Note also that not all forest communities naturally provide snags; therefore, across a given landscape, not all sites must be managed for leave trees and snags.

Coordination among neighboring landowners may result in varying numbers of leave trees on a site if adjacent lands exceed or fall short of the recommendations. Managers of larger landholdings may be able to plan for sufficient cavity-dependent wildlife habitat on portions of their property (such as riparian reserves) and reduce leave tree/snag requirements on other portions.



Leave trees provide sites for nesting, such as this goshawk nest. *Photo courtesy of Potlatch Corporation*



Coarse woody debris provides cover, food, habitat structure and growing sites for many different animals and plants. *Photo courtesy of Potlatch Corporation*

Coarse Woody Debris and Slash

Purpose: To provide cover, food or growing sites for certain amphibians, reptiles, mammals, birds, invertebrates, fungi and green plants through retention or creation of coarse woody debris and slash during forest management.

Rationale, Background and Benefits

Salamanders, snakes, small mammals and birds will benefit most from coarse woody debris and slash. Small mammals dependent on slash and coarse woody debris in turn provide food for mammalian carnivores and forest raptors (such as the pine marten and the northern goshawk).

A variety of invertebrates, soil microorganisms and plants will also benefit from the niches created by down logs. Regeneration of yellow birch, white cedar and eastern hemlock will be enhanced. Many sites already provide the number of down logs (or more) called for in the guidelines. Coarse woody debris may need to be created in some plantations.

Ecoregion Applicability

When choosing leave logs, note that species at the edge of the range will differ depending on ecoregion. (See *Sensitive Communities and Sites, and Tree Species at the Edge of Their Range*, page 26). Coarse woody debris decays more rapidly in the southeast, where consideration should be given to making leave logs with as large a diameter as possible.

Landscape Implications

Although the guidelines focus on the managed site itself, coarse woody debris left on that site may be benefiting reptiles and amphibians living there but breeding elsewhere. Thus, coarse woody debris placement might be influenced by off-site features. Therefore, consider proximity to wetland inclusions and seasonal ponds off the site.

Conifer Retention and Regeneration

Purpose: To ensure diversity of wildlife habitat through the retention and regeneration of conifers for food, nesting and cover in mixed deciduous/coniferous stands. Conifers should continue to be a significant structural component in appropriate habitats and landscapes.

Rationale, Background and Benefits

One of the greatest concerns for wildlife in northern Minnesota is extensive conversion of mixed aspen/birch-conifer forests to early successional aspen-birch. Retaining young conifers, including isolated trees and scattered clumps, can provide habitat and food needed for many different wildlife species and can increase the probability that conifers will later regenerate on harvested areas.

Various animal species, including the great gray owl, bald eagle, pine warbler, white-tailed deer, moose, pine marten, lynx, snowshoe hare and red-backed vole, depend on coniferous stands for structural attributes. Others—including spruce grouse, red-

12 Wildlife Habitat

breasted nuthatch, red squirrel, porcupine and moose—depend on food that coniferous stands provide. Conifers provide thermal cover from both heat and cold. Reduced snow depth and surface crusting benefit both deer and moose. Some conifer-associated species of birds will only remain in clearcut areas if conifer patches of sufficient size are left.

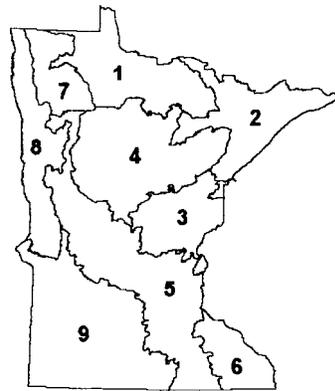
Encouragement of coniferous regeneration in mixed deciduous-coniferous forests in the northeast will help lessen the impact on those reptiles and amphibians associated with mixed forests, such as the wood turtle, ringneck snake and red-backed salamander. Retaining clumps of conifers will also protect soil characteristics and associated ground flora.

Conifers should be left for the many important habitat characteristics that these trees provide to a large portion of Minnesota's vertebrate fauna. Conifer stands, inclusions of conifers within mixed-species stands, and conifer understories in mature aspen and birch stands are all important components of wildlife habitats in Minnesota.

When retaining conifers, clumps are preferable to scattered trees. Clumped conifers are more windfirm; are better potential seed sources because of improved pollination; can withstand snow and ice loads more successfully; and can provide better cover. See Table WH-1.

Ecoregion Applicability

These guidelines are applicable to Ecoregions 2, 3 and 4 and possibly Ecoregions 1, 5 and 6.



Landscape Implications

Application of these guidelines may have implications where landscape connectivity or riparian corridors are a concern.

Table WH-1

Conifer Species and Examples of Use by Wildlife

Conifer Species	Examples of Use by Wildlife
Red pine	Mature trees may be used by raptors for perches or nest trees. Seeds are important mast for winter songbirds and red squirrels.
White pine*	When young, provides good escape and severe weather cover for many species. High calorie, large seeds eaten by many small mammals and winter songbirds. Mature trees are important for cavity-dependent wildlife, preferred bald eagle nest trees, and escape trees from bears. Roosting trees for wild turkeys.
Jack pine	Very good cover when trees are young. Used as browse. Buds and needles are important spruce grouse food. Seeds eaten by red squirrels. Persistent cones provide a year-round food source.
Balsam fir	Important winter and summer cover for deer, moose and many species of birds. Birds eat seeds and use trees for nesting. Winter browse for moose.
Black spruce	Important escape and severe winter cover. Birds eat seeds and use trees for nesting. Buds and needles are important spruce grouse food.
Tamarack	Mature stands provide excellent habitat for owls. Snags are used as hunting/singing perches.
White cedar	Mast is important food source for winter songbirds. Very important winter cover for deer. Important for browse during severe winters. Provides cover and cooling effect near water.
White spruce	Important seed source for winter finches. Summer nest cover for songbirds. Black-backed woodpeckers forage under bark for insects.
E. red cedar	Important winter cover. Berries used by birds for food.
Hemlock	Mature trees provide important owl roosting sites. Very limited range in Minnesota: special concern species.

*See also *Minnesota's White Pine: Now and for the Future*, 1996. White Pine Regeneration Strategies Group, Minnesota DNR, St. Paul, Minnesota.

Mast

Purpose: To provide for adequate mast production from trees and shrubs as food for wildlife.

Rationale, Background and Benefits

High levels of fat, protein and carbohydrates in mast contribute to energy stores critical for migration or hibernation, and for survival of newly independent young. Some birds and mammals depend heavily on mast during peak production periods in late summer and early fall. During winter, some sources remain available on trees and shrubs, under snow or stored in caches.

Mast production is generally favored by increased crown exposure to light, crown size, maturity of trees or shrubs, increased soil nutrients, tempered microclimates (especially during flowering) and adequate soil moisture. Production on a site tends to vary considerably from year to year.

Other considerations:

- Mast-producing species often depend on animals for their dispersal and reproduction.
- Riparian edges often contain a higher concentration and richness of mast-producing species.
- Most shrub species will regenerate well and produce mast after cutting, burning or soil disturbance.

Although the GEIS points out concerns for oak and other dominant tree species, especially in relation to game species (such as deer or gray squirrels), trends in other mast species were not modeled.

As a result, recommendations for oak and other dominant tree species are presented as “guidelines,” while recommendations for other mast-producing species are presented as “additional considerations.” See Table WH-2.

