FORESTRY-WILDLIFE GUIDELINES TO HABITAT MANAGEMENT

1985 Revision

FOREST

TRANSITION

PRAIRIE

MINNESOTA
DEPARTMENT OF NATURAL RESOURCES

GENERAL CONTENTS

Minnesota DEPARTMENT OF NATURAL RESOURCES Policy

Effective Date 10/28/80
Number 8
Approved:
Revised: 5/3/82

Supersedes Number ____
Date ____

Other Guidelines
Commissioner Order # ____
Rules & Regulations ____
Operational Order ____
Department Manual ____
Other ____

SUBJECT: WILDLIFE/FORESTRY COORDINATION 0064D

Preamble

As state administered lands are to be managed for compatible multiple use benefits, unless otherwise dedicated by law, both the Divisions of Forestry and Fish and Wildlife are jointly charged with the responsibility of achieving the goal of integrating forest and wildlife management, while recognizing other multiple use purposes. The following policies and procedures are meant to ensure that integration takes place.

General Policy

1. All State Administered Lands (unless otherwise dedicated by laws)

The department shall strive to implement the practices delineated in the Forestry/Wildlife Guidelines To Habitat Management on all state administered lands. Such implementation is important since manipulation of forest vegetation is the key to managing for wildlife as well as timber products. Successful management for these two purposes depends upon achieving the desired combination and distribution of age classes by forest types in conjunction with stated multiple-use policies and overall sustained forest and wildlife goals. Therefore, both disciplines will follow these guidelines when planning and implementing forestry and wildlife management practices on forestry and wildlife administered lands recognizing that whenever possible wildlife management objectives should be met through forest management practices. These guidelines will be expanded and updated as new techniques are developed.

A. Forestry Administered Lands Outside of State Forests in Wildlife Management Areas

1. To the extent possible on lands determined to have significant wildlife and significant forestry values, wildlife management objectives should be met through forestry management practices. However, where long term forest management objectives are in conflict with long term wildlife objectives on specific tracts of land internal transfers of administrative control-- lease, or acquisition shall be considered.* However, this should be considered only where critical habitat conditions cannot be met through cooperative planning.

*In this document, all such referenced actions on specific tracts of land shall be consistent with department policy and procedures for all divisions governing exchange, and internal transfers of administrative control.

SUBJECT: WILDLIFE/FORESTRY COORDINATION

2. Lands determined to have primary value for wildlife with relatively low values for forestry should be acquired or custodial control transferred to the Division of Fish and Wildlife.

B. Wildlife Management Area Lands Within State Forests

Where overlap of unit boundaries occurs, i.e. state forest and state wildlife management areas, cooperative agreements relative to administration shall be established. These agreements shall become part of the forest management and wildlife management area plans. However, where long term forest management objectives are in conflict with long term wildlife objectives on specific tracts of land transfer of custodial control, lease, or acquisition shall be considered.

2. Other Non-DNR Lands

Wildlife and forestry personnel should seek to establish cooperative agreements with other public land management agencies, private landowners, or industrial land owners for the purposes of meeting wildlife and forest management objectives. Private forest management assistance should consider the Forestry/Wildlife Guidelines To Habitat Management.

Specific Policy

1. Forestry/Wildlife Guidelines To Habitat Management

Forestry/Wildlife Guidelines To Habitat Management have been developed. Subsequent changes or additions to these guidelines shall be brought to the attention of the division level of Forestry and Fish and Wildlife. Upon joint agreement at the division level, all changes will be forwarded to the field for implementation.

2. The following items are covered in the Forestry/Wildlife Guidelines to Habitat Management.

a. Habitat composition goals: Habitat composition goals have been developed so that each district in the state has something to work with. It should be recognized that these goals provide a general framework within which the area manager has leeway to develop more specific objectives.

b. Compartment analysis: The guidelines define a procedure for getting a specific compartment analysis to the districts.

c. Forestry practices: The specific types of modifications (size, design, etc.,) to forestry practices e.g., timber sales, site preparation, roads for habitat enhancement have been addressed.

d. Openings: The guidelines develop a system for dealing with wildlife openings created through forestry practices.

SUBJECT: WILDLIFE/FORESTRY COORDINATION

e. Special Wildlife Considerations: Those considerations needed for special wildlife species or wildlife concentrations (e.g., eagles, osprey, prairie chickens, etc.) have been addressed.

f. Habitat development projects: The guidelines develop a method for handling and keeping track of habitat development projects (e.g., browse strips, impoundments, prescribed burns).

3. The task force on wildlife/forestry coordination shall meet on an annual basis to determine how well the policies, procedures, and guidelines are working and to recommend any changes that may be necessary in these documents.

4. To improve coordination and cooperation between the Divisions of Forestry and Fish and Wildlife, wildlife and forestry personnel, within the primary forested area of the state shall have a common office, when the opportunity exists.

5. The department should initiate forest and wildlife research projects and provide information on mutually important tree species (such as white cedar, oak, and others) to address wildlife and forestry values.

6. Management plans for all DNR management units will have input from all divisions prior to public release or public information meetings.

7. The Divisions of Fish and Wildlife and Forestry need to develop a joint policy on the use of prescribed fire.

8. A policy statement or cooperative agreement(s) should be developed to address problems between fish management and forest and wildlife management practices.

General Procedural Policy

As a general rule, assigned Forestry and Wildlife staffs should attempt to review all management practices at joint meetings (see specific management practices) since such meetings foster better working relationships, promote understanding, and favor mutual agreements. It is hoped tnat these meetings will encourage more frequent contact between staffs.

If, upon notification of a specific practice, a discipline opts to not review a specific practice, then lack of review shall indicate that there are no concerns. Any differences in judgement in interpreting this policy or procedure or in deciding any particular management project or program which cannot be resolved shall be immediately referred to the next higher level of the department organization. Under no circumstances is one level or division to delay a decision on a proposal of another because of disagreement. It should be referred to the next level of supervision with recommendations as to why it should not be approved.

Disagreements that cannot be resolved at the division directors' level will be immediately referred to the Planning and Environmental Review Team (PERT). PERT will review the problem and forward its recommendations for resolution to the commissioner's office for a decision.

SUBJECT: WILDLIFE/FORESTRY COORDINATION

Specific Procedural Policy

Notification on each of the following specific management practices (1-13) to be carried out on forestry and/or wildlife administered lands shall be by "speed letter." A speed letter shall be initiated by the discipline level proposing an action. The speed letter shall be forwarded to the identified staff level and discipline for each activity below.

Upon receipt of notification the reviewer has two options:

1. No review needed - sign pink copy and return to initiator.

2. Review needed - Request review meeting to discuss modifications, alternatives or other concerns. Following this meeting one of the following actions shall take place:

   a. Review and agree - sign pink copy, state agreement, and return to initiator.

   b. Review and disagree - sign pink copy, list the project with an explanation, and send copy of memo to next higher level of review.

Time schedules for review are noted under specific activities to be reviewed. Mutually agreeable arrangements concerning waiver of review for certain categories of projects may be proposed by memo, at the regional level, for joint approval at the division director level (e.g., non-review by forestry of wetland acquisition in the farmland area of the state) when necessary to prevent the creation of a cumbersome review and approval process.

To assure that integration of management will take place Forestry and Wildlife staffs shall adhere to the following procedural policies:

1. Site Preparation
   Planting/Seeding
   Timber Stand Improvements

   Area wildlife and area forestry personnel will review draft plans, ideally at a joint meeting(s), at the time such plans (down to site level plans) are proposed. Such review should take place within two weeks of notification, unless some other time interval is arranged. Review snall include agreement, modification, or suggestions of alternative projects. Any changes in the planned projects shall be reviewed within five working days of notification of change.

2. Vegetative Management;
   Timber Sales and Non-Commercial Stand Regeneration

   Area wildlife and area forestry personnel shall review the "planned annual cut" and non-commercial stand regeneration proposals at a joint meeting at the time such management activities are planned. Such review should take place within two weeks of notification from Forestry or Wildlife, unless some other time interval is arranged. Review shall include agreement,

modification, or suggestions of alternative projects. Any changes in the planned annual cuts or non-commercial stand regeneration proposals shall be reviewed within five working days of notification of change. Any work outside of the planned area is considered a change.

3. Roads and Trails

Area wildlife and area forestry personnel will review all new road and trail project proposals, ideally at a joint meeting(s), as such roads and trails are planned. Such review should take place within two weeks of notification, unless some other time interval is arranged. Review shall include agreement, modification, or suggestions of alternative projects. Any changes in planned projects shall be reviewed within five working days of notification of change.

4. Agricultural leases

Area wildlife and area forestry personnel will review all agricultural leases as they are proposed. Such review should take place within two weeks of notification, unless some other time interval is arranged. Review shall include agreement, modification, or suggestions of alternative projects.

5. Forest Inventory

Area wildlife, and area forestry personnel, and the inventory project leader will review the inventory project before field work starts. Such review should take place within one month of notification, unless some other time interval is arranged. Review shall include agreement, modification, or suggestions on the type of field information needing emphasis within the individual area.

6. Significant Wildlife Conditions

Area wildlife and area forestry personnel will notify each other of significant wildlife conditions (e.g., bald eagle nest, heron rookery, and osprey nest sites, listed by the non-game program) and emergency situations (e.g. deer starvation) as soon as they become aware of such conditions on any land. Review of forest management considerations relative to significant wildlife conditions shall take place as soon as possible following notification. Wildlife recommendations shall be given priority consideration if such conditions are confirmed as significant or of an emergency nature.

7. Significant Forestry Conditions

Area wildlife and area forestry personnel will notify each other of significant forest management opportunities (e.g., unique soil conditions for a high value species) when they become aware of such opportunities on any land. Review of wildlife management considerations relative to significant forestry opportunities shall take place within one month of notification.

SUBJECT: WILDLIFE/FORESTRY COORDINATION

8. Boundary Changes, Acquisition, Land Excnanges, Land Sales, Easements, and Leases

Area wildlife and area forestry personnel will notify each other of all proposals for boundary changes, acquisition, land exchanges, land sales and easements. For wildlife management projects, the wildlife management area land acquisition proposal (G.F. 300) shall constitute notification for all acquisition, easement, and boundary changes for that wildlife management area. These shall be reviewed internally within the two divisions at all levels prior to official public release and/or submittal for legislative consideration. Following approval by the respective directors, all levels shall be notified of the decision prior to official public release.

9. Other Projects

Wildlife projects not specifically noted in the preceeding e.g. dugouts, openings, browse management, impoundments, etc. will be reviewed by area forestry personnel within two weeks of notification, unless some other time internal is arranged. Review shall include agreement, modification, or suggestion of alternative projects.

10. District or Forest Management Plan

Development of district or forest management plans shall be the responsibility of forestry. The wildlife management recommendations for these plan are to be developed by wildlife personnel. Recommendations will address browse management, cover management, openings, impoundments, significant wildlife conditions, access roads, and other priority needs during the life of the management plan. Review, by each discipline, shall be conducted according to a jointly agreed upon management plan schedule. Review shall include agreement, modification, or suggestions of alternatives.

11. Wildlife Management Area Plan

Development of wildlife management area plans shall be the responsibility of wildlife. The forestry management recommendations for these plans are to be developed by forestry personnel. Recommendations should cover the life of the management plan. Review, by each discipline, shall be conducted according to a jointly agreed upon management plan schedule. Review shall include agreement, modification, or suggestions of alternatives.

12. Wildlife Projects Initiated by Wildlife

a. Other Lands: (Private, Industrial, Federal, County, Municipal): Area wildlife personnel will inform appropriate forestry personnel of planned and desired wildlife projects and conditions on other lands when they are proposed so as to foster greater opportunities for cooperation and the achievement of optimum forestry and wildlife benefits. Such projects and conditions include, but are not limited to, planned development and treatment of openings, browse management, cover management, impoundments, significant wildlife conditions, etc.

SUBJECT: WILDLIFE/FORESTRY COORDINATION

13. Forest Projects Initiated by Forestry

Other Lands (Private, Industrial, Federal, County, Municipal): Area forestry personnel will inform appropriate wildlife personnel of planned and desired forestry projects e.g. PFM and conditions on other lands when they are proposed so as to foster greater opportunities for cooperation and achieving optimum forestry and wildlife benefits.

SECTION I

INTRODUCTION

CONTENTS

FOREWORD

These guidelines are part of the Minnesota Department of Natural Resources' Wildlife/Forestry Coordination Policy as required by General Policy statement 1:

> The Department shall strive to implement the practices delineated in the Forestry/Wildlife Guidelines to Habitat Management on all state administered lands -- both disciplines will follow these guidelines when planning and implementing forestry and wildlife management practices, recognizing that whenever possible management objectives should be met through forest management practices.

The policy further states under General Procedural Policy that:

> As a general rule, assigned Forestry and Wildlife staffs should attempt to review all management practices at joint meetings since such meetings foster better working relationships, promote understanding, and favor mutual agreements.

However, due to distances between work stations, time restraints, and work loads, it is not always possible for Area Forestry and Wildlife personnel to meet and confer on the best way to carry out a management activity consistent with good forest and wildlife management practices. Recognizing this, these guidelines have been developed to ensure that every area in the state has a guide for forest and wildlife managers to refer to in the absence of discussing the activity with each other. Both Area Forestry and Area Wildlife personnel will follow the guidelines as much as possible when preparing any development proposal or carrying out any activity that may influence habitat. If the guidelines are used, the project review process will be that much easier. Use of these guidelines does not eliminate the need for joint meetings whenever possible.

These guidelines do not represent the ideals for either wildlife habitat or silviculture. They represent varying degrees of compromise between the two disciplines to provide management integration with a minimum number of potential conflicts.

At times special conditions may occur (e.g., insects, disease, etc.) that will influence a decision as to whether or not a particular guideline is implemented. Major problems should not result if a guideline was not carried out because of special conditions and such conditions were noted in the proposal.

Both forestry and wildlife management use a variety of practices to benefit the resources in their charge. Many complex factors interact to influence these practices' success. Guidelines to establish integrated practices that will provide satisfactory results for each discipline are complex, seemingly repetitious, and sometimes in apparent contradiction. The Forestry and

Wildlife guidelines are organized in a manner to overcome these problems as much as possible. Read the following discussion of organization carefully.

A. Organization of the Guidelines

To use these guidelines, recognize that some practices, such as wildlife opening development, must be subdivided into categories that address different situations. By becoming familiar with the organization of the material, you will know which subsection to consult.

The General Contents page shows that the manual is divided into 8 major sections plus an appendix section and an index. Reference to the General Contents page indicates the tabbed section or sections you consult for a particular broad subject, e.g., special area habitat management. At the beginning of each major section is another contents page that tells you which page to consult for more detailed information.

Generally the format for each subject is as follows:

1. The zones that the subject generally applies to are indicated in the upper right hand corner (see pages 7-11 for the zones), but in some cases the subject can also apply out of the indicated zones.

2. Reference is usually made to the applicable section of the Forestry Wildlife Policy.

3. A general statement or guideline briefly explains how the subject applies to forest wildlife habitat and how modifications to habitat practices will benefit.

4. The specific guidelines are presented. These guidelines apply to management actions to benefit wildlife and wildlife habitat in the indicated zones. In many cases, several specific guidelines are given that apply to a single indicated zone. However, you are often referred to other sections of the manual for additional guidelines on a specific subject.

5. At the end of most subjects, there is room for "Managers Notes". Note here items unique to the area you are examining, or specific compromises between Area Wildlife and Forestry personnel for the area.

6. The final section is the index. Consult this frequently to insure that all items on a subject have been addressed. For example, you may be interested in oak management. The general contents suggest that you consult Section II, Timber Harvest and Section III, Oak. The section contents refer you to page 16, Timber Harvest and page 28, Oak. In checking the index, you

will also find a reference to page 27. This page is in the aspen section and we find that specific guideline 9 states that oak in clumps and scattered oak in an aspen timber harvest area are to be reserved for mast production for wildlife.

These guidelines represent the state of the art at this time. They have been compiled from the recommendations of wildlife and forestry personnel of the Minnesota Department of Natural Resources, other states, and the U.S. Forest Service.

Knowledge of how best to manage our forests and wildlife habitat is still developing. Portions of these guidelines will be revised as additional knowledge accumulates.

APPROVAL

These guidelines have been developed in response to the Minnesota Department of Natural Resources' Wildlife/Forestry Coordination Policy wherein Specific Policy 1 states:

> Forestry/Wildlife Guidelines to Habitat Management should be developed by the Division of Fish and Wildlife six months after this policy has been approved. Upon development, these guidelines shall be reviewed by the Forestry/Wildlife Task Force. Upon agreement of the Task Force, the guidelines shall be submitted to the Division Directors of Forestry and Fish and Wildlife for joint approval. Upon joint agreement at the Division level, the guidelines will be forwarded to the field for implementation.

The Forestry/Wildlife Task Force was established by the Directors of Forestry and Fish and Wildlife in February of 1980 and consisted of the following individuals:

Dave Dickey, Area Wildlife Manager, Aitkin
Bob Djupstrom, Supervisor, Policy and Land Classification (Dave Zumeta now has Bob's position), St. Paul
Gary Drotts, Wildlife Habitat Specialist, Brainerd
Larry Olson, Area Staff Forester, Hibbing
LeRoy Rutske, Big Game Specialist, St. Paul
Ramon Tarchinski, Area Forest Supervisor, Baudette
Bruce ZumBahlen, Forest Management & Policy Supervisor, St. Paul

The first volume of guidelines, those for the Northern Forest, was compiled by LeRoy Rutske, Big Game Specialist, reviewed, approved, and sent to the field in 1982.

Later, committees were formed to prepare guidelines for the other habitat zones of the State and consisted of the following individuals:

Transition

Bill Barnacle, Forest Management Specialist, Brainerd
Rick Olson, District Forester, Wannaska
Bob Wennerstrand, Area Forest Supervisor, Warroad
Gary Johnson, Area Wildlife Manager, Little Falls
Jon Parker, Area Wildlife Manager, Shakopee
Gordie Nielsen, Area Wildlife Manager, Fergus Falls

Agriculture and Driftless

Mike Maurer, Area Wildlife Manager, St. Cloud
Nick Gulden, Area Wildlife Manager, Winona
Bob Meyer, Area Wildlife Manager, Marshall
Tom Romaine, Area Forest Supervisor, Lake City
Dave Anderson, District Forester, Willmar
Jeff Haas, District Forester, St. Cloud

The drafts from these committees were reviewed by the Task Force in March 1984. At that time, the Task Force decided to combine the guidelines into one volume to reduce duplication and enhance utilization. Gary Drotts and Dave Dickey, of the Task Force, took on this responsibility.

This volume is the result of many months of work by many individuals to give field personnel a guide to Forestry/Wildlife habitat management.

SUBMITTED BY:

Wildlife/Forestry Task Force

David C. Zumeta — Dated 4/29/86

Dave Zumeta, Leader

APPROVED BY:

Division of Fish and Wildlife

Roger Holmes — Dated 4/29/86

Roger Holmes, Chief of Wildlife

Larry Shannon — Dated 4/29/86

Larry Shannon, Director

APPROVED BY:

Division of Forestry

Raymond B. Hitchcock — Dated 4/29/86

Raymond B. Hitchcock, Director

VEGETATIVE ZONES AND HABITAT EVALUATION

Area Wildlife personnel work with many types of wildlife habitat. Whenever this habitat includes trees, some aspect of forest resource management is involved. Wildlife and Forestry must also coordinate management on some non-forested state land. The physiography of Minnesota creates a variety of habitat types that cannot be managed for both forestry and wildlife with one set of habitat composition guidelines. The habitat composition guidelines for vegetative cover types will be established for each management unit, e.g., state forest, wildlife management area, state park, etc., as plans for the unit are developed. The guidelines must address insect and disease, fire, soils, recreation, and fiber as well as wildlife. This volume presents habitat guidelines for the four general areas of the state described below. These guidelines address the vegetational, wildlife, and land use characteristics of those areas.

Habitat compartment evaluation has been developed and is well underway for the northern forest zone. In the northern forest, compartments are referred to as Forest Habitat Compartments. Procedures for habitat compartment evaluation are found in the Forest Wildlife Habitat Evaluation Procedures Manual (December 1980) which is available from the Wildlife Section, Division of Fish and Wildlife.

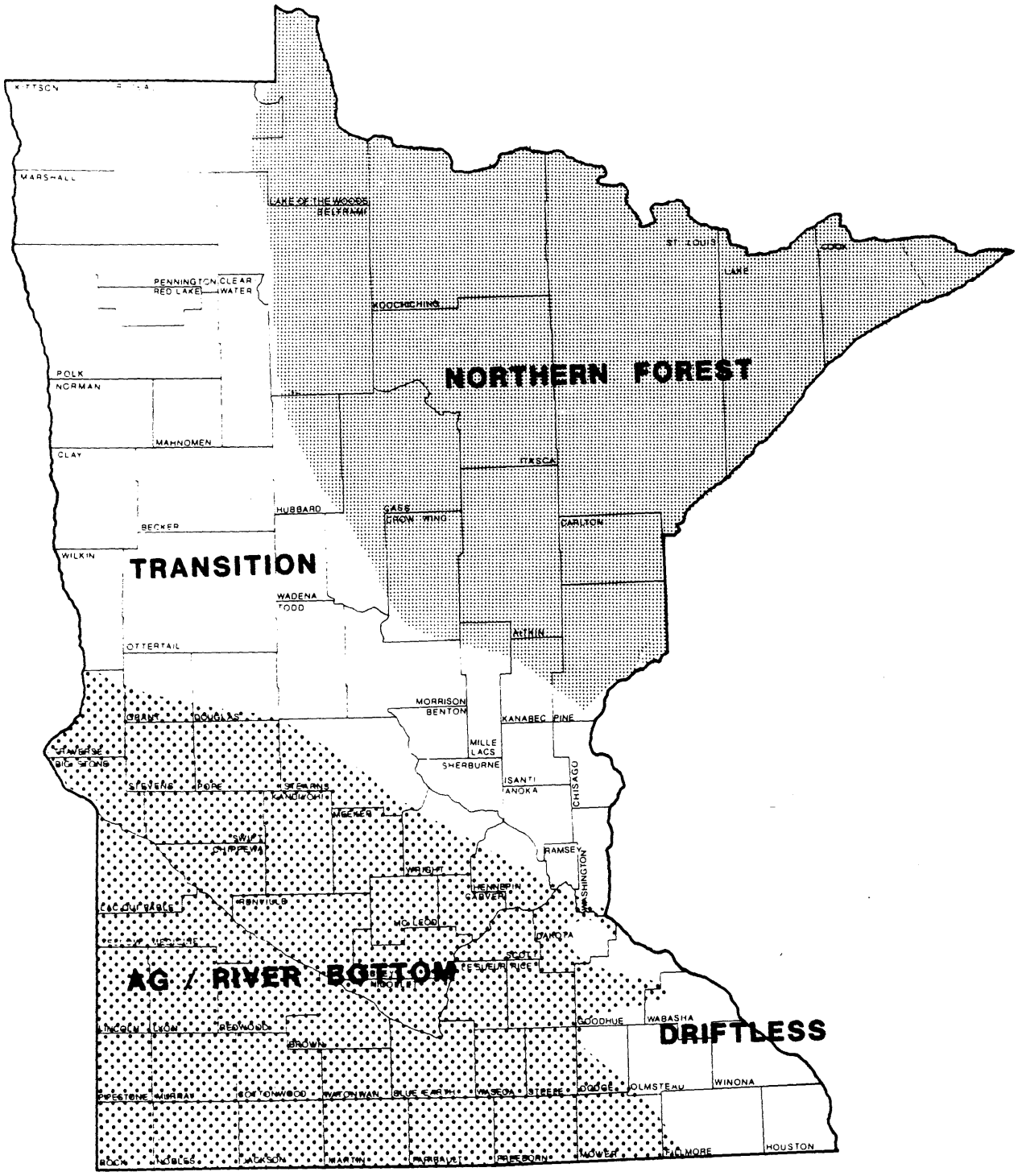
Similar procedures need to be developed for habitat evaluation in the other zones with varying compartment sizes depending upon the habitat and target species. All references to compartments in this manual will be "habitat compartment".

Habitat composition goals will be addressed through habitat compartment evaluation, unit planning, and timber regulation. Final goals for a unit will be arrived at through compromise of these separate goals. In areas where some of this planning has been completed, those goals should be followed when planning forest habitat management.

The goal of the Minnesota Department of Natural Resources is to manage the following zones by maintaining a variety of vegetation and wildlife that are ecologically and environmentally suitable to the area. This goal must be compatible with existing land uses (e.g., state parks, agriculture, SNA's, urban areas, etc.). Valuable prairie, wetlands, and natural communities must be preserved and managed to perpetuate the unique habitat they provide.

The following zones cannot be absolutely defined on a state map. The map on page 8, however, gives an approximate outline (Figure 1). There is overlap of vegetation types and wildlife species within these areas, and as such, the guidelines should be used to achieve the purposes sought, and not strictly on the basis of the particular land parcel's location in the state.

Figure 1. Generalized Vegetative Zones in Minnesota



NOTE : Zones cannot be absolutely defined in the areas shown here.

See text for explanation

NORTHERN FORESTS

The area of the state generally covered by Northern Forests extends from the Canadian border southward to where this extensive forest of mixed conifer and hardwoods (primarily aspen) gives way to farm lands with remnants of hardwood forest and prairie groves. Recognize that there are portions of this general area that are more like the transition or agricultural woodlots/river bottom zones, and these portions should be treated as such.

Criteria for forest composition that delineate good deer, moose, and ruffed grouse habitat have been developed and generally accepted by the U.S. Forest Service (USFS) and Natural Resource Departments in the Lake States. These criteria also delineate, to a considerable degree, the diversity required by many other species. Therefore, as a matter of convenience, guidelines for the Northern Forests will generally refer to benefits to deer and/or ruffed grouse. Keep in mind that some other wildlife species depend upon mature forest stands and will not be benefited by intensive deer habitat management. Management refinements required by these species may need to be made. Recommendations relating to mature forest species are cited in USDA Handbook No. 553 - Wildlife in Managed Forests, and Section VI of these guidelines. Wetland protection guidelines will benefit wildlife species associated with the wetland habitat component of the northern forest.

TRANSITION AND PRAIRIE

This area extends generally from southern Pine County to the northern suburbs of the Twin Cities, extending in a northwesterly direction to the Canadian border and includes the prairie from Wilkin County northward.

The transition zone is characterized by a mixture of land uses and vegetation types including: agriculture, hardwood and scattered conifer forest, and large areas of grassland and brushland. This interspersion of cover types produces an abundance and diversity of wildlife. Forest communities are dominated by oak in the south and aspen in the north. With exceptions, deciduous trees are most common and conifers occur as scattered trees. The original composition was influenced by the inherent characteristics of the soils, fire history, and climatic factors. Current composition has been, and continues to be altered by land clearing, drainage, intensive agriculture, rural residential development, fire suppression, and establishment of conifer plantations. Without focused management to meet identified goals, the transition zone, along with its unique wildlife abundance and diversity, could eventually cease to exist as an ecological type in Minnesota.

The prairie areas are dominated by agriculture, including crop and livestock farms and, increasingly, rowcrop and small grain cash crop operations. Trees are mostly limited to farm groves, shelterbelts, stream channels, and state-owned lands. Some

private and state-owned lands contain wetlands and remnant native prairie. These small tracts of natural vegetation are vitally important to wildlife. Much of this habitat is rapidly being lost to farm development and urban sprawl.

DRIFTLESS AREA

The driftless area of Minnesota includes all or part of Dakota, Goodhue, Olmsted, Wabasha, Winona, Fillmore, and Houston counties.

These counties either escaped the last glaciation or are covered with postglacial loess. This zone is characterized by interspersion of forest and agricultural land, with the forests comprising 10-40% of the land area.

The forest is a hardwood mix that is a transition type between oak-hickory and central hardwood forest types of the lower midwest and the northern forest type of central and northern Minnesota. Individual stand compositions vary depending upon past management practices. Pre-settlement burning led to development of many of these stands. Wildfire has been greatly reduced since European settlement and is no longer a factor in development of forest stands across the state.

Agriculture is oriented toward livestock, primarily beef and dairy cattle, which requires the production of feed grains and forage crops.

Wildlife are somewhat dependent on these agricultural crops for their food supplies, although many wildlife species may not use these crops. Important wildlife cover and food is provided by the forested cover types as well.

AGRICULTURAL WOODLOTS/RIVER BOTTOMS AREA (Agriculture/River)

This area was dominated by tall and mid-grass prairie vegetation at the time of European settlement. Due primarily to periodic prairie fires, trees were generally restricted to river bottoms. After white settlement, this vast grassland area was converted to a landscape dominated by diverse farming operations. Agriculture has now intensified to the point that most land is used for the production of crops such as corn and soybeans, with some oats and wheat. Vast fields of only a few crops have severely limited the diversity and abundance of wildlife.

Early settlers planted woodlots as sources of firewood and lumber, and for protection from the relentless prairie wind. Today, some farmers still plant trees to combat the wind. Due to the conversion of prairie to cropland, wildfires no longer occur and tree establishment is determined primarily by landowners.

This area is characterized as being less than 2% wooded. Soils are very fertile, heavy, and alkaline with a water deficit (evaporation exceeds precipitation). The majority of the land is

used for the production of row crops. Some wetlands, mostly in public ownership, still remain as remnants of the numerous marshes present at the time of settlement. Wildlife, for the most part, are very dependent upon agricultural crops for their food supplies. The forested types are especially important for cover.

SECTION II

FORESTRY AND WILDLIFE MANAGEMENT INTEGRATION BY GENERAL PRACTICES

CONTENTS

MANAGEMENT INTEGRATION BY GENERAL PRACTICES

Wildlife/Forestry Coordination Policy Reference:
Specific Policy 2c - Forestry Practices: The specific types of modifications (size, design, etc.) to forestry practices (e.g., timber sales, site preparation, roads) for habitat enhancement need to be addressed.

RATIONALE - Northern Forest, Transition, and Driftless Area

Two approaches are used to improve habitat for wildlife. One approach is to improve wildlife habitat or hunting by: deer browse cutting, food and cover planting, and development of trails and wildlife openings. The second approach, the most important and that with the greatest potential, improves wildlife habitat by modifying timber management practices.

Projects with the primary objective of wildlife management usually affect relatively small areas because land management agencies seldom have funds to carry out large programs of this type. The second approach, timber management, has much greater possibilities but requires that management of forest lands be planned to benefit wildlife. Often this integrated planning requires some modification of timber management, but this is usually a matter of location and timing of operations and is not likely to entail large additional operating costs.

The distribution of costs specifically for wildlife considerations in forest practices should be negotiated between disciplines at the area level.

When assisting private forest landowners, you will increase benefits to wildlife by using the guidelines presented in this manual.

RATIONALE - Agricultural Woodlots/River Bottom Areas (Agriculture/River)

Less than 2% of the Agriculture/River Area is forested so most wildlife species will benefit tremendously from a coordinated management effort by forestry and wildlife. Because forested acres are important for maintenance of wildlife habitat diversity in intensively farmed areas, the primary concern is to retain all that now exist and, if possible, increase the number of forested acres.

In the Agriculture/River area, certain tree and shrub species are of greater value than other trees and shrubs to many wildlife species. A variety of tree species and ages are preferred to

monotypic, even-aged stands. This mixture provides necessary habitat needs for a wide range of wildlife species.

Over 95% of the forested land in this area is privately owned. Thus, there is little direct control over land management by forestry or wildlife personnel. Conversion of the remaining forested land to other uses such as cropland, pasture and rural residential lots is a very serious problem. According to the District Forester at Redwood Falls, 50% of the forested land in the 15 county Redwood Falls Forestry District was lost between 1966 and 1977.

Private landowners' land management activities can be influenced to benefit wildlife when Area Forestry and Wildlife use this manual as they give technical assistance to the private landowner.

ZONE
Statewide

SOILS EVALUATION

General Statement

Soil type and characteristics are important factors on any site being managed. These factors determine the vegetation species and wildlife that may grow on the site, seasonal and equipment limitations, the investment returns on a project, and potential uses of the area. On fragile soils even minimal disturbance can have long term deleterious effects.

Specific Guidelines

When considering management options, use the most precise information available for the soil on a site. Some information sources are:

1. Forest Soils Manual, Division of Forestry.
2. Soil Specialist, Division of Forestry, usually located at the Regional Headquarters, he or she will provide and interpret soils information and make on-site visits.
3. Soil Conservation Service Office in each county will also provide and interpret soils information.

These sources may also alert the manager to other sources for surveys, maps, etc.

In no case should soils information alone be used as the justification for conversion of a vegetative type (i.e., to conifer from transition, prairie, or hardwood). Wildlife considerations such as threatened or endangered species habitat requirements, history, type availability, etc. must also be considered.

MANAGERS NOTES

ZONE
Statewide

TIMBER HARVEST

Policy

The procedural policy provided by the Wildlife/Forestry Coordination Policy covers both timber sales and non-commercial stand regeneration (Special Projects, page 50). Therefore, to cover only the present subject, the procedure is paraphrased here.

Area Wildlife personnel should continually supply Area Forestry personnel with suggested cutting locations based as much as possible on compartment evaluation. They will also recommend to Area Forestry personnel areas where wildlife will benefit by deferred harvest.

The Area Forester will notify the Area Wildlife Manager when the proposed District cutting plan has been assembled and is ready for review. Review will include agreement, modification, or suggested alternatives.

General Statement

The basic forest management unit is a timber stand. In most cases, the stand's natural boundaries, or a combination of stands of the same type and age, will determine the size and shape of the sale area from a timber management standpoint. It is possible that a stand's border could be modified to correspond with a soil type change.

Some of the wildlife benefits achievable through coordinated timber harvests are:

1. Increased food supply by new growth.
2. Retention of shelter by reserved areas.
3. Creation of openings and edge.
4. Perpetuation of key stands and associated plant species in adequate quantity.
5. Wetland protection and/or enhancement.
6. Conversion of forest to cover types needed in the compartment (wildlife openings, grasslands, etc.).
7. Retention of snags, den trees, and mast-producing trees for wildlife breeding, feeding, and shelter.
8. Enhancement of habitat diversity through forest age-class diversity.
9. Identification and preservation of key stands that should be set aside for old-growth.
10. Preservation and/or enhancement of habitat or community types critical to the perpetuation of unique resources.

Specific Guidelines for Timber Harvest

A. The planning of all timber sales must start with a referral to, or a knowledge of, the following:
   1. Management and composition goals for Unit/Compartment.
   2. Location recommendation from Area Wildlife and Area Forestry personnel.
   3. Silvicultural guidelines for forestry (Division of Forestry).
   4. Timber type guidelines for habitat (this manual).
   5. Special Species Habitat Improvement (this manual).
   6. Wildlife openings management (this manual).
   7. Special areas management (this manual).
   8. Wetland inventory (Area Wildlife personnel).
   9. Managers handbook series (North Central Forest Experiment Station).
   10. Economics of the proposed harvest operation.
   11. Markets and shifts in demands for volumes and species.

B. Action guidelines for wildlife habitat enhancement in Northern Forests, Transition, and Driftless (see "C" for Agriculture/River Area).
   1. Implement recommendations from sources in "A" above.
   2. Determine size and shape of cutting area.
      a. Clearcut areas under 20 acres preferred; where moose or sharp-tailed grouse is the favored species, 200 acre or larger cuts may be acceptable.
      b. Although small clearcuts are preferred, a sale with several 20-acre patches with uncut areas between is another means to maximize edge and provide large sales.
      c. Large or combined stands should be cut to provide the most irregular shape practical using natural stand boundaries, while taking into consideration insect and disease problems and the future regeneration of the stand.
      d. Where large cuts are necessary due to the extent of an over-mature stand, limit the total size of the cut or cuts (made within a 5-year period) to 50 percent of the stand. If this exceeds the recommended maximum cut size for the type, then refer to the specific recommendations for that type (i.e., travel lanes, islands, snags, etc.).
   3. Other considerations.
      a. Follow guidelines by forest type for retention of snags, den trees, and mast producing trees on the harvested area (see Snags, pages 78-80).
      b. Plan type of regeneration effort before harvesting a stand. Regeneration techniques may have a bearing on how the sale is set up and administered.
      c. Do not allow slash, debris, or slash piles within or immediately adjacent to wetlands (see Special Area section, Riparian Zones, page 73).

d. Retain a buffer strip of uncut timber adjacent to designated trout streams and other water areas (see also Section VI, Forest Wetlands, page 66).
e. Manage desirable landings as new wildlife openings. Refer to the Wildlife Opening section, page 47.
f. Identify and assess unique resources in the stand, incorporating any special management considerations necessary to insure their perpetuation.
g. Preserve, when feasible, within-stand features that provide important benefits to wildlife (e.g., conifer inclusions in deciduous stands).
h. Consider proximity factors (e.g., consider the location of stands in adjacent compartments and plan cooperatively with adjacent landowners to maximize benefits of management actions).

C. Action Guidelines for Wildlife Habitat Enhancement (Agriculture/River Area)
1. Implement recommendations from sources in A above.
2. Determine size and shape of cutting area.
a. When clearcutting, areas under 5 acres are preferred.
b. The size and shape of areas to be harvested by selective cutting are not critical as long as you consider the recommendations for management integration by forest types, special area, and species habitat improvement. The primary concerns of forest stand perpetuation, enhancement of the stand's wildlife values, and harvest of the timber crop can best be met by discussions between Area Wildlife and Area Forestry personnel.
c. Confer with Area Wildlife personnel on advisability of cutting adjacent to wetlands. In many cases, wetlands located in prairie or agricultural types will be less attractive to waterfowl if they are ringed with trees. When waterfowl are the favored species, remove these trees permanently to increase the wetland's use.

ZONE
Statewide

REFORESTATION

Wildlife/Forestry Coordination Policy Reference:

Specific Procedural Policy 1 - Area Wildlife personnel and Area Forestry personnel will review draft plans, ideally at a joint meeting(s), at the time such plans (down to the site) are proposed. Such review should take place within two weeks of notification, unless some other time interval is arranged. Review shall include agreement, modification or suggestions of alternative projects. Any changes in the planned projects will be reviewed within 5 working days of notification of change.

General Statement

The modification of reforestation practices to enhance wildlife habitat is particularly critical.

Maintaining forest composition diversity is important for wildlife as well as for protecting forests from fire, insects, and disease. Maintenance demands an interspersion of deciduous, conifer and other types. From a wildlife perspective, the habitat compartment evaluation is the best available basis for evaluating and maintaining diversity.

The actions that lead to reforestation can provide sites and opportunities to obtain wildlife openings at low cost.

Reforestation must consider preservation of snags for birds and mammals, and retention of some slash and dead and downed material for small mammals, reptiles, and amphibians where depredation will not interfere with the successful regeneration of the stand.

Maintain, restore, and enhance interspersion of grassland, brushland, and forest. Exclude conifer planting where use of habitat by sharp-tailed grouse, sandhill crane, or other species of special concern is desired. Favor converting or replanting sites that are already forested or harvested rather than planting fields, grasslands, or brushlands.

Throughout the transition zone, forest development projects (e.g., plant community conversion, conifer plantations, timber harvest, and conifer release) have the potential for being detrimental to critical habitats of sensitive species (e.g., prairie grouse, sandhill crane, ruffed grouse, and waterfowl). Therefore, care must be taken to formulate forestry and wildlife goals that maintain and enhance species inhabiting the transition zone.

Reforestation often involves three separate actions: (1) site preparation, (2) planting, seeding, or natural regeneration efforts, and (3) release of plantations from competing vegetation. Each of these actions will be treated separately.