Table WH-2

Examples of Mast-Producing Plants That Benefit Wildlife in Minnesota

Mast Species	Examples of Use by Wildlife
Oaks (acorns) and hazel nuts	Deer, bear, wild turkey, woodpeckers, blue jay, wood duck, squirrels
Maple and ash seeds	Small mammals, evening and pine grosbeaks
Aspen, birch and hazel buds	Ruffed grouse
Yellow and white birch seeds	Common redpoll, pine siskin, American goldfinch
Conifer cones and seeds (such as white cedar, balsam fir, black spruce, white pine, common juniper, red cedar, Canada yew)	Red squirrels, white-winged and red crossbills, pine siskins, red-breasted nuthatch, pine grosbeak
Late summer soft mast (such as juneberries, blueberries, cherries, dogwoods and elderberries)	Important to a wide diversity of birds and mammals as they prepare for migration and winter
Soft mast retained in fall and through winter (such as mountain ash, highbush cranberry and nannyberry, winterberry)	Waxwings, pine grosbeaks, and other diverse bird and mammal species
Vines (such as wild grape)	Diversity of birds and mammals

Ecoregion Applicability

Retention of mast and other key food-producing tree types should be prioritized in accordance with the local abundance of each tree species. In areas of least abundance, greatest attention should be applied to retention. For oaks, the northern range limit is most critical in assuring that the range of producing trees is not diminished. Mountain ash berries are an important food source for birds during harsh winters. This species occurs commonly in three northeastern counties (Cook, Lake and St. Louis).

Landscape Implications

Land managers in regions with low mast availability have opportunities to enhance wildlife habitat characteristics by careful management of mast species on their land. Some wildlife species may travel significant distances to obtain mast. The black bear, for example, may travel 10 miles to obtain mast.

Patterns of Cutting

Purpose: To provide site-level wildlife habitat requirements by using a variety of sizes and shapes of harvest areas.

Rationale, Background and Benefits

Because there is such a great variety in the home range territory of various organisms, it is important that forests be managed at a variety of scales. This management objective will involve making silvicultural decisions on a landscape basis. Ideally the management regime should range from the very fine-scale management represented by selection cutting to the coarse-scale management affected by sizable clearcuts. Size of clearcuts should be determined by considering issues such as size of the management unit, the home range requirements of large animals, aesthetics and natural disturbance regimes.



Size and shape of both cut and uncut areas should meet habitat needs of wildlife. To benefit wildlife in managed forests of Minnesota, a variety of cut sizes—from as small as one acre to larger than 100 acres—is recommended. Larger patch sizes have historically occurred under natural disturbance regimes on even-aged, fire-dependent types, such as jack pine. Smaller patches are appropriate in more heterogeneous forest types, such as deciduous forests on moraines.

Ecoregion Applicability

More diverse (larger) patch sizes are possible in northeast Minnesota than in the forest fragments of southeast Minnesota.

Landscape Implications

In areas dominated by agricultural land use practices (in southcentral and southeast regions), where riparian forests represent the majority of the forest in the area, consider only uneven-age management.

On large clearcuts, consider harvesting in segments over several years. This will provide both early successional diversity and, over the long term, a large mature forest patch. Coordinate with adjacent landowners when natural patch boundaries cross property lines.

Endangered, Threatened and Special Concern Species

Purpose: To increase awareness of endangered, threatened and special concern species (ETS species) and manage forests to maintain or enhance existing populations of these species. See Table WH-3 (beginning on page 21).

Rationale, Background and Benefits

Minnesota is home to more than 2,500 plant species, several hundred vertebrate species, and numerous invertebrates. The Minnesota Department of Natural Resources (DNR) has designated 439 of these plants and animals as endangered, threatened, or species of special concern, with nearly 30%—128 species—further identified as species that may be affected by forest management activities. Eleven of these are also federally listed as threatened or endangered.

All species are part of the natural forest ecosystem and contribute to its healthy functioning. Additional values of diversity include the following:

- Conservation of genetic strains of plants or animals that are adapted to local climate and site conditions
- Conservation of local populations with natural resistance to disease
- Conservation of species that may produce new economically valuable products
- Conservation of rare species that may play critical but unknown roles in ecosystem function
- Conservation of aesthetic and recreational values
- Usefulness for scientific and educational purposes

Knowledge of the occurrence of rare plants and animals in Minnesota is incomplete. The best information on occurrences of rare species is being gathered by the Minnesota County Biological Survey, initially in the more critical prairie, metropolitan and southeastern counties. As of January 1998, surveys have been

completed in 33 counties, and surveys are under way in an additional 18 counties. As each county is surveyed, a more complete basis for identifying sensitive species and areas will be available. Even when this project is complete, however, many occurrences of rare species will remain unknown, especially in forest areas of northern Minnesota.

Relatively little is known about the impacts of timber harvesting or other forest management activities in Minnesota on rare species or their habitat. Several recent studies in other parts of the country suggest that long-lived, slowly dispersing understory plants, especially those in late-successional forests, are negatively affected by timber harvest. If biologists and forest landowners work together, informed decisions can be made to protect rare plants and animals.

Endangered and threatened species are protected in Minnesota by one or both of the following laws: the Federal Endangered Species Act of 1973 (Public Law 100-478) and “Protection of Threatened and Endangered Species” (Minnesota Statute 84.0895). Species of special concern are not protected by either state or federal laws.

Native birds and certain wildflowers (lady’s slippers, other orchids, trilliums, gentians, arbutus and lotus) are protected by other state and federal laws, including the Conservation of Certain Wildflowers statute, the Migratory Bird Treaty Act, and the Bald Eagle Protection Act.

Other laws, both state and federal, may apply to the protection of plants and animals in the state. For specific information on ETS species occurrences, the laws protecting them, and recommended management practices (including buffers), contact either the Minnesota Natural Heritage and Nongame Research Program or a DNR regional nongame specialist. See *Resource Directory*.

Field Survey Consultants and Other Resources

Consult with DNR wildlife managers, nongame specialists or Minnesota Natural Heritage and Nongame Research staff. See *Resource Directory*.

Other survey consultants and sources of information include:

- Local wildlife biologists, foresters, park managers or naturalists
- Nature centers, environmental learning centers, colleges, universities and University of Minnesota Extension offices
- Ecologists, botanists, natural resource consultants or forest stewardship plan preparers
- ETS source books, including:

Coffin B. and L. Pfannmuller. 1988. *Minnesota's Endangered Flora and Fauna*. 473 pp. University of Minnesota Press. *Illustrated book covering some 300 species, ranging from mosses and lichens to vascular plants, birds, mammals, reptiles, amphibians, fish, butterflies, mollusks and tiger beetles. Individual species accounts, state distribution maps, illustrations and habitat. (Note that the status of many species has changed since this book was published).*

Chippewa National Forest, Minnesota Department of Natural Resources, Leech Lake Reservation. 1996. *Rare Plants Field Guide: Chippewa National Forest and Cass County*. Unpaginated. *Loose-leaf in ring binder. 36 species. Color photo, description and habitat information for each species, line drawings for some species.*

Shubat, Deborah, and Gary Walton. 1997. *Rare Plants of Minnesota's Arrowhead*. Olga Lakela Herbarium, University of Minnesota, Duluth. *Pocket-size field guide to 56 species of non-grasslike plants from the 1996 Minnesota DNR ETS list that have records in Carlton, Cook, Lake or St. Louis counties. Color photo, distribution map, description and habitat information for each species.*

Ecoregion Applicability

Applies to all ecoregions.

Landscape Implications

Some area-sensitive ETS species will benefit most from large, unfragmented habitat blocks.

Table WH-3

Minnesota ETS Species To Be Concerned About When Conducting Forest Management Activities

Table WH-3 (cont'd)

Table WH-3 (cont'd)

Source: Natural Heritage and Nongame Wildlife Research Program, Minnesota DNR. Based on Minnesota's List of Endangered, Threatened and Special Concern Species, July 1996.

Sensitive Communities and Sites, and Tree Species at the Edge of Their Range

Purpose: To increase awareness of sensitive communities and sites and maintain or enhance these where they are found; and to provide for perpetuation of most of the genetic diversity within tree species, as well as maximization of the potential for tree species to shift their geographic ranges in response to possible rapid climatic changes. See Figure WH-1, beginning on page 29.