SITE PREPARATION

Site preparation is action taken to facilitate planting or seeding where:

-- a harvested site is prepared for reestablishing the species of timber removed, or for establishing a more desirable species, or

-- non-merchantable timber is removed so that a more favored species or timber density can be established, or

-- trees do not presently exist; e.g., cropland, brushland, or grassland.

Specific Guidelines

1. Avoid creating large contiguous stands of a single species and age. Plan for plantations by site index, soil type, evaluation of current forest diversity, habitat requirements of wildlife target species or species of special concern, and economic feasibility. The habitat compartment evaluation program will assist managers in determining the best all-around sites.
2. Favor irregular shapes following type lines unless insects and/or disease or wildlife depredation are considerations.
3. Plan site preparation to be less than 40 acres in northern forests and less than 20 acres in the transition and driftless areas. If site must be larger, reserve travel lanes and islands. Travel lanes should be large enough to be managed as a stand (5 to 10 acres), and islands should be at least 1/2 acre. If residual timber must be windrowed, leave gaps in the rows at least every 300 feet. Random piling is preferred over windrows.
4. Regard areas around potholes or wetlands as special areas and consult with Area Wildlife personnel.
5. See Special Areas section, page 73, for riparian zone guidelines.
6. See Special Project section, page 44, for wildlife opening guidelines.
7. See Special Species section, page 78, for snag preservation.

Specific Guidelines Unique to Agriculture/River Area

1. Site preparation on lands now in forest should be less than 5 acres with adjacent areas withheld for 5 years.
2. Avoid steep slopes and recommend the termination of grazing.

3. Place residual timber and slash in random piles to provide cover for raccoon, cottontail rabbits, reptiles, and amphibians. Leave some logs over 12" in diameter that have no commercial value lying separately to provide habitat for reptiles and amphibians.
4. Do not disturb native prairie areas without consulting Area Wildlife personnel and the Natural Heritage Program.

PLANTING, SEEDING, AND NATURAL REGENERATION

Specific Guidelines

1. Favor natural regeneration as much as possible.
2. Seriously consider jack pine in evaluating pine regeneration sites because of its high wildlife value.
3. When red pine is planted, lower stocking densities for wildlife benefits are encouraged.
4. Where the compartment analysis shows a need for developing additional upland winter cover, the order of preference is cedar, balsam, jack pine, white spruce, red pine, depending on soils.
5. Plant native hardwood or native conifer species whenever feasible in the Driftless Zone.
6. See Special Project section, page 44, for wildlife opening guidelines.
7. See Special Species section, page 78, for snag preservation and other nongame considerations.
8. See Special Area section, page 66 regarding wetlands, and pages 87 and 93 regarding prairie grouse.

Specific Guidelines Unique to the Agriculture/River Area

1. Give special consideration to oak, basswood, hackberry, boxelder, and maples because of their values to wildlife.
2. Conifers planted in blocks of 2-10 acres in conjunction with nearby hardwoods provide winter cover and species diversity. Give consideration to spacing and species to prevent self pruning as much as possible when the planting is primarily for wildlife habitat.

PLANTATION RELEASE

Specific Guidelines

1. Sites with an abundance of beneficial shrubs should be selectively released if the remaining cover will not pose a threat from wildlife depredation. Use release by hand tools, spot gun with herbicide, boom wick applicator, and ground tanker with nozzle rather than aerial application.
2. When considering herbicide release always review DNR herbicide policies.
3. See Special Projects section, page 44, for wildlife openings guidelines.

ZONE
Statewide

TIMBER STAND IMPROVEMENT

General Statement

Timber stand improvement (TSI) refers to all treatments made during the life of a forest stand to improve the stand composition, condition, and rate of growth.

Opening dense stands for the benefit of tree growth can provide supplementary deer food and increase wildlife food production until the canopy closes again. Keying TSI to local wildlife needs can provide real benefits for wildlife while attaining the objectives of silviculture.

General Guidelines

Funding usually limits the number of sites for non-commercial improvements. Therefore, TSI sites keyed to deer needs should be made in or adjacent to known deer wintering complexes, or adjacent to cover or topography that has deer wintering potential.

Coordination of TSI and wildlife habitat enhancement must include proper timing, location, and distribution of treatment to benefit timber production and targeted wildlife species, and retention of selected trees and shrubs for the benefit of wildlife. The latter is especially important because removal of competing growth is the objective of TSI work (see Specific Guidelines below).

TSI adjacent to deer wintering areas in the hardwood type should be directed toward hardwood sites that need uneven-age management because of the supplemental browse provided.

Specific Guidelines for the Northern Forest, Transition, and Driftless Areas

1. Maintain several clones of mature male aspen in every 40 acre tract to benefit ruffed grouse where aspen occurs in a mixed type.
2. Consider maintaining the shelter value of conifers in areas where cover for deer is scarce. Do not prune or thin stand perimeters or reduce crown closure below 50 percent.
3. Maintain fruit or mast producing trees, such as oaks, black cherry, butternut, and mountain ash.
4. Maintain enough snag and den trees to meet wildlife needs (see Special Species section, page 78). Girdle trees instead of felling in thinning projects to meet snag needs.

Specific Guidelines for the Agriculture/River Area

1. Favor oaks on appropriate sites.
2. Thinning to allow full crown development of oaks will increase mast production.
3. Maintain a minimum of one den tree per acre, especially for squirrels and raccoons, and approximately 2 snags over 10" dbh per acre for various wildlife species (see Special Species section, page 78).

MANAGERS NOTES

SECTION III

MANAGEMENT INTEGRATION BY FOREST TYPE

CONTENTS

MANAGEMENT INTEGRATION BY FOREST TYPE

This section contains guidelines for managing various timber types. For further information refer to:

1. Timber harvest guidelines on pages 17 - 19 of this manual.
2. North Central Forest Experiment Station Technical Reports in the Managers Handbook Series:

   NC-36, Aspen
   NC-37, Oak
   NC-39, Northern Hardwoods
   NC-38, Black Walnut
   NC-35, Cedar
   NC-33, Red Pine
   NC-1, Aspen Symposium Proceedings
   NC-99, Establishing Even Age Northern Hardwood Regeneration by the Shelterwood Method
   NC-31, Oak Forest of the Lake States and Their Management
   NC-32, Jack Pine

3. Division of Forestry's "Aspen Management Guidelines - Revised" (1981).
4. Northeastern Forest Experiment Station's Birch Symposium Proceedings, 1969.
5. Division of Forestry's Northern Hardwood Management Guidelines.
6. Division of Forestry's Red and Jack Pine Management Guidelines.
7. U.S. Dept. of Agriculture, Agriculture Handbook No. 271, Silvics of Forest Trees of the United States - Eastern Red Cedar.
8. Section of Wildlife - Wildlife Habitat Improvement Program's Minimum Requirement for Woody Cover Plantings.
9. North Central Forest Experiment Station - NC-51, Workshop Proceedings, Management of North Central and Northeastern Forests for Nongame Birds.
10. Gullion, G. 1984. Managing northern forests for wildlife. The Ruffed Grouse Society. 72pp.
11. Mooty, J. J. 1979. Relationship of white-tailed deer to plant communities in northern Minnesota: vegetation inventory of the Bearville Study Area. Minn. Wildl. Res. Q. 39(1): 1-59.

This is only a partial list of many references that could and should be consulted to improve forest and wildlife habitat management.

ZONE
Statewide

SHADE-INTOLERANT HARDWOODS

ASPEN (AND PAPER BIRCH)

General Statement

- The aspen community, where it occurs, is the forest type that most often provides the food supply required by deer, moose, and grouse, either from the young aspen or from the shrubs and ground cover associated with it. Aspen is also an important spring food for black bear.

- Natural forest succession can convert stands from aspen to more shade-tolerant species that provide less deer, moose, and grouse habitat.

- Maintaining deer, moose, ruffed grouse, and other wildlife habitat requires perpetuating sufficient acreage of aspen. The silvicultural method to meet this objective is to clearcut and allow natural regeneration of aspen. However, where conifer mixed with aspen is used by deer as part of a wintering complex, maintain enough conifer cover for wintering deer.

- Paper (white) birch is closely associated with the aspen type and, like aspen, supports a diverse shrub and herbaceous layer. Birch stands managed for pulpwood and fuelwood should be managed to benefit wildlife in the same manner as aspen stands.

Specific Guidelines

1. Maintain the aspen type as recommended in each habitat compartment evaluation and unit plan.
   a. If the acreage of aspen type does not meet the recommended minimum of the habitat compartment, consider converting to aspen when the parent stand contains at least 20 square feet of aspen basal area, distributed evenly throughout the stand and, in the Driftless Area, does not have a red oak site index greater than 40 (refer to Section of Wildlife Forest Habitat Compartment Evaluation Manual).
   b. If no possibility exists for expanding the aspen acreage to meet the minimum standard of the habitat compartment, maintain whatever aspen exists in the compartment and compensate for the missing habitat benefits of aspen by managing other shade-intolerant types.

2. If aspen stands exceed the recommended proportion of a habitat compartment, some sites could considered for conversion to other cover types, depending on the overall diversity and compartment needs, as follows:
   a. Direct stand conversion to the poorer aspen sites.
   b. Avoid conversion of aspen types adjacent to traditional deer wintering complexes.
   c. Avoid conversion of aspen under 10 years old if this age class is lacking.
3. Maintain at least 25% of the habitat compartment-recommended aspen acreage in age classes 10 years and under.
   a. Locate aspen sales through Phase II Inventory data, the habitat compartment evaluation process, and/or give priority to sales adjacent to known deer wintering complexes.
   b. Consider aspen regeneration by mechanical means if markets are absent, or if the stand is not economically operable due to terrain, volumes/acre, or transportation costs. Priority should be on deteriorating stands based on site index and age.
4. Utilize aspen sales or mechanical regeneration to develop any needed wildlife openings noted in habitat compartment evaluation (see Openings, as a special project, p. 44).
5. Meet the basic needs of ruffed grouse by maintaining good distribution of age-classes of aspen. For maximum benefit, consult the recommendations of Gullion, Appendix A, page 102.
6. Consider wildlife security cover and access to food when cutting aspen. If the width of a harvest area exceeds 5-6 chains (300-400 feet), or the size exceeds 40 acres, travel lanes or islands should be left where topography does not already provide such cover. Travel lanes should be large enough to be managed as a stand, 5-10 acres. The minimum size of islands should be 1/2 acre.
7. Follow guidelines for nongame and special species (see Special Species section, page 77).
8. Leave some off-site aspen undisturbed because these low productivity stands with their very open canopies usually support an abundance of shrubs and herbaceous plants.
9. Reserve (do not harvest) clumps of oak and scattered oak for mast production for wildlife.
10. Leave 2 - 4 hard snags (top intact) or live trees per acre, and as many soft snags as possible. Consider leaving male aspen clones as live snags. This will protect potential snags from wind throw and provide grouse food (see Special Species section, page 78).
11. Fall all stems 2" dbh and larger except for snags, mast producing trees, and adjacent male aspen.

MANAGERS NOTES

ZONE
Statewide

MODERATELY SHADE-TOLERANT HARDWOOD - OAKS

General Statement

Oak is very important to wildlife wherever it occurs. Acorns (mast) are eaten by many wildlife species. In the Agriculture/River, the vegetative form or structure provided by a forest stand reduces wind velocities and is thus attractive to deer and many other wildlife species for use as a wintering area. The mutual goal of both Forestry and Wildlife is to perpetuate and expand the oak cover type because of its high mast production and timber values. Timber sales must be closely controlled to maintain both the mast production capability and the future existence or expansion of the stands. From a wildlife standpoint in the Driftless Area, maintaining and expanding the oak cover type is the highest priority goal. Where management for oak timber is not possible or desirable, management for oak savannah provides excellent habitat for transition zone wildlife.

Specific Guidelines

1. Increase, or at least maintain, oak type acres on appropriate sites in habitat compartments where oak is considered inadequate to maintain mast production.
2. Use shelterwood cuts to maximize mast production if advance regeneration is lacking.
3. Cut oaks during dormancy to encourage sprouting.
4. Maintain an acorn production level of at least 100 pounds per acre averaged over the oak cover type component of the habitat compartment. In stands having average diameters of 9"+, this production level correlates with a basal area of 50 square feet.
5. Where doing partial cutting or TSI:
   a. Retain at least 1 - 2 den trees per acre. Den trees should be hollow, have an entrance at least 20 feet above the ground, and be living trees with a life expectancy of at least 5 years. If trees having all these characteristics are not available, leave those with some of the requirements.
   b. Manage oak stands, where not limited by existing stand composition, by creating a ratio of one white (or burr) oak to two red oaks. In stands having very low amounts of white or burr oak, favor the white or burr oak.
6. Maintain hickory as a stand component for mast production in the Driftless Zone.
7. Leave 2 - 4 snags per acre if clearcutting. See section on snag management, page 78.

8. Maintain age class variety within a stand by selective clearcuts with a minimum of 2 - 5 acres to assure perpetuation of the oak type. To maximize mast production, thin oak stands heavily at an early age to get full crown development. Thin the stand so that it achieves crown closure at the age when mast production first becomes significant.
9. Leave clumps or scattered oak for mast production in other types having oak in them.
10. Eliminate grazing.

MANAGERS NOTES

ZONE
Statewide

SHADE-TOLERANT NORTHERN HARDWOODS

General Statement

The shade-tolerant northern hardwoods generally do not provide the abundance and diversity of shrub and forb growth that are found in aspen, birch, and oak types. They do, however, provide a diversity of forest resources.

Northern hardwood stands can range from the pure climax maple-basswood forests to high-graded mixed stands of aspen, birch, oak, maple, basswood, or combinations thereof.

Where this mixed northern hardwood type occurs over extensive areas, and is neither old growth nor an important maple-basswood type, it may be desirable to increase the overall density and abundance of wildlife species through cutting. Generally this can be accomplished by establishing a diversity of age classes or through some conversion where necessary for specific timber or wildlife management benefits. In lieu of a commercial market for northern hardwoods, well-managed fuelwood sales can provide hardwood reproduction that will result in a diversity of plant ages and species that, in turn, will produce a greater diversity of wildlife species. In the northern forest zone where there is sufficient aspen-birch type in the habitat compartment to meet deer and grouse habitat needs, northern hardwoods should not be considered for management practices to benefit these species.

Pure maple-basswood stands that are mature and previously undisturbed occur on only a few scattered sites protected from fire, and deserve protection through special timber management plans. Before any manipulation of these stands occurs, the community should be completely inventoried by the Natural Heritage Program. This should include a careful documentation of the herb layer because maple-basswood forests harbor several rare plant species that are restricted to mature examples of the community. Creating openings or converting the community could have devastating effects on rare plants and animals. Mature maple-basswood stands with some previous disturbance should also be inventoried and protected through special timber management plans. Refer to the section on Old Growth Considerations, page 70.

Specific Guidelines

1. Encourage long-term hardwood management to favor oak species over maple-basswood, unless rare species are threatened. Do not, however, sacrifice high quality maple-basswood stands in favor of oak management.

2. Consider leaving sites as permanent old growth acreage rather than converting to conifers where site index is less than 50.
3. To increase browse production in average stands, management should consist of an even-age two-cut shelterwood system, discriminating against maple reproduction and residual trees.
4. The shelterwood system can be employed to greatly increase available browse (generally as much as clearcutting) as well as timber management goals.
5. Manage low quality hardwoods on an even-age basis. In habitat compartments low in aspen, clearcuts in northern hardwoods with at least 20 square feet aspen basal area, distributed evenly in the stand, may be converted to aspen.
6. Wildlife openings are even more important to edge wildlife species in the northern hardwoods than in aspen-birch mixtures. However, since openings may be detrimental to some non-edge species, do not construct openings in high-quality northern hardwood stands.

   Although small openings usually revegetate quickly and lose value for wildlife, their life can be extended to 20 or 30 years by:

   (1) cutting them in stands 50 years old or less where there is little or no advanced reproduction, and
   (2) cutting them on either excessively well drained or poorly drained soils, or on soils that are shallow. Openings should be at least an acre in size, but not more than 20, and irregularly shaped. See New Wildlife Opening Development, page 48.

7. Locate winter fuelwood cuttings where they will benefit deer concentrations.
8. See Special Species section, page 78, for retention of snags, culls, and den trees.
9. See Special Areas section, page 70, for Old Growth considerations.

MANAGERS NOTES

ZONE
Transition
Driftless

CENTRAL HARDWOODS

General Statement

The "fine hardwoods" of this type (walnut, butternut, oak, cherry, etc.) provide high timber and wildlife values. Timber management decisions in this type are influenced by the relative amounts of shade tolerant and shade intolerant species. Wildlife decisions are based upon mast production.

Specific Guidelines

As outlined in the OAK cover type and the NORTHERN HARDWOOD cover type, wildlife habitat needs are:

1. Maintain mast producing tree species.
2. Maintain den trees and snags.
3. Maintain 1:2 white oak to red oak ratio.
4. Use slash disposal practices that benefit wildlife.
5. Use harvest methods that result in plant species typical of early successional stages.
6. Eliminate grazing.

MANAGERS NOTES

LOWLAND HARDWOODS

General Statement

Lowland hardwoods occurring in the Northern Forest zone consist primarily of ash, ash/elm, and associated species. There can often be cover species such as cedar and/or balsam in the stand along with good browse shrubs like mountain maple.

Lowland hardwoods in riparian zones are prime candidates for permanent old growth designation. In addition to fulfilling old growth needs, these areas provide abundant cavity trees and snags.

Specific Guidelines

1. In habitat compartments low on intolerants and/or aspen, clearcuts in this type may provide browse not otherwise available.
2. Clearcuts in excessively wet sites may eliminate the type and create a cattail marsh. Use selective cut.
3. Locate winter fuelwood cuts in black ash where they will benefit deer concentrations.
4. Scattered cover species (cedar and balsam) should be maintained in the stand, especially if the stand is in a deer wintering complex.
5. When oaks occur in the type, they should be favored.
6. Check on possible occurrence of colonial waterbird nesting sites in stand and refer to Special Species section on colonial waterbirds, page 81.
7. Leave snags and den trees (see Special Areas section, page 78).

MANAGERS NOTES

ZONE
Transition
Agriculture/River
Driftless

LOWLAND HARDWOODS - FLOODPLAINS

General Statement

Lowland hardwoods such as elm, ash, cottonwood, soft maple, willow, boxelder, and associated species typically are found in the floodplains of the larger streams and rivers. Activities planned for this type should consider limits imposed by stream, shoreland, and floodplain regulations. The elm component is disappearing because of Dutch Elm Disease. Many dead elms are being cut for fuelwood. Within the Agriculture/River Area, the main wildlife benefit is shelter provided by the forest stand, irrespective of species composition. Thus, forest management techniques to perpetuate forest stands are of primary importance. Tree and shrub species diversity of various ages provides the most wildlife benefits to the greatest number of wildlife species.

Specific Guidelines

1. The silvicultural requirements of species that most commonly compose this type are best met by even-age management. Wildlife food and cover needs are best served by a mosaic of even-aged patches.
2. Provide den trees for use by various birds and mammals. Den tree guidelines outlined in the oak type (Agriculture/River) apply here as well. Where a choice between den trees is available, silver maple is preferred over willow and cottonwood. Cavities of the most desirable size are found in trees with a dbh between 24" and 36", but usable cavities occur in trees with dbh of 16"+. For wood ducks, provide at least one cavity per acre of forest within one-half mile of water.
3. Manage for snags as outlined in the OAK type (Agriculture/River).
4. In the Driftless and Agriculture/River zones, willow and cottonwood saplings provide an important food source for beaver. Wooded land adjacent to streams and rivers should be managed to produce this sapling food source.
5. Sandbar willow thickets are excellent winter cover for pheasants and should be maintained.
6. See Special Species section on Eagles and Colonial Tree Nesting Species.
7. See Special Areas section on Riparian Zones, page 73.

MANAGERS NOTES

CONIFERS - NORTHERN FORESTS AND TRANSITION

JACK, RED, AND WHITE PINE

General Statement

Red and white pine are not critical to most game species and may in fact be detrimental to some species when planted in inappropriate areas. Natural pine stands are of some value to some wildlife, primarily nongame species. Most wildlife prefer jack pine for cover and food over red pine and white pine because plants associated with the natural jack pine community such as hazel, blueberry, wintergreen and bearberry provide food. Jack pine communities are important for spruce grouse.

Specific Guidelines

1. Management practices that favor the maintenance of jack pine stands over red or white pine stands, including a balanced distribution of age classes, are recommended.
2. See Timber Stand Improvement section, page 23, for management to retain winter cover value of plantations.
3. Refer to Special Species Habitat Improvement section for prairie chicken, sharp-tailed grouse, and other special considerations, page 77.
4. See Special Species section, page 78, for retention of snags, culls, and den trees.
5. See Special Species section, page 88, for eagle and osprey considerations.

MANAGERS NOTES

ZONE
Forest
Transition

CONIFERS - NORTHERN FORESTS AND TRANSITION

WHITE CEDAR

General Statement

Where white cedar is available, deer strongly prefer it as winter cover. Scattered clumps of cedar are valuable during less severe winter conditions because they permit deer to use adjacent food sources. Closed cedar canopies must be maintained because they protect deer against the most severe conditions. Cover needs will be determined by habitat compartment evaluation.

To learn more about cedar ecology, the Divisions of Forestry and Fish and Wildlife need to conduct studies on cedar sales.

Specific Guidelines

1. White cedar should not be cut in habitat compartments with inadequate cover unless a cedar management plan is written for that habitat compartment. In habitat compartments with an excess of winter cover, white cedar may be cut unless the cedar is providing winter cover for deer from an adjacent habitat compartment(s) with little or no winter cover.
2. Since regeneration is difficult, cedar should be managed on the longest rotational age possible to perpetuate winter deer shelter. Refer to Special Areas section, Deer Wintering Complexes, page 62.
3. When planting or seeding cedar, a higher density than recommended for timber production should be used.
4. Refer to Division of Forestry white cedar management guidelines.

MANAGERS NOTES

ZONE
Forest
Transition

CONIFERS - NORTHERN FORESTS AND TRANSITION

SPRUCE-FIR

General Statement

Naturally occurring spruce-fir type often provides winter cover for deer when cedar cover is lacking, or in conjunction with cedar. It complements the cedar cover in a wintering complex and provides cover over wide areas in milder winter conditions. Maintain this type when needed for cover.

General Guidelines

1. Manage this type based on recommended silvicultural procedures.
2. Maintain adequate winter cover adjacent to a good food supply by managing on the longest rotational scheme consistent with silvicultural guidelines.
3. See Special Areas section of this manual, page 62, regarding deer wintering complexes.
4. See Timber Stand Improvement section, page 23, for management to retain winter cover value of plantations.
5. Refer to Special Species Habitat Improvement section, page 77, for prairie chicken, sharp-tailed grouse, and other special considerations.

MANAGERS NOTES

ZONE
Forest
Transition

CONIFERS - NORTHERN FORESTS AND TRANSITION

LOWLAND BLACK SPRUCE AND TAMARACK

General Guidelines

1. In areas where the emphasis is on spruce grouse management, Area Wildlife and Forestry personnel should follow the wildlife recommendations in North Central's Technical Report NC-34.
2. Tamarack and black spruce stands are important for Great Gray Owls. Refer to specific guidelines in Appendix B, page 115.
3. This type is important to bog lemmings, and the edges are important to wintering bear, and to moose and bear in summer.
4. On sites with low site indexes, convert to shrub types (especially bog birch) or other cover types needed in the habitat compartment.
5. Refer to Special Species section for sharp-tailed grouse (page 93) and moose (page 82) considerations.

MANAGERS NOTES

CONIFERS - DRIFTLESS ZONE

General Statement

Scattered native stands of eastern red cedar, white and jack pine, and plantations of white, red, Scotch, and ponderosa pine will be considered as an upland conifer type. A small amount of forested land in the Driftless Area is in this type.

These conifers provide roosting sites and escape cover for upland birds. Natural eastern red cedar stands are also valuable as wildlife winter cover, but are detrimental to "goat" prairies. (Goat prairies occur on south facing slopes with sparse vegetation)

Specific Guidelines

1. Ideally, every habitat compartment should have 3-5% of its acreage in this type.
2. When regenerating stands:
   a. Trees used as turkey roost sites should be reserved. Area Wildlife personnel will identify sites.
   b. A mosaic of even-aged stands is preferable for wildlife.
3. Prospective planting sites and TSI areas should be planned as outlined in sections on reforestation and TSI.

MANAGER NOTES

CONIFERS - AGRICULTURE/RIVER BOTTOMS ZONE

General Statement

Natural eastern red cedar stands are of value to many species of wildlife as winter cover. Plantations of conifer species that resist self-pruning also provide essential winter cover for wildlife, especially when located on the south or east side of existing hardwood cover. Because of their adaptability to the climate and soils of the Agriculture/River Area, eastern red cedar, Norway spruce and Black Hills spruce are preferred.

Specific Guidelines

1. The winter cover value of tree plantings can be increased by adding a minimum of 4 rows of conifers on the south or east side of the planting. The Section of Wildlife's Wildlife Habitat Improvement Program (WHIP) and its Pheasant Habitat Improvement Program (PHIP) specify at least 10 rows of trees for wildlife cover plantings with the downwind 4 rows being conifers.
2. Conifer plantations on state land in the Agriculture/River zone should be created for wildlife benefits and not for timber production.
3. Consider spacing within the planting so self pruning is minimal, while still permitting as complete crown closure as possible when wildlife cover is the primary goal of the planting.
4. In some locations, the establishment of conifers may be difficult. A larger deciduous planting (over 5 acres) can be substituted to provide shelter for wildlife. While not as desirable as conifers for optimum wind protection, a large deciduous planting is preferable to a mixed planting in which the conifers fail.

MANAGER NOTES

DEFORESTED AREAS

General Statement

Deforested areas are lowland grass and brush types. These types may provide wildlife food and cover different from that found in forested parts of a habitat compartment. Deforested areas often are special ecosystems, particularly in the transition zone. They are important for sharp-tailed grouse, prairie chicken, sandhill crane, and many others including deer and moose. Before proposing reforestation, consider the need of the habitat compartment and/or the target wildlife species and then plan an appropriate management activity. Pay particular attention to the needs of those game and nongame wildlife species dependent on the lowland grass/brush ecosystem.

Specific Guidelines

1. Refer to the section on Reforestation, page 20.

2. Refer to the section on Prairie Chicken, page 87.

3. Refer to the section on Sharp-tailed Grouse, page 93.

4. Refer to the section on Sandhill Crane, page 92.

MANAGERS NOTES

SECTION IV

WILDLIFE PROJECTS FOR HABITAT MANAGEMENT IN CONJUNCTION WITH TIMBER MANAGEMENT

CONTENTS

ZONE
Forest
Transition
Driftless

WILDLIFE OPENINGS

Wildlife/Forestry Coordination Policy Reference:
Specific Procedural Policy No. 9 - Other Projects.

General Statement

An ideal wildlife opening, as defined here, is an upland grass/herbaceous area of 1/2 to 10 acres with less than 10 percent trees and shrubs. Upland brush areas can be considered as openings if they can be developed into grass/herbaceous areas.

Permanent, non-forested wildlife openings are important to about half of all wildlife species because they provide a variety of forage and high insect populations. Nesting cover is provided for many species of birds. Small mammals restricted to these openings provide valuable raptor food.

Openings provide courting and loafing space to many different wildlife species. Openings also provide "edge" which is important to many wildlife species, including deer.

While many wildlife species benefit from forest openings, not all species live on the forest edge. Some, like many of the wood warblers, prefer the interior of unbroken forest tracts. These species may be adversely affected by too many openings in the forest canopy.

To assure that the critical opening component is met, the Minnesota DNR has established a goal that not less than 5 percent of the upland area of any Forest Habitat Compartment will be composed of permanent grass/forb wildlife openings. This goal can be met by maintenance of existing wildlife openings and creation of new ones through timber sales and forest development projects. Preventing regeneration in part of the timber sale or forest development area can provide forest openings at reasonable cost.

Stands to be regenerated by planting need to be considered separately from timber sales and other development. The two methods are separated and described as follows:

New Wildlife Opening Development, page 47.

New Wildlife Opening Development on Plantation Sites, page 48.

Two excellent references on wildlife openings are: McCaffery and Creed, Significance of Forest Openings to Deer in Northern Wisconsin, Tech. Bulletin Number 44, Wisc. DNR, Madison, 1969; and McCaffery, et al., Forest Opening Construction and Impacts in Northern Wisconsin, Tech. Bulletin Number 120, Wisc. DNR, Madison, 1981.

ZONE
Forest
Transition
Driftless

EXISTING WILDLIFE OPENINGS

Specific Guidelines

1. Logged areas, lowland openings with sedges and mosses, and young plantations will not be inventoried as wildlife openings because they do not meet the wildlife opening definition.
2. Area Forestry personnel will report to Area Wildlife personnel the location, size, and condition of any openings not listed on the maps provided by Area Wildlife personnel or on the Phase II inventory maps.
3. Wildlife openings within areas to be harvested are susceptible to loss through sprout growth or debris accumulation. Area Forestry and Wildlife personnel should confer on logging techniques to be used in or near existing wildlife openings.
4. Consult individual habitat compartment evaluations to determine the acreage of openings on private land included in the wildlife opening habitat component.
5. Open areas, or wildlife openings that may be considered for reforestation, will be treated as follows:
   a. Inventoried wildlife openings less than 10 acres will not be planted unless special circumstances determined in the habitat compartment evaluation or unit plans warrant further consideration. In such cases, Area Wildlife and Area Forestry personnel will resolve the question as per policy.
   b. In most cases, areas larger than 10 acres, that are considered for reforestation, will have permanent wildlife openings of 2-5 acres maintained in the planting, particularly if the opening requirement of that habitat compartment has not been met.

MANAGERS NOTES

ZONE
Forest
Transition
Driftless

NEW WILDLIFE OPENING DEVELOPMENT

Specific Guidelines

1. Timber sales (or special browse regeneration projects) will provide for the creation of wildlife openings as an integral part of the projects. This usually involves conversion of log landings or direct construction.

2. Area Forestry and Wildlife personnel should determine the number, acreage, and location of wildlife openings associated with the annual cut for ideal forest wildlife habitat.

3. Wildlife openings should be on south or southwest facing slopes to take full advantage of sunlight and have a 3 to 1 ratio of length to width. The width should be at least twice the height of the expected or existing mature trees growing along the edge of the opening.

4. Generally, wildlife openings should be located along the edges of cuts and be 1 to 5 acres in size. Optimum size in shade-intolerant timber stands would be 2-4 acres, and up to 10 acres in shade tolerant forest types. A general rule of thumb is 2 acres of wildlife openings per 40 acres of upland type.

5. Larger openings are preferred over smaller openings for certain nongame species. Clustered openings have advantages over well-distributed openings in ease of construction and maintenance and for some nongame species that need large undisturbed tracts.

6. Developed wildlife openings should be a minimum of 1 acre and be free of most logging debris. This debris should not be pushed into wetland areas. Area Wildlife and Forestry personnel should together determine whether work will be done by the logger, by force account, or by contract, and who will bear the cost.

7. Seeding and maintenance of wildlife openings is the responsibility of Area Wildlife personnel.

8. New wildlife openings added to the opening inventory will also be added to the Phase II inventory through the alteration process.

MANAGERS NOTES

ZONE
Forest
Transition
Driftless

NEW WILDLIFE OPENING DEVELOPMENT ON PLANTATION SITES

Specific Guidelines

1. In new conifer plantations, wildlife opening development will be minimized in favor of obtaining wildlife opening needs on other sites within the habitat compartment. If it is desirable to develop wildlife openings in the plantation, the Section of Wildlife will bear the cost of clearing the site. These wildlife openings are most valuable if established on the edge of the plantation and on better soils.

2. In habitat compartments that have less than 5 percent wildlife openings, any spot failures that show up 5 to 10 years after planting may be developed into wildlife openings.

3. Spot failures up to 5 acres within a planted area should not be replanted when the total unstocked area is less than 25 percent of that plantation. These areas may then be counted toward the wildlife opening goal if they are inventoried by Area Wildlife personnel and found to be suitable wildlife openings.

4. After canopy closure of the plantation, any spot failures that exceed one acre may be included in the total toward the 5 percent goal if the site is inventoried by Area Wildlife personnel and found to be a suitable wildlife opening.

5. Wildlife openings established in plantations will be included in the Phase II inventory through the alteration process.

MANAGERS NOTES

ZONE
Forest
Transition
Driftless

COORDINATION OF RESPONSIBILITIES REGARDING WILDLIFE OPENINGS

Specific Guidelines

1. Until wildlife openings are included as a type on the Phase II township maps, Area Forestry personnel will receive copies of maps (FHC or section) from Area Wildlife personnel showing the locations of known wildlife openings to be reserved as an essential wildlife habitat component.

2. Area Wildlife personnel will be responsible for keeping Forestry's wildlife opening maps up-to-date. Refer also to the alterations section of the Phase II Inventory Manual.

3. To protect wildlife openings, Area Forestry personnel will refer to wildlife opening maps when planning any forest development work.

4. The following procedure will be used to report potential sites for seeding and/or creation of wildlife openings on timber sales:

   a. Area Forestry personnel will indicate locations of landings and other suitable sites when submitting F121 forms for sale closure. If there are not any suitable sites, so indicate.
   b. Copies of the closed sales are on file in the District or Area office and will be available to Area Wildlife personnel, or copies may be sent to the Area Wildlife office.
   c. Area Wildlife personnel will use closed sales to plan spring seeding schedules. Desirable landings will be included in the wildlife openings inventory. Maps will be sent to the District upon mutual agreement by Area Wildlife and Forestry personnel.
   d. Area Wildlife personnel will seed, enlarge, or otherwise maintain these wildlife openings upon agreement with Area Forestry personnel.

MANAGERS NOTES

ZONE
Forest
Transition
Driftless

ROADS AND TRAILS

Wildlife/Forestry Coordination Policy Reference:
Specific Procedural Policy No. 3 - Roads and Trails.

General Guidelines

1. Determine if a road or trail is needed for either forest or wildlife management purposes. A road or trail is desirable if it assures better dispersion and proper utilization of timber and wildlife with minimal negative impacts. The Section of Wildlife or the Division of Forestry may build roads or trails where construction is too expensive for a logger to undertake.

2. All road and trail (new and reconstruction) projects will have input by Area Wildlife and Forestry personnel on construction plans and subsequent use and regulations. Items to consider:
   a. Existing access and impact of new access on resources.
   b. Should the system be a dead-end or loop?
   c. The season of use.
   d. Is access open or controlled?
   e. Construction methods and design.
   f. Funding sources.
   g. Long range planning of area habitat needs such as wildlife openings and timber sale design.
   h. Other important wildlife features such as deeryards, eagle nests, turkey roosts, heron colonies, etc.
   i. Seeding clover for erosion control and wildlife forage.
   j. Impact on wetlands by road and culvert placement.

3. The classes of roads are as follows:

   Class 1: Multi-purpose two-lane roads with a roadway width of 26 feet. These are heavy-use roads.

   Class 2 and 3: Multi-purpose, two-lane roads. Class 2 roadway width of 22 feet; class 3, 18 feet. Major timber haul use.

   Class 4: Multi-purpose, one-lane roads with a roadway width of 14 to 16 feet. Access to areas for continued management.

   Class 5: Timber haul roads for seasonal or temporary use. Roadway width of less than 14 feet.

ZONE
Forest
Transition
Driftless

REGENERATION OF COVER TYPES BY NON-COMMERCIAL MEANS

Wildlife/Forestry Coordination Policy Reference:
Specific Procedural Policy No. 2 - Vegetative Management.

General Statement

When in the best interest of long-term cover type management, recycle decadent, unmerchantable cover types through non-commercial regeneration by mechanical, chemical, or prescribed burning methods. Area Wildlife and Area Forestry personnel should continually identify such sites and coordinate this recycling for both optimum cover type and wildlife benefits. Consider, however, reserving some of these sites for "old growth" benefits.

MANAGERS NOTES

ZONE
Agriculture/River
Driftless

BRUSH PILES

Wildlife/Forestry Coordination Policy Reference:
Specific Procedural Policy No. 9 - Other Projects.

General Statement

One of the most valuable habitat improvements for small mammals, reptiles, and amphibians is to provide brush piles for cover. Ideal locations are on woodland-cropland boundaries. Where feasible, piling of slash for cover should be part of slash disposal regulations on timber sales and slash treatment on TSI projects.

Specific Guidelines

1. Location: a) along the edge between fields and woods, b) in cutover lands that have plenty of stumps with new sprouts, shrubby cover, and second growth.

   For reptiles and amphibians some small brush piles should be placed at increasing distances from the edge of ponds and wet areas. (Do not dispose of logging debris in wetlands.)

2. Size: Minimum of 12-15 feet in diameter at the base, and 5 feet high. (Big enough to keep a dog from crawling through or a person from kicking the pile over.)

3. Materials: The foundation should consist of big rocks, stumps, logs, etc., to keep the brush pile from rotting down too quickly.

4. Methods: Lay slash on foundation generously, and put several heavy pieces on top of the pile to keep the wind from blowing it apart. Old 6-inch tile or stove pipe may be placed at the bottom of the pile to serve as a den. An occasional log over 12" in diameter with no commercial value should be left lying separately, close to water if possible, to provide habitat for reptiles and amphibians.

5. Refer to Reptiles and Amphibians, page 90.

MANAGERS NOTES

ZONE
Transition
Agriculture/River
Driftless

FRUIT TREES

Wildlife/Forestry Coordination Policy Reference:
Specific Procedural Policy No. 9 - Other Projects.

General Statement

Fruit trees, especially apple trees, are prized food for birds, fox, raccoon, deer, and many other species. Old orchards, usually found around building sites, can be maintained by pruning and releasing them from competing trees and shrubs. Isolated fruit trees in old fields, pastures, or woodlands can be managed similarly.

Specific Guidelines

1. Where TSI projects are planned in areas containing fruit trees, consider pruning and release.

2. In planting areas having fruit trees present, include them as part of the plantation. Avoid disturbing these trees during site preparation and planting. Prune and release them along with the planted stand.

3. Pruning should be done during dormancy.

MANAGERS NOTES

SECTION V

WILDLIFE PROJECTS FOR HABITAT MANAGEMENT SEPARATE FROM TIMBER MANAGEMENT

CONTENTS

ZONE
Forest
Transition
Driftless

BROWSE REGENERATION

Wildlife/Forestry Coordination Policy Reference:
Specific Procedural Policy No. 2 - Vegetative Management and No. 12 - Wildlife Projects Initiated by Wildlife.

General Guidelines

1. Browse regeneration should be considered only when a need is shown by habitat compartment evaluation or by known conditions related to a traditional deer wintering complex.

2. Work should be undertaken only when no other practical means of regenerating a stand of aspen or other browse producing types is available.

3. Specifics on methods, size, shape, and procedures will be resolved between affected Area Forestry and Wildlife personnel.

MANAGERS NOTES

ZONE
Statewide

AGRICULTURAL LEASES AND COOPERATIVE FARMING AGREEMENTS

Wildlife/Forestry Coordination Policy Reference:
Specific Procedural Policy No. 4 - Agricultural Leases.

General Guidelines

1. Wildlife needs will be considered when leases are proposed, such as for food plots.

2. Existing leases should be reviewed by Area Wildlife personnel for wildlife considerations at the time of renewal.

3. Area Wildlife personnel will address wildlife needs by assisting Area Forestry personnel in drafting leases on Forestry administered lands. The Division of Forestry and the Section of Wildlife will periodically make field inspections to evaluate compliance of leases and use of food plots by wildlife.

4. No leased lands will be posted against public hunting.

5. Soil Conservation Service, Agricultural Extension Service, or other professional soil and crop management personnel may be contacted for recommendations on grazing and crop management.