Rationale, Background and Benefits

Sensitive communities and sites represent only a very small portion of the total forested area of the state. Even where they do occur, they often occupy only a limited part of a managed parcel of land. Adjoining properties may share these features in some cases.

The best information on occurrences of sensitive sites and communities is being gathered by the Minnesota County Biological Survey, initially in the more critical prairie, metropolitan and southeastern counties. As of January 1998, surveys have been completed in 33 counties, and surveys are under way in an additional 18 counties. As each county is surveyed, a more complete basis for identifying sensitive areas will be available. Even when this project is complete, however, many sensitive communities and sites will remain unknown, especially in forest areas of northern Minnesota.

Identifying sensitive sites and communities in the field can be challenging and may require expert evaluation.

Some sensitive sites and communities are best managed by avoidance, while other sites can either be maintained or enhanced by the use of appropriate silvicultural or harvesting procedures.

For the most part, sensitive communities and sites are not protected by statutes. One exception is calcareous fens, a particular kind of treeless wetland community, which is protected by Minnesota Statute 103G.223.

Most tree species in Minnesota reach the limit of their geographic range somewhere within the boundaries of the forested portion of the state. There is a need to perpetuate genetic diversity within tree species and maximize the potential for tree species to shift their geographic ranges in response to possible rapid climatic changes.

Species and Communities Affected

The following natural communities (native plant communities) may possibly be affected. This list of communities is based on the current version (1.5) of *Minnesota's Native Vegetation: A Key to Natural Communities*. (These are specifically described plant communities in specific parts of the state. Thus, "jack pine woodland" is not just any jack pine stand, but a particular assemblage of plants in a certain part of Minnesota):

- Mesic oak savanna
- Dry oak savanna
- Jack pine woodland
- Jack pine barrens
- Oak forest (big woods section) mesic subtype
- Oak forest (central section) mesic subtype
- Maple-basswood forest (big woods section)
- White pine forest (southeast section)
- White pine-hardwood forest (southeast section)
- Upland white-cedar forest (southeast section)
- Northern hardwood-conifer forest (southeast section)
- Northern hardwood conifer forest (northern section)
(yellow birch-white cedar subtype)
- White cedar swamp (seepage subtype)
- Black ash swamp (seepage subtype)
- Lowland hardwood forest (bur oak, basswood-black ash subtype)
- Algific talus slope

Field Survey Consultants and Other Resources

The following resources can assist in a field survey to identify sensitive sites or communities:

- DNR wildlife managers, nongame specialists or Minnesota Natural Heritage and Nongame Research staff. For information and assistance, see *Resource Directory*.
- Local wildlife biologists, foresters, park managers or naturalists.
- Source publications, including:
 - *Minnesota's Native Vegetation: A Key to Natural Communities*
 - *Natural Vegetation of Minnesota at the Time of the Public Land Survey*
 - *Minnesota's St. Croix River Valley and Anoka Sandplain: A Guide to Native Habitats*
 - *Minnesota's Natural Heritage: An Ecological Perspective*

Ecoregion Applicability

Applies to all ecoregions.

Landscape Implications

Forest prairie transition zones typically will have different management options than forest zones. Cooperative management with neighbors is possible when sensitive sites or communities extend over several ownerships.

Figure WH-1: Tree Range Maps

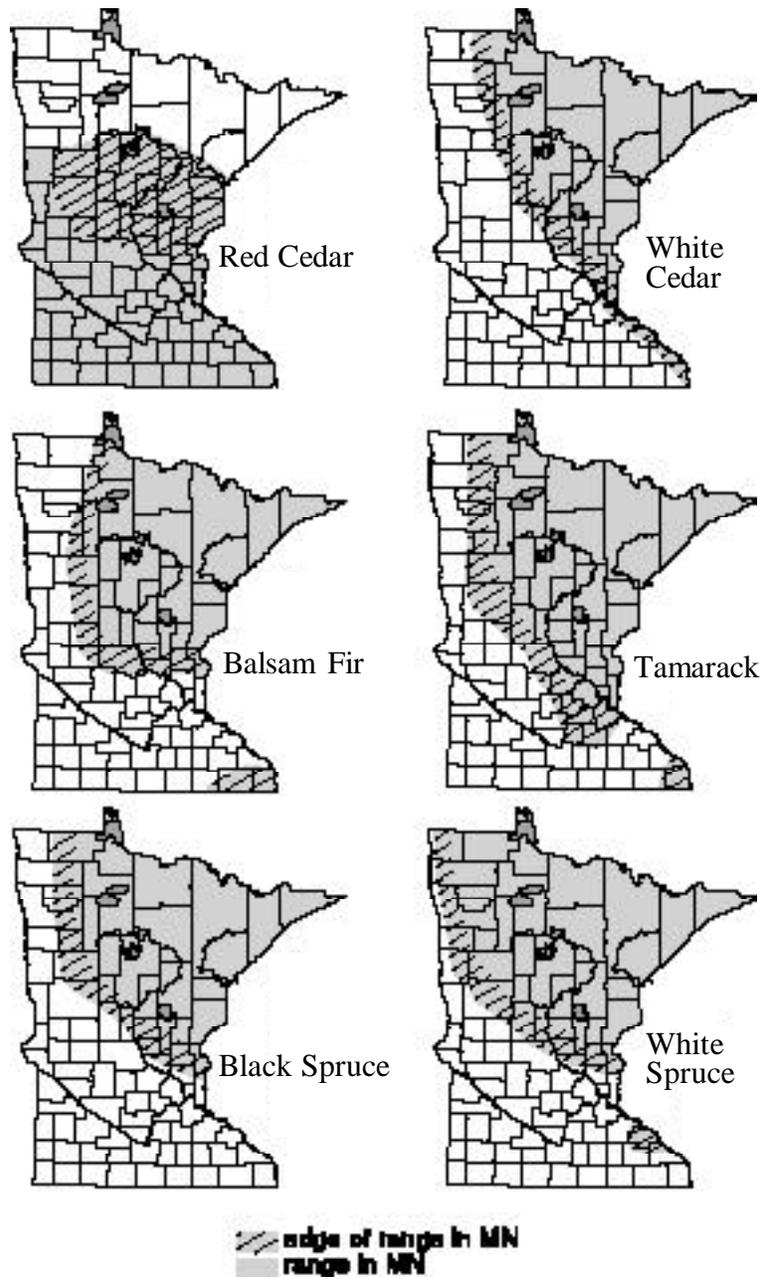


Figure WH-1: Tree Range Maps (cont'd)

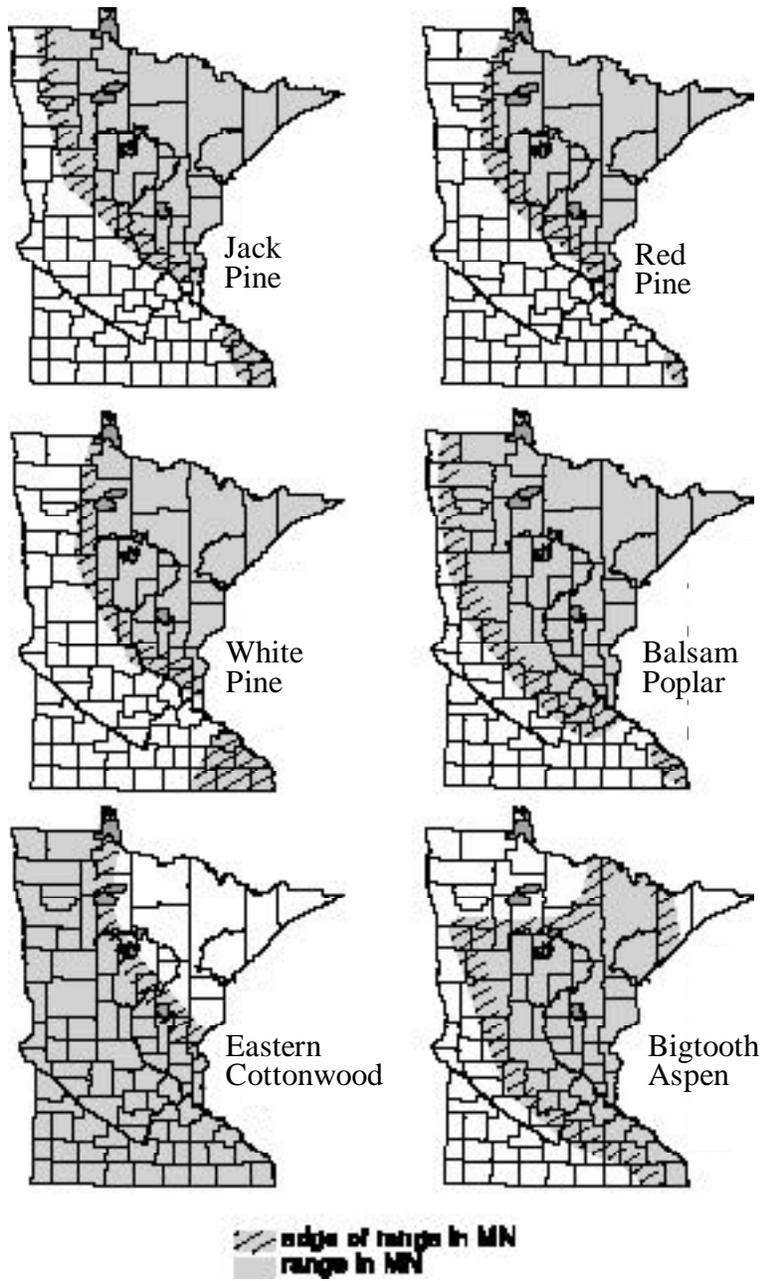


Figure WH-1: Tree Range Maps (cont'd)

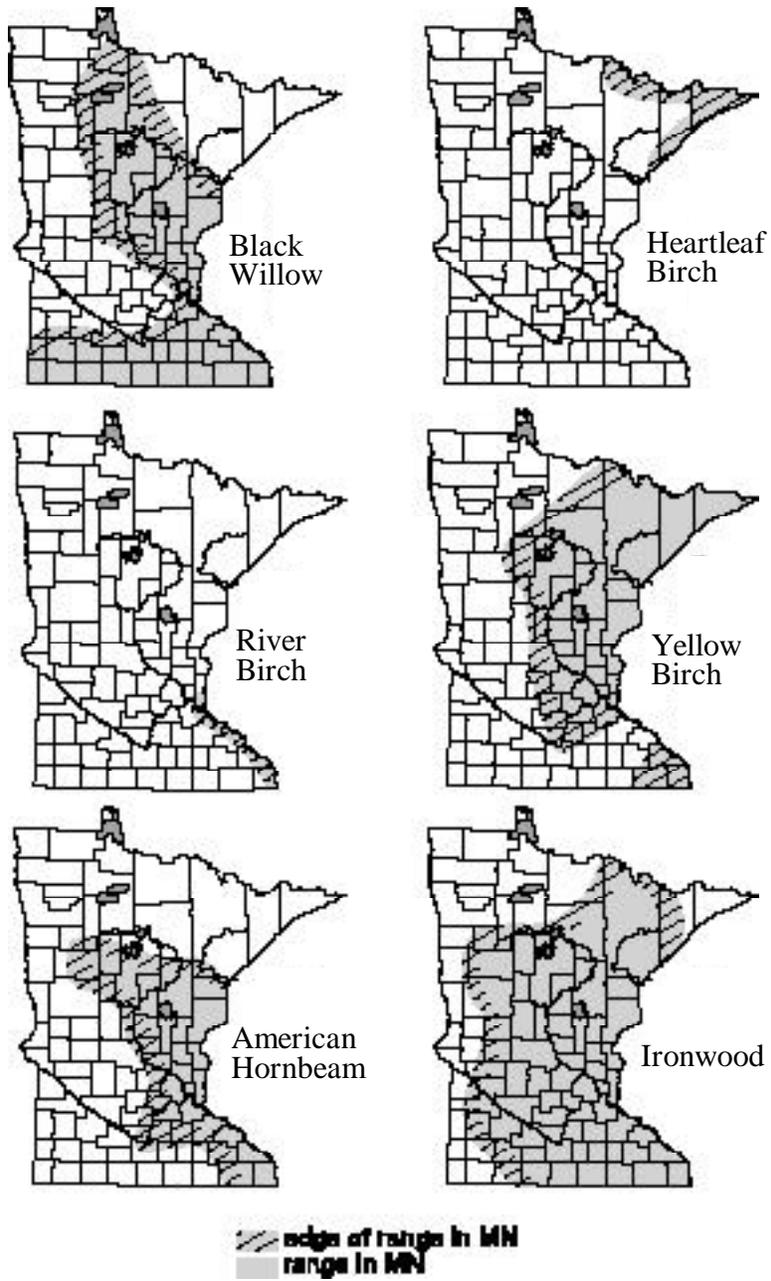


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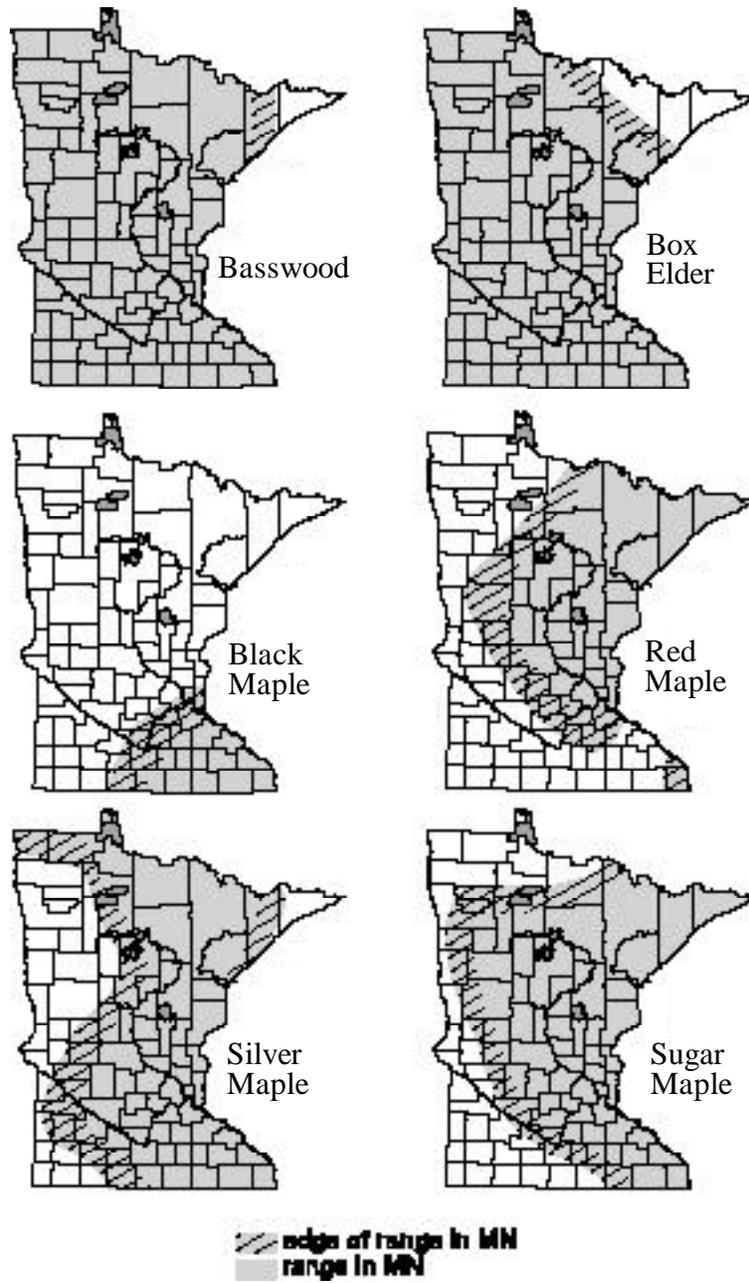