6. Pesticide use on agricultural leases and cooperative farming agreements should be done within DNR pesticide guidelines.

Specific Guidelines for Crop Leases

1. Agricultural leases on DNR administered lands that include cutting hay will restrict cutting to between July 15 and September 1, to protect nesting birds and provide nesting cover for the next year.

2. Grazing of stubble fields is not permitted.

3. Conservation tillage should be encouraged wherever feasible. Only pesticides that will not cause degradation of adjacent waters should be used, and all pesticides should be applied in accordance with DNR pesticide use guidelines. These provisions should be specified in the agricultural leases.

4. Food plots should be located near existing woodland or other heavy cover and away from winter recreation use. However, food plots for prairie chickens should be away from timber.

5. Where share-crop leases and lease rate concessions are not feasible, Wildlife funding may be used to purchase food plots from leaseholders.

6. Although corn is the most desirable crop for a food plot, other grains such as sorghum, millet, sunflowers, and soybeans are acceptable. Specific guidelines for selected species follow:
   a. Deer - Corn or sunflower food plots should be established near traditional wintering or depredation areas. Winter wheat and rye fields could be planted for late fall use and early "green-up".
   b. Prairie Grouse - Both sharptails and prairie chickens will benefit from corn and sunflower food plots. Stacking and baling wheat, barley, and oats supplies winter food to enhance winter habitat.
   c. Pheasants - Corn or sorghum food plots should be established as needed in the pheasant range. Sorghum provides cover as well as food.
   d. Waterfowl and Geese - Establish and enhance upland nesting areas for waterfowl by planting dense nesting cover near high quality wetland habitat.
   e. Moose and Elk - Follow the same guideline as for deer with whatever other special treatment may be specified by Area Wildlife personnel.
   f. Wild Turkey - Corn food plots should be established at known winter concentration areas in conjunction with deer food plots.

Specific Guidelines for Grazing Leases

It is the responsibility of Area Wildlife personnel to determine the effects of specific grazing proposals on wildlife, to suggest minimal densities and proper grazing practices, and to assist Area Forestry personnel in preparing and enforcing lease provisions. Wildlife personnel will consider timing, payment, inspections, fencing, rotational grazing, etc. The allowable grazing period will be June 15 to September 15 where dense nesting cover is desired.

MANAGERS NOTES

ZONE
Statewide

WETLAND DEVELOPMENT

Wildlife/Forestry Coordination Policy Reference:
Specific Procedural Policy No.9 - Other Projects, and
No. 12 - Wildlife Projects Initiated by Wildlife.

General Statement

Area Wildlife and Area Forestry personnel should identify and capitalize on opportunities to develop, restore, or improve wetlands. When possible, such efforts should be coordinated with local soil and water conservation agencies for possible cost-sharing and incorporation of compatible flood and erosion control benefits. Potential wildlife benefits and losses, and timber losses should be carefully evaluated and related to long-range wildlife and timber production goals.

Specific Guidelines

1. During habitat compartment evaluation, Area Wildlife and Area Forestry personnel should identify potential wetland development sites such as impoundments, dugouts, and gravel pits.

2. Combined projects are encouraged with prior negotiation of funding between the Division of Forestry and Section of Wildlife.

3. Tree planting and timber harvest plans should consider any potential for wetland development.

4. Potential sites should be studied to determine overall feasibility. Look at soils, water availability, current species use, etc. In some cases, the lowland area may have more value for native species than the value of the proposed impoundment.

MANAGERS NOTES

ZONE
Agriculture/River
Transition

WILDLIFE COVER PLANTINGS

Wildlife/Forestry Coordination Policy Reference:
Specific Procedural Policy No. 12 - Wildlife Projects Initiated by Wildlife.

General Guidelines

1. Cover plantings may be beneficial to wildlife in the transition and prairie zones where agriculture is the dominant land use. Unless approved by Area Wildlife and Forestry personnel, conifer cover plantings for wildlife should not exceed 5 acres in any one block. Area Wildlife personnel will recommend the species and areas to be planted. If a plantation is not economical because of size and species, the additional cost may be paid by the Section of Wildlife.

2. Plant single or multiple row field windbreaks where possible. Coordination between Area Forestry and Area Wildlife personnel will assure up-to-date information for planting purposes.

3. To assure that farmstead shelterbelts provide the minimum cover needed to over-winter pheasants, requirements for woody cover establishment in the Section of Wildlife's Wildlife Habitat Improvement Program Guidelines should be followed.

4. Do not put cover plantings on native prairie, adjacent to prairie wetlands, or on potential wetland development sites.

MANAGERS NOTES

SECTION VI

SPECIAL AREA HABITAT MANAGEMENT

CONTENTS

ZONE
Forest
Transition

DEER WINTERING COMPLEXES - NORTH

Wildlife/Forestry Coordination Policy Reference:
Specific Procedural Policy No. 1 - Site Preparation, No. 2 - Vegetative Management, and No. 3 - Roads and Trails.

General Statement

Good quality winter habitat is vital to the survival of deer populations in northern Minnesota forests and requires special consideration. Therefore, deer wintering habitat management will be given priority over timber management goals. This will not cause significant loss of wood fiber production because the forestry practice modification is seldom much different than normal practice, and the acreage of winter concentration complexes is a relatively small part of the northern forest.

Specific Guidelines

1. Management plans for important wintering complexes should be written.

2. Maintain adequate winter cover.
   a. Use habitat compartment evaluations to determine winter cover needs for each compartment.
   b. Where winter cover is primarily balsam fir, conversion to other species in part of the type may be necessary to assure adequate winter cover in case large scale spruce-budworm defoliation occurs. Cedar, jack pine, and white spruce, in order of preference, are recommended in these areas.
   c. Where cedar is the desired concentration area cover type, long rotation and forced regeneration are essential. In some cases emphasis must be given to reestablishing cedar in historic wintering areas.

3. Maintain adequate deer nutrition.
   a. Create permanent and rotated winter forage production areas in or adjacent to winter cover.
      1) Winter forage production areas within wintering complexes.

         Winter forage production areas within dense coniferous concentration complexes are best created on sites well suited for growing shrub species, including lowland brush with suppressed dogwood shrubs. Overstory vegetation should be eliminated in scattered sites to allow sunlight to reach shrub species. This is accomplished by felling the standing trees, treating individual

trees with chemicals, or by coordinating with Area Forestry personnel to allow cedar or balsam stumpage to be sold in the scattered pattern desired. These techniques can be applied quite well in complexes where mountain maple, red-osier dogwood, or other preferred shrub species are relatively abundant but where the overstory is too dense to allow them to proliferate. In well used complexes, heavy browsing should keep the shrubs within reach of the deer for many years. Complexes that are less heavily browsed may require periodic hand-cutting, chemical treatment, shearing, or burning of the overgrown shrubs to keep them within reach of deer.

2) Winter forage production areas on complex perimeters.

Winter forage production areas established in upland hardwoods on the perimeters of coniferous complexes are used extensively by deer when they are confined to the complex. These upland feeding sites can be created by shearing over-mature timber, coordinating logging operations, controlled burning, or hand-cutting small plots. If the age class of these sites is kept under 10 years they may serve as pseudo-wildlife openings for spring deer dispersal. The upland edges of lowland wintering complexes should be managed for long-range food production by maintaining at least 25% of the edge area in young successional stages and wildlife openings. Winter forage production areas should not be located on hilltops or other exposed sites.

b. Provide adequate spring nutrition near wintering complexes.

Create and maintain permanent grassy wildlife openings as near as possible to wintering complexes.

MANAGERS NOTES

ZONE
Transition
Agriculture/River
Driftless

DEER WINTERING COMPLEXES - SOUTH

Wildlife/Forestry Coordination Policy Reference:
Specific Procedural Policy No. 6 - Significant Wildlife Conditions.

General Statement

Good quality winter habitat is important to the survival of deer populations in Minnesota. Main concentration complexes consist primarily of wooded river bottoms or other wooded sites of 100 acres or more. Topographic relief also appears to be an important attribute of wintering complexes. In the Agriculture/River Zone, deer commonly travel 10 or more miles to a wintering complex.

Food sources are primarily by-products of agricultural production of crops such as corn and soybeans. Deer also do a considerable amount of grazing on standing alfalfa, and during extremely severe winters will feed at hay stacks, corn cribs, and silage piles near farmsteads. In the Driftless Zone, deer may be highly dependent on browse during severe winters that restrict their activity to S-SW facing slopes.

Any forest management activities being planned for traditional deer wintering complexes must be coordinated with Area Wildlife personnel. Special emphasis will be placed on perpetuation of the forest stand in these complexes.

General Guidelines

1. Area Wildlife personnel will provide Area Forestry personnel with the locations of traditional deer wintering complexes.
2. Grazing of wintering areas in private ownership by domestic livestock should be strongly discouraged, and grazing on state administered land will not be permitted.
3. Primary management efforts should be to maintain a healthy forest stand to provide continuing shelter for wintering deer.
4. When harvesting is required to perpetuate the stand, cutting activity from November to mid-December will provide deer with additional browse.
5. Browse production areas in the Driftless Zone are usually associated with southwest exposures and old fields, and can be developed and maintained by commercial or non-commercial means.
6. Selective cuts to provide natural regeneration should be small and conducted in several different years to increase regeneration during years of low deer use.

7. Area Wildlife personnel assisted by Area Forestry personnel should monitor forest conditions on traditional wintering complexes so appropriate actions can be suggested to private landowners to perpetuate cover.
8. Cropland within or adjacent to wintering complexes may be used to create food plots. Therefore, Area Forestry personnel (including PFM) will consult with Area Wildlife personnel before recommending planting trees in these fields.

MANAGERS NOTES

FOREST WETLANDS

Wildlife/Forestry Coordination Policy Reference:
Specific Procedural Policy No. 9 - Other Projects, and
No. 12 - Wildlife Projects Initiated by Wildlife.

General Statement

Forest wetlands of particular concern include: temporary, seasonal, and permanent marshes; wet meadows; ponds; lakes; bog lakes; permanent and intermittent stream and river bottoms, and similar treeless areas. Certain identified shrub swamps may also be of concern.

These wetlands and floodplains within northern Minnesota forests are abundant, unique plant communities that provide a high level of habitat diversity. Temporary or seasonal wetlands are important for courting and nesting waterfowl, small birds, mammals, reptiles, and amphibians. Many of these wetlands do not need active management, but do need protection from degradation and destruction.

Specific Guidelines

1. All forest wetlands should be typed and identified on habitat compartment evaluation maps. See wetland types, Appendix H.
2. Forest wetlands are important for many wildlife species and therefore, the following procedures will be considered in their management:
   a. Logging slash will not be piled within 50 feet of wetlands, or placed within the wetland basin. One or two very small piles near the wetland can be considered for reptiles and amphibians. See Special Species section, page 77.
   b. Reserve snags and cavity-containing trees within 100 feet of wetlands. The number should reflect the value and use of the wetland.
   c. Existing grassland or open brushland within 100 feet of wetlands should not be considered for tree planting.
   d. Wetlands should be managed by the use of fire, where possible, to prevent excessive brush and tree encroachment.
   e. Stabilize or increase water levels and allow for periodic drawdowns through wetland development.
   f. Reserve buffer strips of uncut timber adjacent to wetlands and watercourses.
   g. See Special Areas section, Riparian Zones, page 73.

3. Some wetlands with temporary or seasonal water regimes may be considered for tree planting. Because these areas can be important for courting and nesting waterfowl, small birds, mammals, reptiles and amphibians, consult with Area Wildlife personnel before considering any planting of these areas.

MANAGERS NOTES

ZONE
Transition
Agriculture/River

PRAIRIE WETLANDS

Wildlife/Forestry Coordination Policy Reference:
Specific Procedural Policy No. 9 - Other Projects, and
No. 12 - Wildlife Projects Initiated by Wildlife.

General Statement

Prairie wetlands include: temporary, seasonal and permanent marshes; wet meadows; ponds; lakes; bog lakes; shrub swamps; permanent and intermittent stream and river bottoms, and similar treeless areas in a prairie or agricultural setting. All efforts will be made to protect and improve these increasingly scarce habitats.

Specific Guidelines

1. All wetlands should be typed and identified on habitat compartment evaluation maps. See wetland types, Appendix H.

2. Wetlands and surrounding uplands with waterfowl or other resource significance should be managed and maintained to prevent brush and tree encroachment.

3. Uplands within 1/2 mile of wetlands should be managed for dense nesting cover if such cover is lacking, or if the site is not needed for food plots.

4. Strongly consider development to stabilize or improve water levels including drawdown capability.

5. Use of prairie wetland/upland complexes by reptiles and amphibians can be enhanced by:
   a. early spring burning, mowing, and controlled grazing in rotation to discourage growth of unwanted woody plants. Exclude small areas from burning, haying, and grazing to allow thatch accumulation.
   b. providing shelters by placing rock piles near fence rows, pond and woodlot edges, and in several areas on the south facing slopes.

6. See Special Areas section, Riparian Zones, page 73.

MANAGERS NOTES

ZONE
Transition
Agriculture/River
Driftless

NATIVE PRAIRIE

Wildlife/Forestry Coordination Policy Reference:
Specific Procedural Policy No. 9 - Other Projects, and
No. 12 - Wildlife Projects Initiated by Wildlife.

General Statement

Native prairie is an increasingly rare plant community that must be protected, maintained, and improved.

Specific Guidelines

1. Prairie should be identified and evaluated for special management, including private landowner assistance programs, in each Wildlife Habitat Compartment. Assistance in identification and management planning of native prairie may be obtained from Regional Resource Specialists (Division of Parks) or the Natural Heritage, Scientific and Natural Areas, and Nongame Programs (Section of Wildlife).

2. Food plots, impoundments, intensive grazing, cover plantings, and forest plantations should be excluded from such sites.

3. Management should be by prescribed burning, or when burning is impossible, by mowing, haying, or limited grazing. Area wildlife personnel should design a rotational burning plan to restore or maintain the prairie.

MANAGERS NOTES

OLD GROWTH CONSIDERATIONS FOR WILDLIFE

Under Preparation

ZONE
Statewide

Old Growth Forests

General Statement

The purpose of this guideline is to provide DNR resource managers with the means to identify and reserve candidate old growth forest stands on state lands for further evaluation.

The purpose of reserving candidate old growth stands from harvest and other management activities is to protect them until an evaluation of each stand's "old growth" quality can be made. Based upon this evaluation, future management of a stand may include Scientific and Natural Area (SNA) or Natural Heritage Registry Site designation or normal forest management.

Old growth forest stands have developed over a long period of time essentially free from catastrophic disturbances. They contain large, old trees of long-lived species that are beyond economic rotation ages. Typical old growth forest stands experience frequent ongoing mortality, including some mortality in canopy trees. Such stands contain a relatively high frequency of large snags and large-diameter, downed logs in various stages of decay.

Old growth forest communities, like native prairie and some wetlands and fire-dependent communities, are becoming increasingly rare in Minnesota. Most of the old growth stands that existed prior to settlement were logged. Those that escaped logging did so because they were inaccessible, did not contain merchantable species, were in poor condition, or were protected by ownership or policy. These stands have escaped catastrophic fires and windstorms because of their position on the landscape, lack of flammability, microclimate, or simply by chance.

Remaining old growth forests are important for their non-commodity scientific and educational values. Old growth forests provide special habitats for native plants, important habitat features for wildlife, and examples of the maximum limits of individual tree and stand production. Because old growth ecosystems have developed for a long time without large-scale disturbance, the study of plants, animals, soils, and ecosystem processes in old growth stands will provide important insights into the natural function of forest ecosystems. Such insights can be crucial for future forest management and for the maintenance of biological diversity.

1. Identification of Candidate Old Growth Stands

Old growth represents the latter stages of succession in forested ecosystems. The following forest types will develop into old growth communities if they escape a catastrophic disturbance for a long time: northern hardwoods, lowland hardwoods, central hardwoods, black ash, upland white cedar, white spruce, red pine, white pine, oak, and lowland conifers. Stands dominated by relatively short-lived, intolerant species such as aspen, birch, and jack pine are excluded because they do not fit the definition of old growth, although the benefits of older stands will be addressed in old forest guidelines.

A. Candidate old growth stand characteristics by type:

Criteria provided here are intended to be used as they apply to the DNR Cooperative Stand Assessment (CSA,formerly Phase II Inventory) procedures.

Black Ash: Candidate old growth ash stands are uneven-aged and the ages of these stands often are difficult to determine, but stands 120 years old or greater showing damage and mortality are candidate stands. Although tree size varies between individuals on the same site and between sites, stands with over 10" average diameter (over 15" in southern Minnesota), with both damage and mortality, qualify as old growth candidates. Candidate stands have some evidence of reproduction in the understory. Quality stands show little or no evidence of selective cutting.

Lowland Hardwoods: Characteristics of old growth lowland hardwood stands vary by location within the state. In the north, these stands are an elm/ash type with many dying elms. Basswood and oak are often components. In the south, old growth stands are dominated by silver maple, elms, and ash, and often contain a large number of other species. Candidate old growth lowland hardwood stands have both damage and mortality and show some evidence of reproduction in the understory. Candidate old growth stands are at least 120 years old or have an average diameter greater than 10" (greater than 15" in southern Minnesota). In candidate lowland hardwood stands, early successional species like willow, cottonwood, aspen, birch, and balm-of-gilead are absent or occur only in very limited clumps of old trees. Extensive salvage of elms or other significant cutting disqualifies a stand.

Northern Hardwoods: Old growth northern hardwood stands most nearly represent classic old growth in Minnesota. These stands are uneven-aged, multi-layered, structurally diverse communities that perpetuate themselves barring catastrophic disturbance. Candidate old growth stands have an understory type of northern hardwoods and contain some damage. Candidate stands are at least 120 years old or have an average diameter greater than 10" (greater than 15" in southern Minnesota). Mortality should be present in the canopy, but this criterion is not always reliably represented on the CSA. If present, aspen in old growth stands is limited to a few scattered small clumps, usually of old trees. Most old growth northern hardwood stands in northern Minnesota have been selectively logged for white pine and/or yellow birch, but many of these stands are otherwise ecologically intact.

Oak, Central Hardwoods: Like pines, these types are included because of their longevity. Most old growth stands escaped pre-settlement catastrophic disturbances (e.g. fire) and are not products of recent fire control. (Some stands that originated following settlement in the mid-1800s may be reaching old growth.) Candidate old growth stands are at least 120 years old or have an average diameter greater than 10". In southern Minnesota, candidate stands exhibit both damage and mortality. Stands in southern Minnesota should be over 15" average diameter or be at least 120 years old.

Red and White Pine: These types are dominated by very long-lived species. Old growth pine stands may include one or more age classes of pines. On some sites, white pine stands are composed of a variety of age classes due to reproduction occurring in canopy gaps. Because some old growth stands are even-aged, they do not develop a high frequency of snags and down logs until they are very old. Old growth stands are of natural origin. Candidate old growth stands are at least 120 years old or have an average diameter over 20". Stands that have experienced appreciable timber stand improvement or salvage work generally should be disqualified as candidates.

White Spruce: This type is found primarily in northeastern Minnesota and includes stands formerly typed as spruce-fir. Candidate old growth stands are aged greater than 90 years. The dominant white spruce in a typical stand have survived multiple generations of balsam fir.

Upland White Cedar: Upland stands of white cedar are common in northeastern Minnesota, but most accessible stands containing sound timber have been high-graded. Candidate old growth stands are found on mesic sites (physiographic class less than "4") and have at least 8 cords of cedar per acre. Candidate old growth white cedar is at least 120 years old or has an average diameter greater than 10". Old growth upland white cedar stands may have a rather open canopy with large cedars concentrated in small clumps.

Lowland Conifers: Old growth lowland conifer stands typically are non-commercial, stagnant stands of cedar, black spruce, and tamarack. There are about 689,000 acres of these types on state land alone, with over 87,000 acres over 120 years old. These vast lowland acreages are the most intact major ecosystem in Minnesota, most of which have been minimally disturbed. Because these lowland tree species survive longest on the poorest sites, these stands usually do not contain large trees, snags, or downed logs, but they do perpetuate themselves and are uneven-aged. Large expanses of some of these types are found within the Lake Agassiz National Landmark and more than 145,000 acres of state owned peatlands have been identified by the DNR as ecologically significant (Recommendations for the Protection of Ecologically Significant Peatlands in Minnesota, MN DNR - 1984). Existing statutes and/or administrative management guidelines already provide protection for these areas. Data are insufficient to characterize quality old growth candidates at this time, and no specific criteria for selection or management of these stands are provided.

B. Size of stands to be considered:

Stands identified as old growth candidates should be a minimum of 20 acres in size. Stands smaller than 20 acres should be considered candidates when the field manager feels the stand exhibits significant old growth features that are unique in the work area, or are part of a larger stand complex of similar stands.

C. Potential replacement stands

Red pine, white pine, and oak/central hardwood cover types usually require a disturbance for regeneration because the young trees (red pine,white pine,and oak) are not shade tolerant or are susceptible to diseases, animal browsing, or other damaging agents. As the older trees of these species die, they are usually replaced by more shade tolerant species on the site.

Thus, to maintain a representative component of old growth in these cover types, replacement of dying stands may have to be found on other sites.

Therefore, an acreage equal to or greater than the acreage of old growth will be identified and nurtured to provide potential replacement for old growth lost to ecological succession. (red pine,white pine,& oad/central hardwood types). Replacement stands should have the following features :

1. Larger (greater than 20 acres) stands should be selected as potential replacement stands when possible.

2. Unmanaged stands with little or no disturbance should be selected as potential replacement stands.

3. These potential replacement stands should be managed the same as candidate old growth stands.

4. Specific criteria for identification of replacement stands will be developed in the old forest guidelines.

2. Management of candidate old growth stands during the evaluation period.

A. Candidate old growth stands will not be selected for harvest or forest development work including salvage and timber stand improvements.

B. Wildlife opening and browse regeneration developments will not occur in candidate old growth stands.

C. New road and trail development will not occur in candidate old growth stands.

D. Pesticides will not be used in candidate old growth stands except when determined to be necessary to protect adjacent forest stands from a serious exotic threat (e.g. gypsy moth).

3. Management of stands adjacent to candidate old growth stands

The ecological sensitivity of candidate old growth stands should be considered when planning adjacent timber, habitat, or recreational developments. The minimum size necessary to maintain the ecological integrity of a forest stand depends on 1) the nature of the surrounding vegetation, 2) the

degree of isolation of that stand from similar vegetation (e.g. mature or old-forest stands), and 3) habitat requirements and population structures of the species found in that stand. The nature of the vegetation that surrounds an old growth stand is extremely important. In general, small stands will probably maintain their ecological viability if these stands are part of a larger block of mature or old forest. Management of adjacent stands should consider measures to avoid exposing the old growth stand to the effect of wind, sun, and invading edge species. Attempts should be made to maintain most of the surrounding canopy to avoid isolating the stand from similar forest cover, especially with stands less than 20 acres.

A. If adjacent stands of shade intolerant species are over-mature and at risk, management for understory species should be considered if such management is silviculturally sound.
B. Adjacent stands should be treated through all-aged management prescriptions where the types allow.

C. Where conditions allow, adjacent intolerant types should be managed on extended rotations to reduce the perimeter of the candidate old growth stand affected in a 10-year period.

D. Providing buffers of 1.5 x average tree height should be considered when clear-cutting adjacent stands.

E. Where adjacent stand types and conditions favor clear-cut treatments, no more than 25% of the perimeter of the candidate stand should be treated during a 10-year period.

4. Evaluation of candidate old growth stands

Lists of candidate old growth stands developed by field personnel will be field examined by natural resource professionals under the direction of the DNR's Natural Heritage Program for consideration as SNAs or Natural Heritage Registry Sites. Candidate stands that do not qualify for protection based upon this examination will be removed from the candidate list and returned to normal management activities by the land administrator.

Field personnel can recommend to their discipline's Regional Manager the removal of a stand from the candidate old growth list based upon a site visit if, in their judgment, the ecological integrity of the stand has been compromised by disturbance, or the stand does not have old growth

characteristics. Additions to the list of candidate stands can be recommended to the Regional Manager by field personnel based on a site visit if they feel the stand meets the criteria for candidate stands.

5. **Evaluation of potential replacement stands for red pine, white pine, and oak/central hardwood types.**

Potential replacement stands will be evaluated for protection as old growth at the same time candidate old growth stands are evaluated in each area.

Glossary of Terms

All-Aged: an uneven-aged stand in which all ages or age classes from seedlings to rotation age trees are represented

Average Age: the average age of at least 2 dominant or co-dominant trees in a stand of individuals comprising the main species within the stand, and of the predominant size class of the stand [see CSA (Phase II) manual for procedures]

Average Diameter: an observed average diameter of the predominant size class of the main species in the stand [see CSA (Phase II) manual for procedures]

Candidate Old growth Stand: a stand that exhibits certain CSA (Phase II) characteristics consistent with those observed in known old-growth stands of a similar community type; management of these candidate stands is deferred pending a field evaluation

Clear-cut: the complete removal of all trees during harvest to permit the reestablishment of an even-age forest; management option to regenerate intolerant species

Cooperative Stand Assessment: stand by stand examination of condition, composition, size, age, health of vegetation on all DNR-administered lands for operational and strategic activity and planning purposes

Cord: a unit of gross volume measurement for stacked, round or cleft wood; contains 128 stacked cubic feet

High-grade: a partial cut removing only trees of the most valuable species or quality

Mesic Site: a site intermediate between extremely dry and wet; soil and water relationships generally are favorable to tree growth

Natural Heritage Program: a program within the DNR with the responsibility of identifying and evaluating the status and quality of rare species, communities, and landscapes in which they occur

Normal Forest Management: the practical application of scientific, economic, and social principles to the administration and working of a forest for multiple-use objectives, including wildlife, timber, recreation, aesthetics, water quality, and other benefits

Physiographic Class: a measure of available moisture on a site as it affects the suitability of the site for growing trees [see CSA (Phase II) manual for descriptions and codes]

Registry Site: a tract of public land managed by the land administrator to incorporate the protection of its rare and unique features, species, and/or communities through a memorandum of understanding

Rotation: the period of years required to establish and grow timber crops to a specified condition of maturity; this time period is an administrative decision based on economics, site condition, growth, or other factors

Selective Management: removal of the mature timber either as single scattered individuals or in small groups at relatively short intervals; the continuous establishment of reproduction is encouraged and an uneven-aged stand is maintained; management option for shade-tolerant species

Silviculture: the theory and practice of controlling the establishment, composition, growth, and quality of forest stands to achieve the objectives of management

SNA: abbreviation for Scientific and Natural Area; lands and waters legally dedicated by the DNR for protection of its rare and unique features, species, and/or communities

Snag: a standing dead tree or a portion of a tree which has died without falling

Stand: a contiguous group of trees sufficiently uniform in age, composition, structure, site quality or geography to be a homogeneous and distinguishable unit

Succession: the directional change in composition and structure of a natural community

Tolerance: the measure of the genetic and physiological capacity of a plant species to develop in a given environment, with the capacity to withstand low light intensities (from shading) the most important characteristic (tolerant species are tolerant of shade)

TSI: abbreviation for timber stand improvement; a loose term comprising all intermediate cuttings or other manipulations made to improve the reproduction, composition, structure, condition and increment of vegetation in a stand

ZONE
Statewide

RIPARIAN ZONES

General Statement

Riparian zones are wetland areas of standing or flowing water, plus the adjacent habitat. "Wetland" denotes streams, springs, ponds, lakes, shrub, and forested swamps and marshes. Riparian zones vary in size and shape depending on the interaction between the water source and the physical features of the land. Unique characteristics of these areas include high primary plant productivity and high species richness, often surrounded by less productive environments. Many animal species are associated with these systems because of the diverse vegetation and its high food value. Wetland zones are used by wildlife disproportionately more than other habitats.

This complex interaction of water, plants, animals, and saturated soil makes this zone extremely vulnerable to disturbance by various land management activities. The fragility of this system suggests that a minimal or non-disturbance policy would be beneficial.

Forested riparian zones are prime candidates for permanent old growth designation. In addition to fulfilling old growth needs, these areas provide abundant cavity trees and snags. Leaving riparian zones intact also helps protect the productivity and quality of adjacent water bodies.

Increased product demands in timber and agricultural industries may allow continued harvesting and clearing of wetlands. While these demands must be considered, the extensive losses of wetland habitat since settlement dictates that alternative methods to meeting these demands must be explored.

Some of the wildlife species indicative of quality riparian zones are listed below:

- Barred Owl
- Great Blue Heron
- Broad-winged Hawk
- Wood Turtle
- Spotted Sandpiper
- Pileated Woodpecker
- Green Frog
- Raccoon
- Otter
- Osprey
- Belted Kingfisher
- Snapping Turtle
- Numerous Invertebrates
- Crayfish & Other Crustaceans
- Arthropods
- Red-Shouldered Hawk
- Big Brown Bat
- Mink
- Beaver
- Wood Duck

Specific Guidelines:

1. The individuality of each riparian zone requires consultation of Area Forestry, Area Wildlife, and Area Fisheries personnel when planning management activities within or near riparian zones.
2. Single tree or small group selection is the recommended harvesting method for forested riparian zones because increases in water temperature, sedimentation, and nutrient flow can occur with clearcutting or shelterwood cutting.
3. When cutting is done in riparian zones, consider the needs of colonial nesting birds and cavity nesters, as well as water quality.
4. Even though riparian zones appear to be convenient spots to dump slash, this should be prohibited and written into the timber sale contract (F-121).
5. Buffer zones, approximately 100 feet wide, should be left around all areas of standing or flowing water next to where logging, road construction, or other habitat disturbances are planned.
6. Existing grasslands adjacent to riparian zones are important nesting sites for species associated with wetlands. Protect these grasslands. No mowing, grazing, or tree planting should be allowed.

MANAGERS NOTES

ZONE
Forest
Transition

GRAVEL PITS

Wildlife/Forestry Coordination Policy Reference:
Specific Procedural Policy No. 9 - Other Projects, and No. 12 - Wildlife Projects Initiated by Wildlife.

General Statement

Because gravel pits are an opening in the forest canopy, they provide some benefits to wildlife. Of the 158 wildlife species of the northern forest using openings, 21 require bare ground and banks. The belted kingfisher, snapping turtle, wood turtle, gray wolf, red fox, woodchuck, badger, common nighthawk, smooth green snake, killdeer, and bank, barn, and cliff swallows are examples. Many of these species make nests on open ground or dens in banks. Wolves use pits as rendezvous sites.

Ideas on gravel pits and wildlife have changed. Formerly viewed as an eyesore to be landscaped and revegetated by planting and seeding as quickly as possible, gravel pits are now seen as a unique habitat type meeting the specialized needs of certain wildlife species. Management practices for abandoned pits or inactive parts of pits should enhance their uncommon features. The following recommendations will enhance wildlife use of gravel pits:

Specific Guidelines

1. Leave banks created by excavation. If there are safety concerns, reduce bank slopes.
2. Bank dwelling species will use banks as low as 6' with a minimum 20% slope (3:1).
3. At least 50% of the pit floor should be bare ground; bare and vegetated ground should be interspersed over the floor area.
4. Seeding and fertilizing may be appropriate. Favor warm-season grasses on poor sites.
5. To control tree invasion, maintenance treatments with herbicide, hand cutting, or burning may be required.
6. Snags may be left in clumps or along the edge of the pit.
7. When possible, and where it will contribute to diversity, the pit management plan can specify excavation below the water table to develop temporary and permanent wetlands.

MANAGERS NOTES

SECTION VII

SPECIAL SPECIES HABITAT MANAGEMENT

CONTENTS

ZONE
Statewide

CAVITY AND SNAG USERS & DEAD AND DOWN MATERIAL

Wildlife/Forestry Coordination Policy Reference:
Specific Procedural Policy No. 6 - Significant Wildlife Conditions.

General Statement

Enough standing dead or dying trees or living culls should be left to provide for the many species that use these snags for nesting, perching, territory establishment, and food sources. In Minnesota 40 birds, 29 mammals, and several species of reptiles and amphibians utilize snags. Some species also use snags indirectly.

The specific guidelines given below are condensed from the U.S. Forest Service manuals and approved by Minnesota Forestry and Wildlife personnel.

These specific guidelines will be implemented unless Area Wildlife and Forestry personnel have determined that snag management should not be implemented on a stand. Because of the time element and difficulty of marking and reserving all snags, the guidelines have been established to help select snags where effective management can be easily established, yet provide habitat for the widest variety of wildlife. Recommendations are designed for areas that are awaiting harvest or site preparation.

Along with snags, consideration of dead and down material is important. This material provides downed logs for ruffed grouse drumming, insects for bear to feed on, and important material for many nongame species. There is an abundance of this material in some forests. Land managers should, however, resist practices that result in a clean or park-like forest floor.

Definitions

Hard snag - A dead or partially dead tree with at least some limbs remaining and with fairly sound wood.

Soft snag - A standing dead tree with advanced heart rot and decomposition, with very few or no limbs.

Specific Guidelines

1. Select snags that are 6" dbh and larger, 15' or taller, and that still retain all or most of their bark. Select the largest trees possible, giving preference to deformed or "wolf" trees.

2. Species providing the widest benefit are oak, sugar maple, basswood, ash, and elm. Aspen is an important snag species in some areas because of its abundance. Although a mixture is desired, hardwood snags are preferred over conifers due to better bark retention and subsequent high use. However, pine and tamarack snags are long lasting and offer good sites for osprey nests and perches if adjacent to lakes or beaver ponds.

3. Leave snags throughout the harvest area, if possible, reserving a few extra around water areas, oak clumps, and brush piles.

4. Reservation of snags and live trees in young conifer stands may conflict with aerial herbicide release projects. Therefore, snags on sites likely to need such release should not exceed 30 feet in height. Exceptions are along edges, within wetland buffer strips, in clumps, or other areas excluded from spraying where tree height will not be a safety factor. Snags in plantations should be hardwoods, not conifers.

5. Reserve 1 to 6 hard snags or live trees per acre, and as many soft snags as possible, considering insect and disease problems and habitat type. The following snag density objectives should be considered when planning snag retention (the lower figure will accommodate 30% of the snag users while the upper will accommodate 100%):

Snag Density Objectives (1)

Community	Snags/100 acres	Per acre
Open	80-200	1-2
Upland deciduous	160-400	2-4
Upland deciduous (riparian) (2)	180-600	2-6
Upland coniferous	160-400	2-4
Upland coniferous (riparian)	160-500	2-5
Upland mixed	160-400	2-4
Upland mixed (riparian)	160-500	2-5
Lowland conifer	40-100	1
Lowland deciduous	40-100	1

(1) Hard snags or live trees.
(2) Riparian is the upland within 100 feet of water.

6. Buffer strips around streams and wetlands and mast trees may wholly or partially provide cavity and snag needs in the harvest area.

7. Timber sales should require that all soft snags be reserved unless there are serious operational or safety reasons.

8. In the aspen type, leave at least 2 hard snags or live trees per acre, and as many soft snags as possible. Hardwood species other than aspen or birch, especially mast trees, should usually be favored.

MANAGERS NOTES

ZONE
Statewide

COLONIAL TREE-NESTING WATERBIRDS

Wildlife/Forestry Coordination Policy Reference:
Specific Procedural Policy No. 6 - Significant Wildlife Conditions.

General Statement

Colonial waterbirds are those species nesting close together in trees near or over water.

In the forest habitats of the state, nesting sites may include great blue heron, cattle egret, great egret, snowy egret, black-crowned night heron, yellow crowned night heron, double-crested cormorant, or little blue heron in mixed or single species colonies.

Report to Area Wildlife personnel all colonial tree nesting sites, and jointly plan nesting area management.

To prolong the breeding activity at colonial nesting sites, the following guidelines have been established; note the criteria are the same as those for osprey.

Specific Guidelines

1. 0 to 5 chain zone - Habitat alterations will not be permitted at any time within 5 chains of any nest site, except for activities necessary to protect the site.

2. 5 to 10 chain zone - Habitat alterations will not be permitted except those activities that do not make significant changes in the landscape. Permitted activities during the period October 1 to March 14 include thinning, permanent opening maintenance, and pruning. Clear cutting, land clearing, and construction activity are not permitted in this zone.

3. Roads, trails, or similar improvements that facilitate access to the nests or increase vulnerability will not be constructed.

MANAGERS NOTES

MOOSE - NORTHERN FOREST

Under Preparation

MOOSE - TRANSITION

Wildlife/Forestry Coordination Policy Reference:
Specific Procedural Policy No. 12 - Wildlife Projects Initiated by Wildlife.

General Statement

The moose is a unique game species that will be perpetuated in Minnesota in huntable numbers. Moose habitat in the northern transition zone can be threatened by agricultural land clearing and by vegetational succession. To ensure the maintenance of current moose population levels, the state land in the transition zone moose range should be retained and managed with consideration for moose where habitat in a compartment is threatened.

General Guidelines

1. A statewide "Moose Management Plan" specifying management zones, population goals, and habitat composition goals is in preparation by the Section of Wildlife. This plan will be made available to Forestry and Wildlife personnel.

2. Moose in the northern transition zone are more dependent on brushland and aspen groves than in the northeast. Management for sharp-tailed grouse is generally compatible with moose. However, optimum moose habitat may require denser and slightly taller brush communities. Brush should be maintained in the optimum stage for moose use by fire and mechanical means.

3. Large clearcuts (up to 200 acres) are beneficial to moose.

4. Prescribed burning is the preferred treatment for maintaining brushland for moose. Mature willow may require herbicide treatment or shearing before burning to provide a sufficient loading of fine fuels to carry a running fire.

MANAGERS NOTES

ZONE
Transition
Agriculture/River

PRAIRIE CHICKEN

Wildlife/Forestry Coordination Policy Reference:
Specific Procedural Policy No. 6 - Significant Wildlife Conditions.

General Statement

The primary habitat for prairie chickens is open grassland with widely scattered shrubs and groves (see Appendix B, Figure 2). The range map in Appendix C shows the areas with breeding populations of prairie chickens. These populations should be maintained and expanded if possible. Where populations are noted outside this range similar measures should be taken.

Specific Guidelines

1. Area Wildlife and Foretry personnel will identify existing prairie chicken habitat in compartment analysis, and agree on a management plan.
2. Prairie chicken habitat compartments should be 2 square miles, and preferably 4 square miles or larger, with at least 2 square miles of grassland.
3. Once prairie chicken compartments are identified, conifer plantations should not be considered.
4. Manage habitat for restoration and maintenance of native and introduced grasses, especially prevent shrub and tree establishment or expansion, if not needed for food plots.
5. Manage habitat compartments by fire to meet habitat composition goals. Haying, mowing, or spot herbicide application may be used where burning is not possible.
6. Some grazing may be beneficial. Area Wildlife personnel will decide if this practice is necessary and advise on the proper techniques.
7. Agricultural leases, including grazing, should be on a sharecrop basis whenever possible. The state's share of sunflowers or corn should be left standing, or small grains baled or stacked. Area Wildlife personnel will assist Area Forestry personnel in setting such leases. See section on ag leases, page 57.
8. Food plots of standing corn or sunflowers are beneficial. Food plots should be on active agricultural land where they do not entail destruction of grassland.

MANAGERS NOTES

ZONE
Statewide

RAPTORS

Wildlife/Forestry Coordination Policy Reference:
Specific Procedural Policy No. 6 - Significant Wildlife Conditions.

General Statement

Many species of raptors are uncommon in Minnesota, or have undergone reductions in range or populations in recent years. The following raptors are of concern in the state. Consider them in natural resource management decisions. These raptors have been listed as "Endangered", "Threatened", or "Special Concern" pursuant to Minnesota Statues 97.488.