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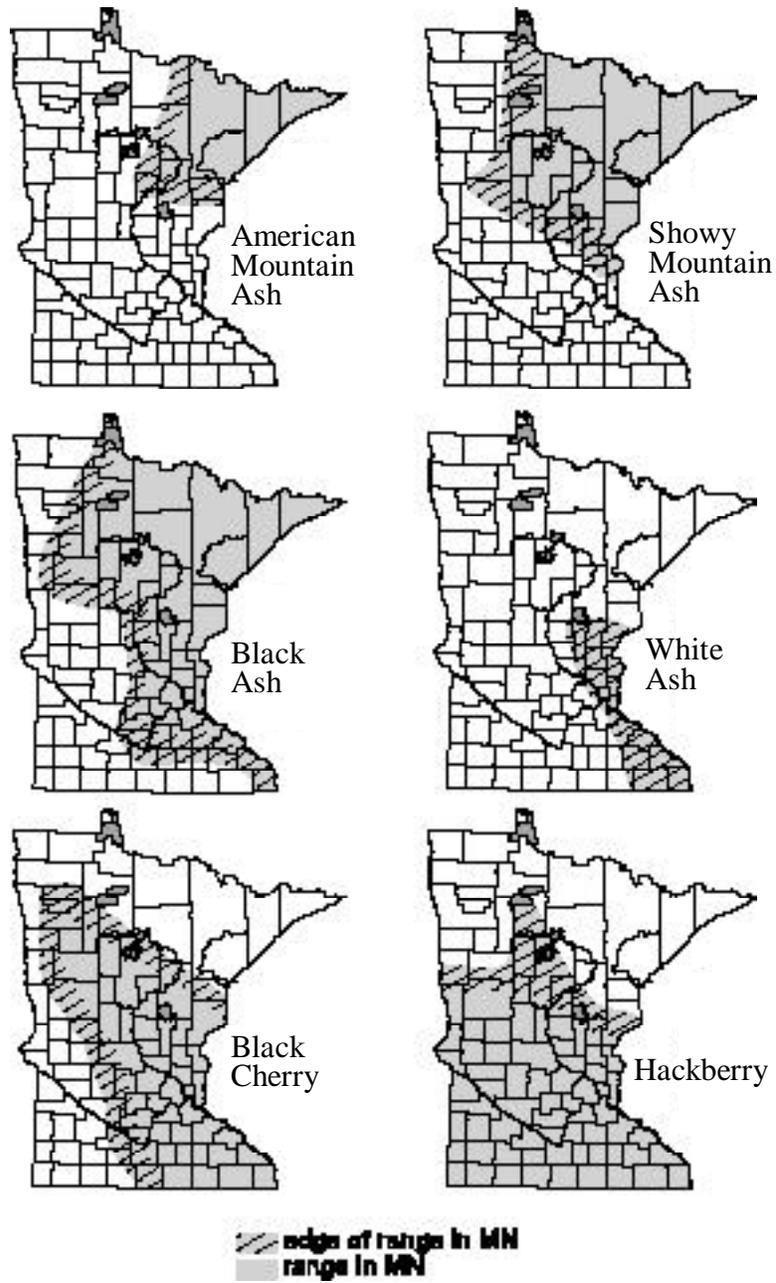


Figure WH-1: Tree Range Maps (cont'd)

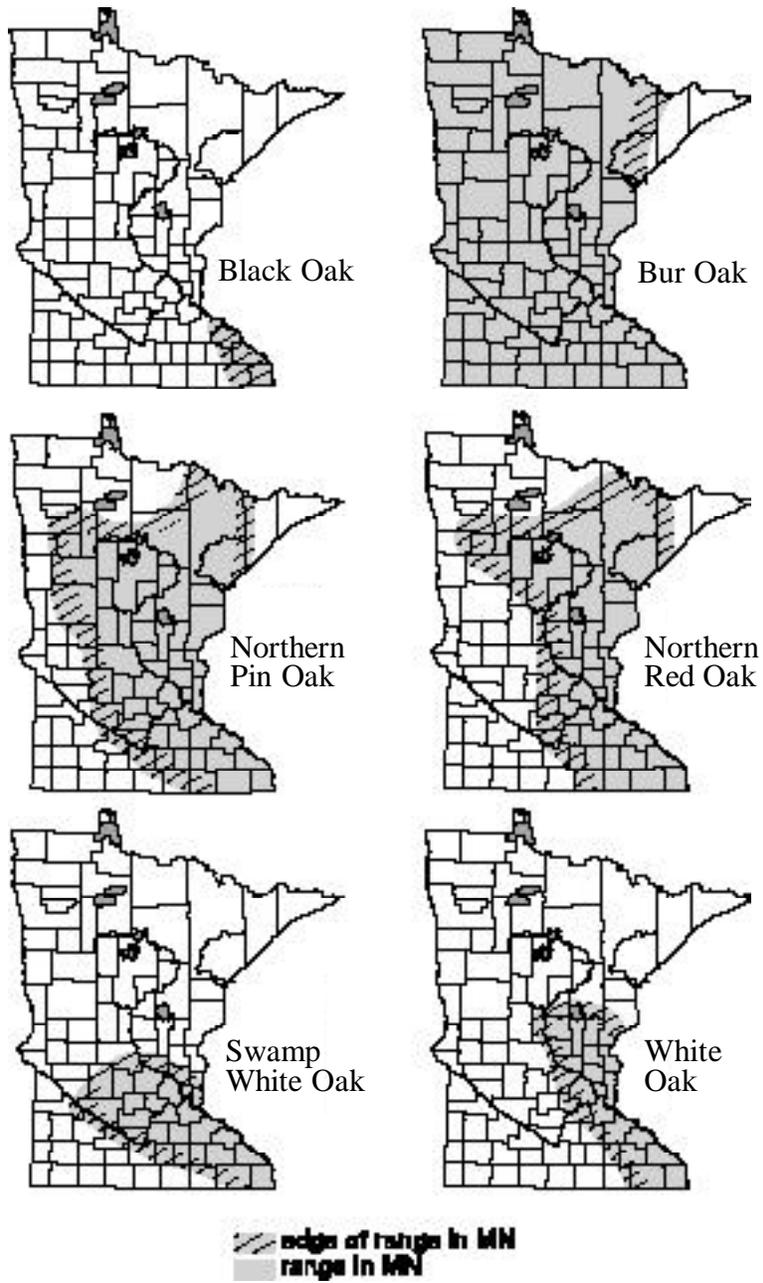
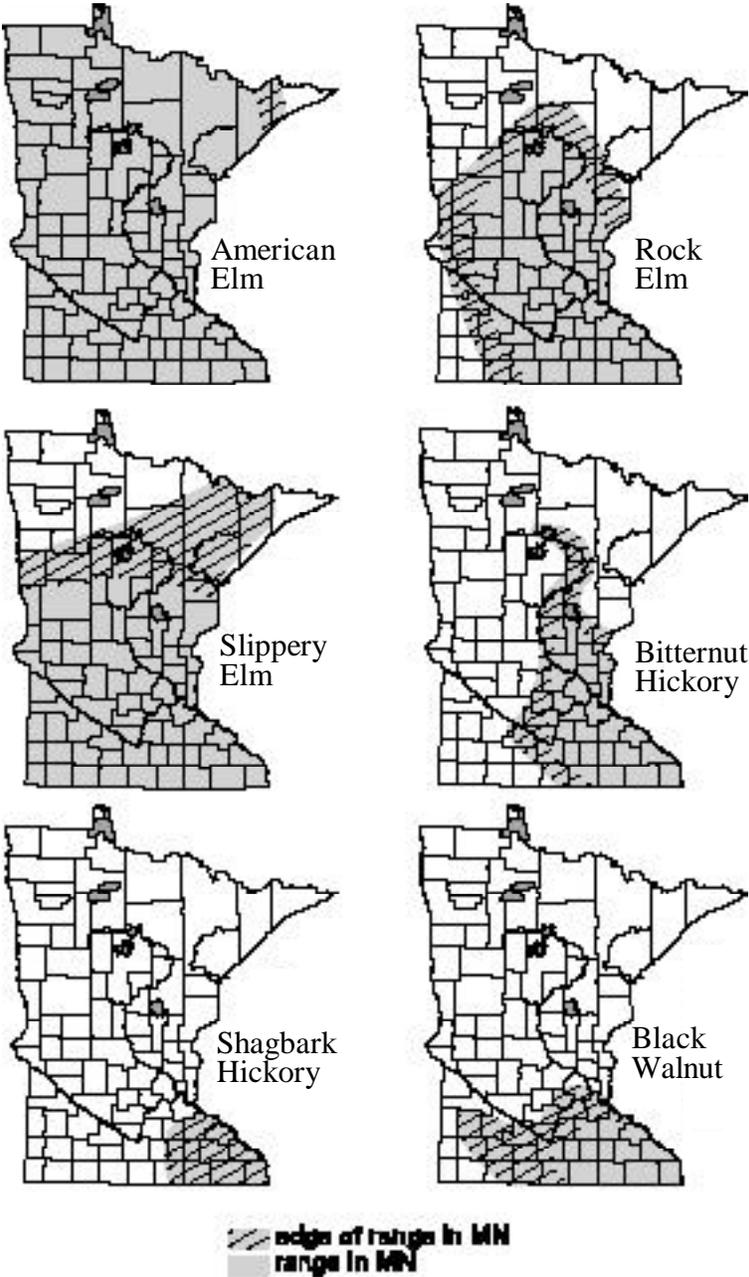