Endangered Species

Peregrine Falcon and Burrowing Owl

Threatened Species

Bald Eagle

Special Concern Species

Red-shouldered Hawk, Short-eared Owl, and Osprey

Other Raptors of Concern

Turkey Vulture; Goshawk; Sharp-shinned, Cooper's, and Swainson's Hawks; Great Grey, Barn, Boreal, and Hawk Owls; Prairie Falcon; and Merlin (Pigeon Hawk).

Specific Guidelines

1. Report sightings of the above raptors or any unusual raptors, especially nests or suspected nests, to Area Wildlife personnel.

2. Where nesting is confirmed, Area Wildlife and Forestry personnel should plan land management to retain necessary habitat.

3. Management for Peregrine Falcon and Burrowing Owl will take precedence over all other forestry and wildlife concerns on any state land where nesting occurs.

4. Record confirmed nesting on habitat compartment forms and nest sites on inventory maps.

5. Active raptor nests must not be disturbed in timber management conducted during the nesting and brood rearing season for raptors (March-July).

6. See Appendix E, page 118, for Bald Eagle management concerns.

7. For Osprey nest site management, see Colonial Tree Nesting Waterbirds, page 81.

8. See Appendix D, page 115, for Great Gray Owl management.

9. For additional information regarding raptor management, consult the Regional Nongame Specialist.

MANAGERS NOTES

ZONE
Statewide

REPTILES AND AMPHIBIANS

Wildlife/Forestry Coordination Policy Reference:
Specific Procedural Policy No. 6 - Significant Wildlife Conditions.

General Statement

Minnesota's reptiles and amphibians are the least known and least appreciated components of the state's vertebrate fauna. Compared to other northern states, species diversity in Minnesota is relatively high for frogs, salamanders, turtles, and snakes. Consequently, reptiles and amphibians deserve consideration as important elements of ecosystems.

In Minnesota, terrestrial habitats important to reptiles and amphibians are the wooded blufflands and bottomlands associated with the streams and tributaries of the Minnesota and Mississippi rivers. The oak barrens, sand plains, beach ridges, and moraines are also crucial to many reptiles and amphibians.

Management of habitats specifically for reptiles and amphibians is not widespread. The effects of specific management techniques have only recently been considered. Some general recommendations have been forthcoming and are the basis for the guidelines presented below.

Specific Guidelines

1. Selective thinning that stimulates the growth of shrubs and non-woody plants on the forest floor will increase cover and benefit reptiles and amphibians.

2. Exclude grazing on state woodlands to protect the understory and enhance woodlands for reptiles, amphibians, and all other wildlife.

3. Increase the number of natural shelters such as old logs of all sizes, bark, slabs, or slash, and small brush piles on the forest floor. Logs are important to several salamander species that use them for shelter and egg laying sites. See page 52, for brush pile construction and Appendix G, page 127, for use of logs around ponds.

4. Protect hibernacula (nesting and wintering mounds) and useful features that provide shelter. These features include:
   a. Ponds, wetlands, springs and seeps, ephemeral woodland pools, and wetlands with temporary or seasonal water regimes.
   b. Stone walls and rock piles.

c. Inactive mounds of the ant Formica ulki - reported by Lang (1981) to be important as hibernacula for 3 species of snakes. These mounds are conical above the surface with a base diameter of 3-4 feet.
d. See Appendix G, page 127, for guidelines on constructing hibernacula.

5. Ponds in or near woodlands are important to reptiles and amphibians and may be built and managed to enhance use of woodlands and prairie by reptiles and amphibians. (See Appendix, page 127, for specific guidelines on constructing fishless ponds.

Endangered Species - Five-lined Skink

The five-lined skink is classified as endangered in Minnesota and deserves special consideration. Known populations exist along the Minnesota River near Granite Falls. Habitat requirements include open, grassy areas interspersed with boulders. The skinks hibernate in cracks in the boulders and require open areas for sunning themselves. Invasion of these open sites by Eastern red cedar has reduced available skink habitat; consider maintaining and/or creating openings in areas of known skink populations.

The regional nongame specialist should be consulted (through Area Wildlife personnel) prior to recommending or undertaking any forest management activities in the area from Granite Falls to Redwood Falls.

MANAGERS NOTES

ZONE
Forest
Transition

SANDHILL CRANE

Wildlife/Forestry Coordination Policy Reference:
Specific Procedural Policy No. 1 - Site Preparation, No. 2 - Vegetative Management, No. 4 - Agricultural Leases, and No. 6 - Significant Wildlife Conditions.

General Statement

The greater sandhill crane breeds primarily in the transition and northern prairie zones of Minnesota. Although rare on a statewide basis, it has recently become locally common in suitable habitat. Populations may not have reached their maximum, but their ultimate numbers will be limited by habitat. They require at least 40 acres of shallow marsh interspersed with brush, aspen, grassland, pasture, or cropland. The brush/grassland/wetland habitat complex is very vulnerable to successional destruction by invasion of brush and trees.

Specific Guidelines

1. Locations of paired cranes or cranes with young from mid-April through August should be recorded and reported to Area Wildlife personnel.
2. Identify suitable crane breeding areas in habitat compartment evaluation. Crane management is compatible within sharp-tailed grouse habitat compartments of 2 to 4 square miles. Consider cranes also on smaller, isolated tracts as small as 160 acres, especially if breeding cranes are present.
3. Protect suitable breeding territories from conversion to timber or crops.
4. Manage breeding areas by prescribed fire or other means to retard brush succession. Although cranes will probably renest if nests are destroyed in spring burns, fall burns may be preferable in known nesting areas.
5. Grazing and haying appear to be compatible with sandhill crane management. Area Wildlife personnel should determine the extent and intensity of such practices.
6. Protect crane pairs from human disturbance during the nesting season.

MANAGERS NOTES

ZONE
Forest
Transition

SHARP-TAILED GROUSE

Wildlife/Forestry Coordination Policy Reference:
Specific Procedural Policy No. 1 - Site Preparation, No. 2 - Vegetative Management, and No. 4 - Agricultural Leases.

General Statement

Primary habitat for sharp-tailed grouse is an interspersion of open grassland and shrubland which may also include bog-muskeg. These bog-muskeg vegetation types are extremely vulnerable to destruction by clearing and draining for agriculture and conversion to coniters or hardwoods. They are also lost through succession brought about by efficient fire prevention and suppression. Use the detailed discussion of sharp-tailed grouse management considerations in Appendix B in habitat compartments where sharptails are a target species.

Specific Guidelines

1. Area Wildlife and Area Forestry personnel should prepare sharp-tailed grouse management plans in habitat compartments where it is agreed that sharptails are a target species.

2. Direct management toward habitat composition goals as outlined in Appendix B, page 108.

3. Prescribed fire should be one of the primary management tools in sharp-tailed grouse habitat compartments.

4. Avoid planting conifer in these habitat compartments. But, if they are being considered, consult Appendix B for considerations.

5. Refer to the section on Prairie Chicken, page 87, for additional specific guidelines that may also apply to sharp-tailed grouse.

MANAGERS NOTES

WILD TURKEY

Wildlife/Forestry Coordination Policy Reference:
Specific Procedural Policy No. 12 - Wildlife Projects Initiated by Wildlife.

General Statement

It is questionable whether wild turkeys were ever native to Minnesota, although they were historically present in southwestern Wisconsin and eastern Iowa, and may have occurred in limited numbers in the extreme southeastern corner of the state. Because Minnesota is on the northern fringe of their historical range, the birds are more susceptible to vagaries of weather and therefore more dependent on agricultural crops as a winter food source. Winter losses from starvation can be expected every 3 to 4 years on the average.

General Guidelines

1. Management units for wild turkey should be a minimum of 1,000 acres of mature hardwoods dominated by oak and interspersed with agricultural lands. Management techniques designed to preserve or increase the oak type are beneficial to turkeys.

2. Refer to Minnesota's Wild Turkey Management Plan, Section of Wildlife, September 1983.

Specific Guidelines

1. Food Plots.
   Standing corn food plots adjacent to mature hardwoods are especially important for preventing starvation during severe winters when snow depths exceed 10 inches for 20 consecutive days. Indications are that turkeys are somewhat traditional in their wintering sites and food plots should be at these locations. It is also important to keep them free from constant human disturbance.

2. Nesting Cover.
   Nests are usually located in wooded areas near the edge of fields and openings, and occasionally within hay fields. To protect potential hay field nests, a strip one rod wide adjacent to timber should be left unmowed until the second cutting.

3. Roost Trees.
   Preferred roost trees are mature hardwoods. Generally, turkeys do not roost in the same tree(s) all year. However, they may use specific trees during the winter, especially if

food sources such as standing corn are nearby. Large pine trees located on or near hillsides seem to be preferred roost sites. Identify and protect these trees, when feasible.

4. Shrub Communities.
The seeds and berries of shrubs, primarily sumac, provide an important food source during severe winters. These and other species are commonly found at the crest and foot of south-southwest facing slopes (Goat Prairies). Periodic burning in conjunction with prairie management may be necessary to rejuvenate the sumac. Encourage other fruit or berry producers such as apple, grape, dogwood, and bittersweet.

5. South-southwest exposed slopes are important because increased snow melt exposes mast for these ground feeding birds. Mature oaks on these slopes are important for mast production.

6. Red Cedar.
Typically, red cedar invades portions of the south-southwest slopes following elimination of grazing. These areas provide valuable food and cover for both turkeys and deer. Consult Area Wildlife personnel prior to any action that may adversely impact these areas.

MANAGERS NOTES

ZONE
Statewide

OTHER ANIMALS AND PLANTS OF SPECIAL CONCERN

Wildlife/Forestry Coordination Policy Reference:
Specific Procedural Policy No. 6 - Significant Wildlife Conditions.

General Statement

Breeding populations of the following species are either in danger of elimination from Minnesota (endangered); increasingly rare and likely to become endangered in the foreseeable future (threatened); or apparently rare or reduced from former abundance levels with inadequate knowledge of long-term population trends (special concern). They have been designated pursuant to M.S. 97.488. Check with the regional nongame specialist and/or Natural Heritage Program for possible presence of any listed species in your area.

ENDANGERED ANIMAL SPECIES

Sprague's Pipit, Chestnut-collared Longspur, Baird's Sparrow

Presently known only from beach ridge prairies in Clay and Norman counties. All species prefer short to mixed-grass prairie. Sprague's Pipit prefers ungrazed or lightly grazed mixed-grass that is moderately tall and dense upland prairie. Baird's Sparrow habitat is similar though it may be drier and slightly more grazed. Chestnut-collared Longspur prefers short-grass prairie or heavily grazed or mowed grasslands. No tree planting should be undertaken where these species are present; and grazing, haying, and cropping, if any, should be carefully planned in cooperation with Area Wildlife personnel and the Nongame Specialist.

Piping Plover

Only sporadic occurrence in drought periods on mudflats or drying lakes and marshes. No management recommendations except for Lake of the Woods and Duluth Harbor.

THREATENED SPECIES

Loggerhead Shrike

Prefers open country and dry upland prairie where hedgerows, shrubs, small trees, and small groves are found. Suitable habitat should not be destroyed where breeding is likely.

Gray Wolf

This species will maintain itself where habitat is sufficient to maintain good deer or moose populations. Population levels will be limited by the degree to which local citizens will tolerate their presence and by the amount of cover that conceals their movements. No specific management actions are recommended except for controlling road densities. Refer to the Wolf Management-Road Densities guidelines on page 98a-d.

Wood Turtle

Occurs in St. Croix River Valley and vicinity, and in the Cloquet River valley. Habitat and management recommendations later.

Blandings Turtle

Occurs in St. Croix River Valley, Anoka Sand Plain and vicinity, and Weaver Dunes. Habitat and management recommendations later.

SPECIAL CONCERN SPECIES

Sharp-tailed Sparrow & Yellow Rail

These birds prefer shallow wetlands, sedge meadows, grassy marshes, and open peatlands. Management is compatible with sharp-tailed grouse and sandhill crane. Habitat may be destroyed by tree planting or drainage and conversion. Impoundments may destroy or enhance habitat, depending on existing habitat.

Upland Sandpiper (Plover) and Marbled Godwit

These birds prefer large blocks of short grassland. The marbled godwit prefers wetter sites and wetland fringes. Grazing, mowing, and burning are all compatible. Conversion of grasslands to cropland, forest or brush will be detrimental. Impoundments will usually be detrimental.

OTHER SPECIAL CONCERN SPECIES

Consult the official list available from the Section of Wildlife.

Specific Guidelines

1. Management for known breeding endangered species will take precedence over any other management at a specific location.
2. Proposed management actions detrimental to the habitat of endangered or threatened species will not be permitted.
3. Proposed management actions likely to be detrimental to special concern species should be designed to minimize impacts to the extent possible. Areas critical to known breeding individuals or populations should be avoided entirely until populations have been adequately censused and population goals set. When designing potential management actions in these areas, field staff must work closely with the regional nongame specialist and the Heritage Program.

4. Promptly report sightings of endangered or threatened species to Area Wildlife personnel or Regional Nongame Specialist.
5. Record as time permits and report annually sightings of special concern species.
6. Known recent breeding occurrences of these species will be incorporated into the National Heritage system.

UNIQUE PLANTS AND PLANT COMMUNITIES

General Statement

A list of designated endangered, threatened, and special concern plant species has been prepared pursuant to the Minnesota Endangered Species Law (M.S. 97.488). In addition, the Natural Heritage Program (NHP) has prepared a list of endangered, threatened, and special concern plant communities. Records of locations of these plants and plant communities are maintained by the NHP. Check with the Regional Nongame Specialist and/or the NHP for possible presence of any listed species or special plant communities.

Specific Guidelines

1. The level of restriction or management action will be identical to the corresponding classification of animal species.
2. Report sightings as with animal species, except that they should be reported to the NHP either directly or through Area Wildlife personnel or the Regional Nongame Specialist.
3. Locations of species and communities will be incorporated into the forest inventory system (Phase II) as soon as practical.

MANAGERS NOTES

ZONE
Forest
Transition

WOLF MANAGEMENT - ROAD DENSITIES

Wildlife/Forestry Coordination Policy Reference:

Specific Procedural Policy No. 6 - Significant Wildlife Conditions

General Statement

Minnesota wolf populations are most affected by prey availability and human-caused mortality. Recent findings have indicated that road densities are an available widely-applicable indicator of potentially negative human impacts on wolf populations.

These studies suggest that individual wolves or pairs of wolves likely can survive for some time in areas with high road densities, but overall, there seems to be a road density above which wolf population survival (i.e., reproducing packs) is negatively impacted. The limiting factor is not the roads per se, but rather accessibility to humans who kill wolves. Prior to the early 1970's when wolves were unprotected, the number of wolves killed by humans was high, and many forested areas with suitable habitat and prey had no wolves. Since protected, wolves have re-occupied most of the forested portion of the state where suitable prey exists (Fig. 20-1-A) except areas where killing by humans is prohibitively high. These areas appear to be those with high densities of (1) roads, (2) permanent and seasonal residences, and (3) hunters and trappers.

General Guidelines

1. Road Densities - Road densities in areas of actual or potential wolf habitat should be maintained at an average density of no higher than 1.0 mi/mi^2 over sufficiently large areas (see specific guidelines) to allow wolves to meet their biological needs. This will ensure that viable wolf populations are maintained until such time as new data allow refinement of management procedures. This should not adversely affect timber harvest rates.

2. Coordination of efforts - In many areas, a mosaic of various public and private land ownerships exist. Coordination of efforts concerning habitat manipulation, management of population and harvest levels of prey species, and road construction and maintenance should be emphasized to ensure adequate wolf management throughout its range.

3. Management of large prey - Efforts should continue to manage deer and moose according to species and habitat goals.

Specific Guidelines

1. Definitions

a) Road: For wolf management purposes, these are permanent roads requiring routine maintenance that are accessible year-round by 2 wheeled-drive vehicles. All other roads are not to be included in road density calculations. This equates with the following agency road classifications:

MNDNR Division of Forestry classification (MNDNR 1982)	Classes 1, 2, 3, 4
U.S. Forest Service classification (Anonymous 1986)	Levels A, B, C
MN DOT classification (U.S. Dept. of Transportation)	Arterial Collectors Locals

b) Actual or potential wolf habitat - This includes sufficiently large areas that currently have breeding packs of wolves, or those that have adequate prey populations and could have wolves if human-caused mortality of wolves was lower. This includes management zones 1, 2, 3 and 4 designated in the recovery plan for the Eastern Timber Wolf (Bailey, 1978) (Fig. 20-1-B).

c) Sufficiently large areas - At a minimum, this is the average area of a wolf territory and is about 40-120 mi^2 in Minnesota, depending on deer density. Because an isolated wolf pack may have more difficulty sustaining itself than if it were adjacent to other packs, a minimum of 100 mi^2 is the recommended area over which to calculate road densities.

2. Factors influencing calculation of road densities

a) Road closure - Effective closure methods that eliminate use of roads may be used to reduce road densities. These may include gates, mounds, barriers, tree drops, winter access roads through wet areas, etc. Because most human-caused wolf mortality occurs during the fall hunting seasons (September-December), seasonal closure of roads or road networks may be used in some areas to effectively reduce illegal killing of wolves. During the rest of the year, such roads could be opened and utilized for other activities.

b) Road reclamation - Returning road rights-of-way to their original condition by revegetation, much the same as for mine reclamation, is a viable method to reduce overall road density. This may also include eliminating maintenance of a road so that, in time, it would not be classified under one of the above-designated definitions of a road.

c) Non-wolf habitat - Some forest lands are adjacent to towns, cities, populated rural areas, and dense resort or seasonal residential areas, and have high road densities. These areas are not potential wolf habitat and the 100-mi^2 road management zone used to calculate road densities should not include such areas.