Figure WH-1: Tree Range Maps (cont'd)



Wetland Inclusions and Seasonal Ponds

- Wetland inclusions are wetland basins within an upland site.
- Seasonal ponds: Sometimes called *vernal pools*, seasonal ponds are depressions in the soil surface where water pools during wet periods of the year, typically in spring and fall.
 - A seasonal pond will have an identifiable edge caused by annual flooding and local topography.
 - The edge is best identified during the spring or fall, but it may be identified during dry periods by the lack of forest litter in the depression. Such depressions typically are fishless and retain water for longer periods than puddles.

Note: The leaf litter is replenished annually but is consumed during inundated periods and noticeably depleted thereafter. Deciduous litter will likely be consumed faster and more thoroughly than conifer litter.

Wetland Inclusions and Seasonal Ponds

Purpose: To provide site-level wildlife habitat features for terrestrial species associated with wetland inclusions and seasonal ponds within forests.

Rationale, Background and Benefits

Minnesota has a variety and abundance of wetland inclusions and seasonal ponds. The mixture of land and water features across the landscape provides an important dimension to the habitats of many wildlife species.

Wetland inclusions and seasonal ponds are different from puddles. Wetland inclusions and seasonal ponds retain water for longer periods and support populations of invertebrates that consume forest litter that falls into the depressions. These invertebrates provide food for birds and other species. With a lack of fish and other predators, these waters can be prime breeding habitat for amphibians. Seasonal ponds are also important spring food sources for breeding waterfowl.

Seasonal ponds are best identified in spring when full of water. Frog calling in spring, vegetation type or topography might provide additional clues to their location.

Amphibians and reptiles will benefit the most from application of wetland-related guidelines. The GEIS projected no significant negative impacts to species or communities. However, there were four species of reptiles and amphibians not modeled in the GEIS because of a lack of ecological data. Of these four, two are especially linked to wetland inclusions: the gray tree frog and the blue-spotted salamander:

- The gray tree frog requires ponds within forests surrounded by abundant riparian vegetation. The extent to which wetland protection guidelines will maintain shading, litter depth, water quality and plant cover around wetland inclusions and seasonal ponds in forests will closely parallel the degree to which these frogs are protected from impacts.
- The blue-spotted salamander requires semi-permanent ponds surrounded by hardwood forests, preferably maple-basswood, that have abundant woody debris on the ground. This species will be impacted by short rotations where there is a loss of debris and by the degradation of seasonal ponds.

Applying guidelines for water quality, leave trees and snags, coarse woody debris and slash during forest management activities can retain and create key habitat features (including woody debris, litter depth and plant cover) in these areas, while preventing siltation, excessive warming or premature drying-up of wetland inclusions and seasonal ponds.

The Need for Research and Monitoring

Even though the ecological importance of wetland inclusions and seasonal ponds is recognized, the total number and location of all such water bodies in Minnesota forests is unknown.

Existing inventories, such as the National Wetland Inventory, are incomplete with regard to wetland inclusions. Furthermore, seasonal ponds are sometimes difficult to recognize in the field.

Uncertainty regarding the abundance and location of wetland inclusions and seasonal ponds indicates the need to document their occurrence and further research their role in forest ecology in Minnesota.

For more information regarding wetland inclusions and seasonal ponds, see *Technical Literature on Wetland Inclusions and Seasonal Ponds*, page 50.

Riparian Wildlife Habitat

Purpose: To provide site-level wildlife habitat features for terrestrial riparian-obligate species.

Rationale, Background and Benefits

Riparian areas are among the most important parts of forest ecosystems. These areas have high plant diversity, both horizontally and vertically from the water's edge, which contributes to the high diversity of animals that live in these areas.

Up to 134 vertebrate species occur in riparian forests in this region, but many of these species will also use non-riparian forest habitat.

The species that are of most concern in riparian areas are "obligate" species, which require both the water and surrounding forests as habitat. In Minnesota, 32 reptile/amphibian, 20 bird and 15 mammal species are considered obligate riparian species. Numerous plant and invertebrate species are also strongly associated with these habitats.

Different animals are associated with different stream sizes. In general, larger animals are associated with larger streams and smaller species with smaller streams. A reverse pattern is found in some salamanders.

Although some degree of mature forest cover is desirable along many riparian areas, all habitat conditions are valid, given long-term disturbance regimes. The greatest concern for riparian habitats is in those areas of the state where uplands have been converted to agriculture, resulting in little additional forest of any kind in the region. This situation occurs more in the southeastern and western portions of the state rather than in the north, which affords more flexibility in age classes, structures and cover type.

Forest streams come in many sizes, growing from spring-fed trickles to large rivers as they move downhill and converge with one another to drain larger and larger watersheds. Along this gradient, the ecological characteristics of a riparian area change in a gradual continuum. Because of these characteristics, management guidelines for riparian areas in general should be considered on a landscape level.

Landscape issues are not addressed in these guidelines. Application of some wildlife-related site-level guidelines may differ within and outside the riparian management zone (RMZ), as described in Table WH-4.

It is important to keep in mind the following wildlife-related concerns for riparian habitats:

Leave trees and snags:

- Many riparian species are cavity dependent.
- Some riparian species require large super-canopy trees (trees above the existing canopy) for hunting perches and nesting sites.
- Shade is essential for maintaining microhabitat conditions for some riparian animals.

Coarse woody debris and slash:

- Several riparian animal species require downed logs for cover.

Mast:

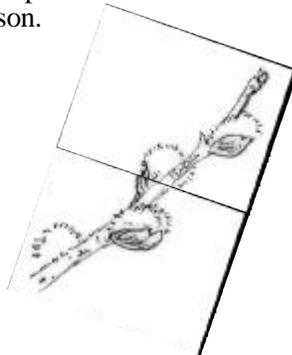
- Riparian edges often contain a higher concentration and richness of unique mast species, especially shrubs, than adjacent upland areas.

ETS species:

- Some ETS species occur in riparian areas.

Sensitive communities and sites:

- Some sensitive communities occur in riparian situations.
- Many riparian species are sensitive to disturbance during the breeding season.



Ecoregion Applicability

These guidelines are applicable to all forested ecoregions. In the southeast, consider limitations of harvest on adjacent slopes and the requirement of wider no-harvest strips adjacent to streams and rivers.

Landscape Implications

In areas dominated by agricultural land use practices (in south-central and southeast regions), where riparian forests represent the majority of the forests in the area, consider only uneven-age management.

Table WH-4

Differences in Application of Guidelines
Within and Outside the Riparian Management Zone (RMZ)

Wildlife-Related Topic	Applying Guidelines Within the RMZ	Applying Guidelines Outside the RMZ
Leave trees and snags	<ul style="list-style-type: none"> <input type="checkbox"/> See RMZ recommendations for numbers and distribution of leave trees. <input type="checkbox"/> Emphasize leave trees from "excellent" category when possible. See <i>General Guidelines: Retaining Leave Trees</i>. <input type="checkbox"/> Leave some bigger conifers and other long-lived tree species. 	<ul style="list-style-type: none"> <input type="checkbox"/> Leave trees in 1/4-acre-plus clumps over 5% or more of clear-cuts, and/or 0-15 scattered leave trees per acre. <input type="checkbox"/> OK to choose all species. <input type="checkbox"/> Leave trees scattered throughout the site. <input type="checkbox"/> Leave a variety of tree sizes.
Coarse woody debris and slash	<ul style="list-style-type: none"> <input type="checkbox"/> Leave or create at least 4 bark-on downed logs per acre (overall site average, including non-RMZ, may still be a minimum of 2 per acre). <input type="checkbox"/> Avoid disturbing down logs and uprooted stumps in the RMZ. 	<ul style="list-style-type: none"> <input type="checkbox"/> Leave or create at least 2 bark-on downed logs per acre.
Conifer retention and regeneration	<ul style="list-style-type: none"> <input type="checkbox"/> Leave undisturbed as many immature and mature conifer trees in the RMZ as possible. 	<ul style="list-style-type: none"> <input type="checkbox"/> Protect conifer regeneration as possible throughout the site.
Mast	<ul style="list-style-type: none"> <input type="checkbox"/> Leave undisturbed as many mast-producing trees and shrubs in the RMZ as possible. <input type="checkbox"/> Plan management activities to avoid removing or trampling mast-producing trees and shrubs. 	<ul style="list-style-type: none"> <input type="checkbox"/> Scatter mast trees and shrubs throughout the site.

Table WH-4 (cont'd)

Wildlife-Related Topic	Applying Guidelines Within the RMZ	Applying Guidelines Outside the RMZ
Patterns of cutting	<input type="checkbox"/> In harvests > 100 acres with an RMZ, consider leaving a forested travel corridor for animals along the RMZ. <input type="checkbox"/> Consider alternative management (other than clearcuts with leave trees) in stands currently comprised of mainly shade-tolerant species.	<input type="checkbox"/> No specific guidelines
ETS species	<input type="checkbox"/> It is important to gather information and contact individuals or agencies with ETS knowledge while planning management in stands that have RMZs.	<input type="checkbox"/> Consider contacting experts if ETS species are suspected to occur on site.
Sensitive communities and sites	<input type="checkbox"/> It is important to gather information and contact individuals or agencies with knowledge of sensitive communities and sites while planning management in stands with RMZs. <input type="checkbox"/> Timber harvest activities should be scheduled or designed to avoid disturbing breeding ETS or sensitive species.	<input type="checkbox"/> Consider contacting experts if sensitive communities are suspected to occur on site.
Legacy patches	<input type="checkbox"/> In a stand that has an RMZ whose vegetation is similar to the surrounding upland, and for which a legacy patch is needed or desired, place the legacy patch in the RMZ.	<input type="checkbox"/> Place legacy patch in representative habitats throughout the site.

Additional Consideration: Legacy Patches

Purpose: To maintain the biological continuity of a harvested site having less than 30 ft² /acre residual basal area.

Rationale, Background and Benefits

Biological continuity of a harvest site is the perpetuation of the full complement of organisms (including fungi, soil invertebrates, ground layer plants, reptiles, amphibians and small mammals) that have been successful in occupying the area in recent generations.

By avoiding soil compaction of the entire harvest site, removal of the natural litter layer and alteration of the hydrology of a reserve patch, additional source areas may be provided for recolonization, gene pool maintenance and establishment of microhabitats for organisms that can persist in small patches of mature forest.

Site sensitivity, and therefore the need for legacy patches, is dependent upon soil compressibility, soil drainage and time of year of harvest. In practice, a legacy patch is similar to a leave tree clump or island (see *General Guidelines: Retaining Leave Trees*), except that a legacy patch:

- Is not disturbed with regard to soil compaction, litter removal and alteration of hydrology
- Does not need to be considered on all sites
- Is representative of the site

Assessing the Need for Legacy Patches

Consider whether a legacy patch is necessary by consulting Table WH-5. Even if the table indicates a need, however, a legacy patch may not be needed if the desired results can be achieved through normal operating procedures that provide the same benefits as a legacy patch (such as a 1/4-acre leave tree island left on frozen ground, or the use of low-impact harvesting equipment that minimizes disturbance on a site).

In harvests where less than 30 ft²/acre basal area remains and Table WH-5 indicates a need, the following characteristics are preferred:

- A patch should be undisturbed in terms of soil compaction, natural litter layer and hydrology.
- Patches should vary in size, with a minimum of 1/4 acre per patch.
- For harvest units at least 15 acres in size, leave a minimum of 5% of the unit undisturbed.
- Randomly locate the patch (or patches) within a harvest unit to represent well the community type being harvested, including, if possible, some high quality trees.
- The duration of a legacy patch is through one rotation. Location of the patch may vary during subsequent rotations. If a legacy patch is left in an intensively managed area (such as a plantation), it would be most beneficial to keep the patch in the same location over several rotations.



Table WH-5 (footnotes on next page)

Decision Matrix for Legacy Patches on Mineral Soil Uplands with Less Than 6 Inches of Peat

Drainage ¹	Texture ²	Depth to Restricting Layer ³	5% Legacy Patch Requirement		
			Growing Season	Dormant Season	Frozen Soil ⁴
Excessive & Somewhat Excessive	Coarse	>2 ft.	No	No	No
		<2 ft.	No	Yes	No
Well & Moderately Well	Coarse	>2 ft.	No	No	No
		<2 ft.	No	Yes	No
	Medium	>4 ft.	No	Yes	No
		<4 ft.	Yes	Yes	No
	Fine	>3 ft.	No	Yes	No
		<3 ft.	Yes	Yes	No
Somewhat Poor	Coarse	>3 ft.	No	Yes	No
		<3 ft.	Yes	Yes	No
Poor	Medium & Fine	not applicable	Yes	Yes	No
		All	Yes	Yes	No

Footnotes to Table WH-5 (page 45):

1. Soil Drainage Classes

Excessively and somewhat excessively drained: Water drains very rapidly. Soils are commonly shallow, very porous, steep, or a combination of these conditions. No gray mottles occur within 60 inches of the surface.

Well-drained and moderately well-drained: Water drains quickly enough in the upper 20 to 40 inches to prevent the formation of gray mottles. Gray mottles may form within 20 to 40 inches (moderately well) of the surface if downward water movement is retarded by a clay layer or if a regional water table is present for part of the growing season.

Somewhat poorly drained: Water drains slowly. Saturation occurs long enough to form gray colors (mottles or dominant matrix) within 10 to 20 inches of the surface. Soils generally have a layer that retards downward water movement or a high water table for part of the growing season.

Poorly drained: Water drains very slowly. Saturation occurs long enough to form gray colors (mottles or dominant matrix) within 10 inches of the surface. Soils generally have a layer for part of the growing season.

2. Soil textures are groups of standard classes as defined by the Natural Resources Conservation Service, 1975. *Soil Taxonomy*. USDA Agric. Handbook 436. pp. 469-472.

Coarse: sand, loamy sand, sandy loam

Medium: fine sandy loam, very fine sandy loam, loam, silt loam, silt, silty clay loam, clay loam, sandy clay loam

Fine: silty clay, sandy clay, clay

3. Any feature that retards downward water movement, such as hardpans, soil horizons greater than 6 inches thick with silty clay loam, clay loam, sandy clay loam, silty clay, sandy clay, or clay textures; bedrock; or frost, during spring breakup.

4. Soil should be sufficiently frozen to avoid disturbing the surface layer. Determining when soil is frozen may vary depending on location. One rule of thumb: "If there is 14 inches of snow by the third week of December, there will be no frost in the soil. Likewise, following winter, if there are three consecutive nights above freezing, the frost will be gone."

Note: Drainage, texture and depth to restricting layer may be obtained from site visits or a county soils atlas map (available from local NRCS offices). See *Resource Directory*.

Species and Communities Affected

Late successional species and those that do poorly on disturbed soils will benefit the most. Many soil microorganisms helpful in plant regeneration and other important processes will help in the regeneration of the harvested site.

Ecoregion Applicability

This guideline is applicable to all ecoregions where soil conditions indicate a need, harvests are initiated on unfrozen ground, and routine harvesting practices do not meet the guideline recommendations.

Landscape Implications

Larger designated reserve areas, such as those found in state parks and Scientific and Natural Areas, can fill a role on the landscape level similar to that provided by legacy patches on the site level.

Selected Resources for Additional Information

Amphibians and Reptiles of Minnesota. 1994. B. Oldfield and J. J. Moriarty. University of Minnesota Press, Minneapolis, Minnesota. 237 pages. *This volume describes each of Minnesota's reptiles and amphibians, noting distribution, habitat and life history of each species.*

Biodiversity: A Technical Paper for a Generic Environmental Impact Statement on Timber Harvesting and Forest Management in Minnesota. 1992. Jaakko Pöyry Consulting, Inc. Raleigh, North Carolina 111 pages. *This technical paper provides background on GEIS modeling results for biodiversity, including information on projected impacts of increased timber harvest, suggested mitigations and detailed information on plants and plant communities. This paper was a primary source for development of site-level wildlife habitat guidelines.*

Birds and Forests: A Management and Conservation Guide. 1995. J. C. Green. Minnesota Department of Natural Resources, St. Paul, Minnesota. 182 pages. *This book provides a wealth of information on habitat needs of and management recommendations for Minnesota's diverse bird populations. Both stand-level and landscape-level recommendations are included.*

County Biological Survey of Minnesota. Minnesota Department of Natural Resources, St. Paul, Minnesota. *This program began in 1987 as a systematic survey of rare biological features. The goal of the survey is to identify significant natural areas and to collect and interpret data on the distribution and ecology of rare plants, rare animals and natural communities. Published maps display the results for 17 of 33 counties surveyed through January 1998. Surveys are under way for 18 additional counties.*

Creating a Forestry for the 21st Century: The Science of Ecosystem Management. 1997. K. A. Kohm and J. F. Franklin (eds.) Island Press, Washington, D.C. 475 pages. *This compilation of papers looks at various aspects of forest ecosystem management, including a summary of various wildlife topics, including economic concerns.*

Final Generic Environmental Impact Statement Study on Timber Harvesting and Forest Management in Minnesota. 1994. Jaakko Pöyry Consulting, Inc. Tarrytown, New York. 496 pages plus an executive summary and appendix. *This GEIS study was the main impetus for the development of forest management guidelines by the Minnesota Forest Resource Council's technical teams. This paper was a primary source for development of site-level wildlife habitat guidelines. It includes projections of significant impacts to various forest resources based on three projected levels of timber harvest in the state.*

Forest Wildlife: A Technical Paper for a Generic Environmental Impact Statement on Timber Harvesting and Forest Management in Minnesota. 1992. Jaakko Pöyry Consulting, Inc. Raleigh, North Carolina. 283 pages plus an appendix. *This technical paper provides background on GEIS modeling results for wildlife, including a host of information on projected impacts of increased timber harvest, suggested mitigations and individual species life histories. This paper was a primary source for development of site-level wildlife habitat guidelines.*

The Mammals of Minnesota. 1982. E. B. Hazard. University of Minnesota Press, Minneapolis, Minnesota. 280 pages. *This book is an excellent source for ranges, habitats and natural histories of Minnesota's mammals.*

Minnesota's Endangered Flora and Fauna. 1988. B. Coffin and L. Pfannmuller (eds.) University of Minnesota Press, Minneapolis, Minnesota. 473 pages. *Although slightly dated because of the changing status of individual species, this book remains a key information source on the status, habitat and identification of endangered, threatened and special concern species in the state.*

Minnesota's Native Vegetation: A Key to Natural Communities (v. 1.5). 1993. Natural Heritage Program, Minnesota Department of Natural Resources, St. Paul, Minnesota. 110 pages. *Descriptions and keys to identification of natural communities are included in this technical manual. Characteristic plant species are listed for each community. Future updates may include successional pathways and clearer ties to the Ecological Classification System and commonly recognized cover types.*

Report on the Scientific Roundtable on Biological Diversity Convened by the Chequamegon and Nicolet National Forests. 1994. T. R. Crow, A. Haney and D. M. Waller. North Central Forest Experiment Station, USDA Forest Service, St. Paul, Minnesota. General Technical Report #NC-166. 55 pages. *This report gives consensus-based alternative management strategies for Great Lakes forests by this group of natural resource professionals.*

Saving Nature's Legacy: Protecting and Restoring Biodiversity. 1994. R. F. Noss and A. Y. Cooperrider. Island Press, Washington, D.C. 416 pages.

Vascular Plants of Minnesota: A Checklist and Atlas. 1991. G. B. Ownbey and T. Morley. University of Minnesota Press, Minneapolis, Minnesota. 307 pages. *More than 2,000 vascular plants found in Minnesota are listed in this reference book. Maps of collected specimens of each species depict their ranges within the state. This book was a key resource for developing maps of tree species at the edge of their range in Minnesota.*

Wildlife, Forests, and Forestry: Principles of Managing Forests for Biological Diversity. 1990. M. L. Hunter, Jr. Prentice Hall, Inc., Englewood Cliffs, New Jersey. 370 pages. *This text reviews the many facets of wildlife in the managed forest, providing a balanced approach to modern forest wildlife management.*

Wildlife Habitats in Managed Forests: the Blue Mountains of Oregon and Washington. 1979. J. W. Thomas (ed.). USDA. Forest Service Agricultural Handbook No. 553. US Government Printing Office, Washington, D.C. 512 pages. *Although this handbook focuses on western wildlife species and their habitats, much of the background information and principles are applicable throughout the forests of the United States and represent accepted management practices of many wildlife management agencies.*

Woodland Stewardship Plan Manual. 1991 (periodically updated). Division of Forestry, Minnesota Department of Natural Resources, St. Paul. *Tabbed three-ring binder including numerous brochures, fact sheets and individual management plans for non-industrial private forest (NIPF) landowners. This document is a primary source for NIPF landowners enrolled in the Forest Stewardship program. The information in the stewardship manual should complement and expand on the site-level wildlife habitat guidelines in this document, providing comprehensive planning information for a specific parcel of land.*

Technical Literature on Wetland Inclusions and Seasonal Ponds

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