3. Calculation of road densities

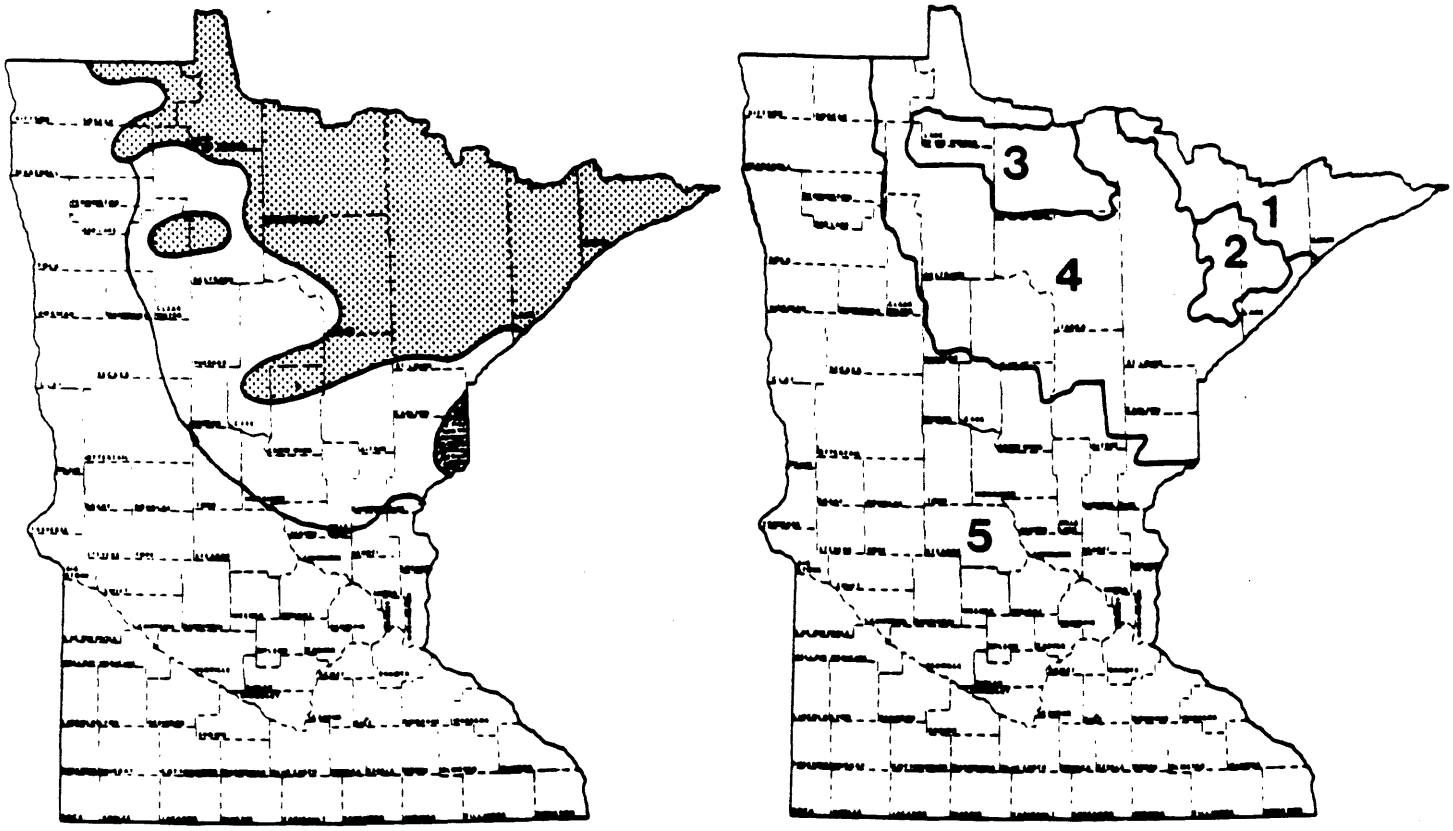
a) Straight line distance of proposed road is less than 10 miles - Determine the road's appropriate geographic center. Using a compass, draw a circle with a radius of 6 miles, using this point as its center to outline an area of about 113 square miles (3.14×6^2). Determine the number of sections (1 mi^2) within this circle that are non-wolf habitat (towns, cities, etc., and lakes >2 mi^2; see guidelines), and subtract the total from 113. If there is still >100 mi^2 of wolf habitat within the circle, use a map measure to determine the total miles of road. Divide this total, plus the total miles of road proposed to be built, by the number of square miles of wolf habitat within the circle. If it is less than 1.0, the project is within acceptable road densities and the project can be completed. If there are more than 1.0 miles of road/$mile^2$, no construction can take place unless the proposed road can be gated, or other roads gated, closed, or reclaimed (see guidelines).

If, after subtracting non-wolf habitat from the total of 113 square miles in the circle, there is less than 100 square miles, draw another circle with the same center but with a radius of 6.5 miles to outline an area of about 133 mi^2. Again, subtract non-wolf habitat from this total, and if there is more than 100 square miles left, determine road density as above. If not, continue to enlarge the circle until the total area minus non-wolf habitat is greater than 100 square miles. Such a procedure would be necessary, for instance, near Lake Superior, where nearly half of the circle might be comprised of the lake.

b) Straight line distance of proposed road is more than 10 miles - Determine its approximate geographic center and roughly draw the smallest ellipse possible around the road such that no part of the road is closer than 1 mile to the edge of the ellipse, and the longer axis of the ellipse is no more than twice the greatest width. To determine the area of the ellipse, multiply the maximum length by the maximum width by 0.785. The resultant figure will be the total number of square miles encompassed by the ellipse. Subtract non-wolf habitat as outlined above, and if the area is $\geq 100 mi^2$, determine the number of miles of roads present and then the road density.

If the area of wolf habitat in the ellipse is $\geq 250 mi^2$, divide the ellipse into 2 halves along the line of the greatest width, and determine road densities for each half. If road density in one half is low enough such that additional road building is acceptable, but is too high in the other half, the road, as originally proposed, could not be built in the half with high road density without changes.

Figure 20-1



A B

A) Approximate distribution of wolves (shaded) in Minnesota. Solid lines indicate southern boundary of forested areas and limit of wolf habitat.

B) Wolf management zones and density goals as delinated by the Eastern Timber Wolf Recovery Team.

Wolf Management Zone	Area (mi^2)	Desired Wolf Density (mi^2/wolf)
1	4462	Fluctuate naturally
2	1864	10
3	3501	10
4	20901	50
5	54603	>50

SECTION VIII

FIRE UTILIZATION

ZONE
Statewide

FIRE UTILIZATION

Wildlife/Forestry Coordination Policy Reference:
Specific Procedural Policy No. 1 - Site Preparation, No. 2 - Vegetative Management, No. 9 - Other Projects, and No. 12 - Wildlife Projects Initiated by Wildlife.

General Statement

It will be the policy of the Department to employ prescribed burning whenever it can be shown to be the most appropriate and cost effective technique for managing ecosystems, particularly those determined to be partially or wholly fire dependent. Examples of burning objectives are controlling brush encroachment in forest wildlife openings and sharp-tailed grouse habitat, reducing bluegrass and shrub invasion on prairies, reducing wildlife hazards, preparing forestry sites for planting, and fire training.

General Guidelines

1. Refer to Operational Order No. 47, Prescribed Burn Policy, December 1985.

2. Refer to various prescribed burning manuals available from the Division of Forestry Fire Section or Northern Fire Center, and the U.S. Forest Service reports on Effects of Fire on 1) fuels, 2) soils, 3) water, 4) flora, 5) fauna, and 6) air. These are available from the Division of Forestry or the U.S. Forest Service, General Technical Report Series.

MANAGERS NOTES

APPENDICES

APPENDIX A
Ruffed Grouse Habitat

From: Managing Northern Forests for Wildlife, 1984 (pages 42-44)
By: Gordon W. Gullion
Leader, Forest Wildlife Project
University of Minnesota
Ag. Exp. Station, St. Paul

This theoretical property consists of somewhat rolling forestland in the Great Lakes region (Figure A1, page 97). It is bounded by National Forest land on the north and west, by lakeshore property being developed for homesites on the east, and an active dairy farm on the south. Property lines are all surveyed and marked. The property also has about 2,500 feet (764m) of shoreline on a bay of a sizeable lake. The land is assumed to have had a varied history. It was logged late in the 1800's, then burned several times. Portions were subsequently cultivated and abandoned, while other portions were allowed to develop a natural, secondary forest succession. A wildfire burned across the northern part in 1931 and a tornado cut a swath through the center in 1950. The older forest has had little disturbance since the fires which followed the period of extensive logging.

The soil is well-drained, sandy-loam over most of the property, with a small, rocky hill in the northeast corner. Aspen growing on this site usually reaches a height of 55 feet (17m) by the age of 30 years.

With this background we can begin to develop a forest management plan for this property which will assure the maintenance of a reasonably good wildlife population indefinitely.

First, the distribution of aspen through the forest needs to be determined. A forest having as little as 10 percent aspen in the canopy can be successfully regenerated as grouse cover. If aspen is quite evenly scattered throughout the stand the cutting pattern can be laid out in a systematic manner with confidence that adequate response will be evenly distributed across the treated areas. But if the aspen is clumped and not widely distributed throughout the stand, the cutting program may have to be modified to be certain enough aspen will be cut each time to provide adequate cover. When this is the case, expectations regarding grouse response should be reduced. For wildlife, response is best where the aspen develops uniformly dense cover, and the estimates for grouse numbers given in Table A1, page 98, are based on this type of development.

Secondly, the condition of the aspen in each stand should be examined to determine the urgency for treatment. If all the aspens are healthy, vigorous trees 30 years old, there is a good likelihood of being able to establish and carry out a 4-stage cutting rotation (cutting at 10 to 15-year intervals). But if the aspens are much older, or are showing signs of decadence

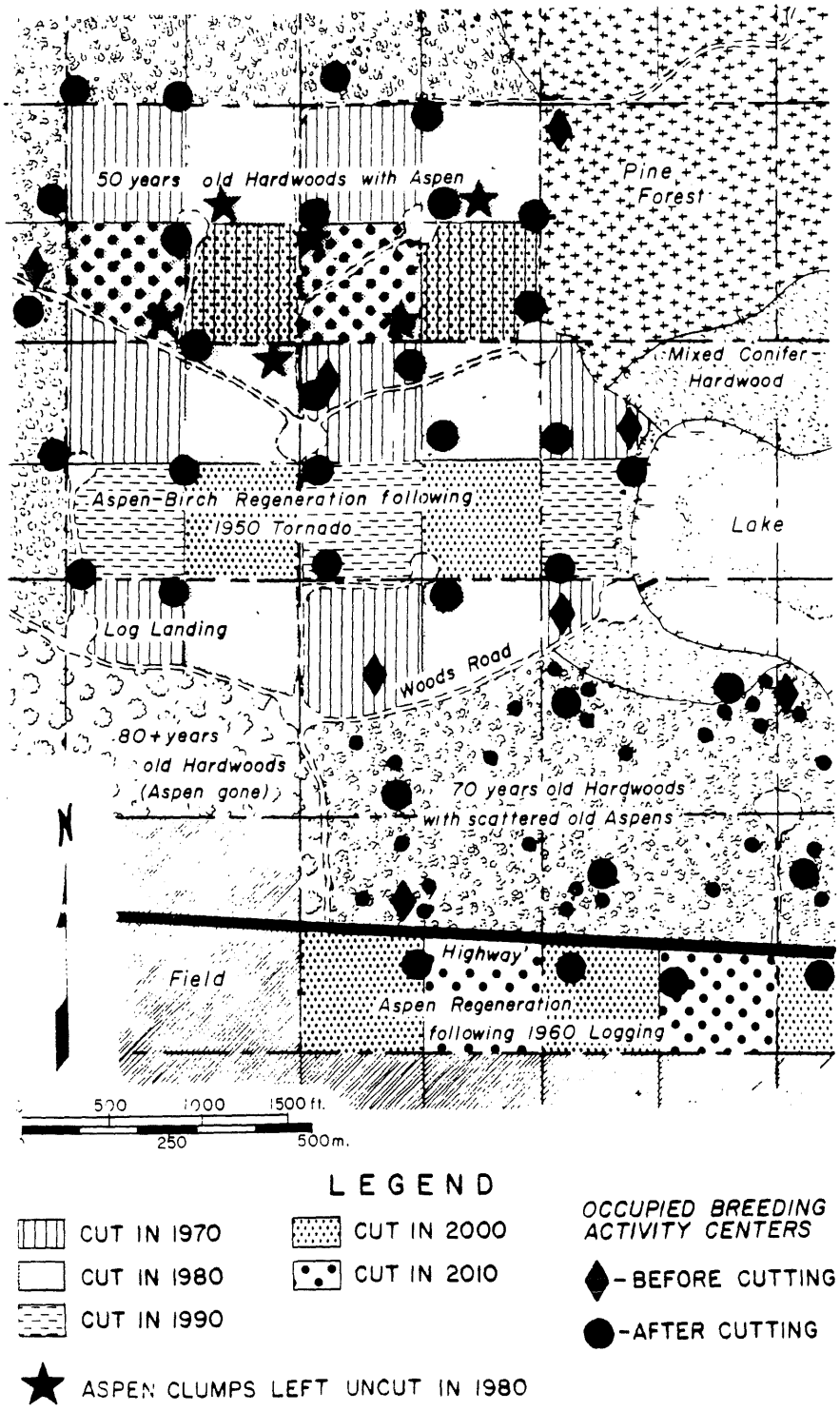


FIGURE **A.1** *One program for managing 440 acres (178 ha) of forestland in a manner that will provide improved habitat for both game and nongame wildlife and income for the landowner. The details of this program are explained in the text. The small dots in the "70-year-old hardwoods" represent old aspen scattered in this stand.*

Table A.1. Expected Ruffed Grouse Breeding Population Densities for Various Sized Clear Cuts.

	Option II and Variation A Option I (maximum probable)				Option I		Option III (max. prob.)		Option IV (max. prob.)		40 acre clearcut (max. prob.)	
	Clearcut		W/Cent. Clone		Var. B, C, D							
	Per 100 ac.	Per* 100 ha.	Per 100 ac.	Per* 100 ha.	Per 100 ac.	Per* 100 ha.	Per 100 ac.	Per* 100 ha.	Per 100 ac.	Per* 100 ha.	Per 100 ac.	Per* 100 ha.
After 10 years	10	25	13	31	13-20	31-49	13	32	10	25	5	12
After 20 years	11	28	16	40	13-20	31-49	19	46	16	40	5	13
After 30 years	13	31	18	43	13-20	31-49	14	34	8	19	7	16
After 40 years	13	31	18	43	13-20	31-49	14	36	9	21	7	16
Est. total breeding over 40 year span	470	1150	650	1570	520-800	1240-1960	600	1480	430	1050	240	570
% of best	58		80		----BEST----		75		50		30	
Maximum production	2115	5245	2925	7065	2340-2600	5580-8820	2700	6660	1935	4725	1080	2565

*Converted values rounded to nearest whole number.

(dying tops or heart-rot), cutting plans must be accelerated to remove the trees before significant mortality can reduce root regeneration. Bracket fungi or "conks" growing on the bark of otherwise healthy looking aspen indicates heart-rot. On the other hand, mortality caused by hypoxylon or nectria cankers should not be considered indicative of a stand commencing breakup -- but if many trees are infected, the stand should probably be scheduled for early cutting and regeneration.

A person should also examine the ground for evidence of adventitious aspen suckers. The presence of these in a mature forest indicates the aspen roots still have sufficient vigor to respond adequately after the trees are felled.

Returning to the property in question, field examination provides an indication of how the area should be treated. The property south of the highway was clearcut in 1970 and now is covered with dense, 10-year old aspen-birch-maple regeneration, and will not need to be disturbed for another 30 years. Some earlier non-commercial cuts might be made to hasten the development of age class diversity and grouse use of this stand, but that can wait. At this time the only occupied breeding activity centers are close to the highway, which the birds frequently cross to feed in the older forest to the north. Several road kills occur each season along this half-mile stretch of highway.

The older forest north of the highway consists of a nearly climax northern hardwood forest. The most prominent species are sugar maple and yellow birch, with some oaks, paper birch and a few scattered old hemlocks. There is no aspen west of the woods road, and this portion of the forest has a low priority in the plans. Little change is likely there in the next quarter-century, except that the large, healthy hardwoods will increase in volume and value. The scattered aspens to the east of the woods road consist mostly of single old trees, surrounded by snags of aspen that have recently died, and aspen logs on the ground (Figure A1). These snags and logs represent members of the clones which succumbed a few years earlier. Preservation of this aspen clonal stock is a high priority in the plan. To the north of the old forest is a vigorous, young aspen-birch forest which regenerated following the tornado in 1950. There are many vigorous branches in the aspen crowns bearing leaves nearly the size of a person's hand.

North of that and extending far into the National Forest is a 50-year-old forest where the aspen is beginning to show signs of decadence. There are a few standing dead aspens and occasional trees have several large, dead branches in their crowns, or branches with yellow leaves in mid-summer. Many have bracket fungi on the bark, and all the leaves in the crown tend to be small, not much more than 1 inch (2.5 cm) across. The early successional, intolerant aspens have about reached the end of their existence in this stand and the longer-lived maples, oaks

and other hardwoods are gaining dominance. Fortunately, though, the aspens are still quite evenly distributed throughout this stand.

The small hill to the northeast is covered with a good stand of red and jack pine, and a mixed stand of ash, hemlock, and old white pines covers the steep, south-facing slopes above the lake.

Having determined the condition and composition of the woodlands, the next step is to develop a cutting program which will provide an economic harvest of the timber and produce the best distribution of breeding activity centers for ruffed grouse. Also, habitat should be provided for as many other forms of wildlife as can be reasonably accommodated. This includes leaving some old, large trees and snags to provide homes for cavity-nesters. The goal for each 10 acres (4 ha) will be to leave standing 2 or 3 trees or snags over 18 inches (46 cm) in diameter, 15 to 20 over 14 inches (36 cm), and 25 to 30 over 6 inches (15 cm). But since ruffed grouse constitute the resident species of most concern, the management layout will be developed primarily on that basis.

This is a quite simple procedure. For economic reasons a 10 acre clearcut is the selected method of timber harvest. This treatment should result in about a ruffed grouse breeding activity center per 10 acres, for a population density about 60 percent of optimum in return for having most of the management accomplished commercially.

This is a fairly simple layout in the stand regenerating from the 1950 blow-down. The cutting program should maintain a population of about 15 breeding pairs of grouse (producing about 68 young per year) on these 138 acres (56 ha) so long as the rotation is maintained.

The problem is more complex in the area of the 1931 burn. The entire area should be cut within the next 10 years to regenerate the aspen before too many trees and clonal root-systems have died. Here the same scheme is used as in the blow-down area, but a group of mature male aspens will be left standing in each block to provide resources for grouse utilizing the cover of the cut-over stand at least until those older aspen die.

This area should have about 8 breeding pairs of ruffed grouse on the 75 acres (30 ha) for a few years before the second cutting is made, and the population should remain fairly static until the old, reserved aspen begin to die. Then the grouse population will begin a gradual decline. About 20 years after the second cut is made the population may be almost nil on this area, but as the earliest aspen cut reaches the age of 30 years (and half of it ready to be cut again) the population should begin to recover.

In addition to an increased number of ruffed grouse, the scattered log landings and logging roads should provide habitat for about 11 pairs of woodcock and about 17 white-tailed deer.

Due to the scarcity of aspen in the 70-year-old forest and the sawlog quality of the other hardwoods, the choice here is to make several "clonal" cuttings around the remnant old aspens (Figure A1). They will be placed so that there is at least one pocket of aspen regeneration in each 10-acre (4 ha) of the old forest. These can be done as firewood sales, and should all be done early in the program to save the root systems of the remnant aspen. This treatment should provide coverts for 5 breeding pairs of ruffed grouse on the 89 acres (36 ha) of old forest where otherwise there would be none.

A corridor of trees will be left uncut along the lakeshore to allow them to become decadent and provide nesting cavities for woodducks and goldeneyes.

APPENDIX B
Sharp-Tailed Grouse Habitat

ZONE
Transition and
Northern Forest

Wildlife-Forestry Habitat Management Recommendations
Sharp-tailed Grouse

by Bill Berg, DNR Forest Wildlife Populations and Research Group

The sharp-tailed grouse is indigenous to Minnesota and is the only native prairie grouse in the state. Because it's open brushland habitat is vulnerable to destruction from many causes, this popular game bird is disappearing rapidly from the state. For example, the hunter harvest in 1983 was 9,000, compared to 116,000 in 1952, a decline of 92%.

Natural succession has claimed the once open homestead areas; brushland has matured to trees. In past decades, wildfire was largely responsible for maintaining brushland in its younger stages; effective wildfire suppression and lack of prescribed burning has permitted this succession to advance. Many of the old fields and brushland areas have been planted to conifers, a practice that has continued into the mid-1980's on both public and private lands. Large-scale clearing of brushland for agriculture has also eliminated vast areas of habitat. In a land-use study of two northwestern Minnesota townships, land clearing, succession, and plantations reduced sharp-tail numbers by 67% from the mid-1960's to 1980. If current land use trends continue, all remaining habitat in one township, and 60% of remaining habitat in the other, will be destroyed by 1993.

This report quantitatively describes the components of sharp-tailed grouse habitat throughout its range in Minnesota (Figure B1). Recommendations are made for maintenance of existing habitat, prevention of further habitat destruction resulting from land management practices, and restoration of decadent habitat. All information is the result of sharp-tailed grouse populations and habitat research in Minnesota since 1962.

The habitat best suited for sharptails in Minnesota is open brushland, located successionally between the very open areas utilized by prairie chickens, and the young forests favored by ruffed grouse (Figure B2). This open brushland flourishes on a variety of soils ranging from highly organic (e.g., muskeg), to purely mineral (e.g., taconite tailings). The open component may be any combination of grass, sedge, open pasture, bog, or small grain cropland. The ecosystem's brushland component usually consists of willow, but may include a variety of shrub species such as bog birch, or scattered, generally off-site, aspen and paper birch clones.

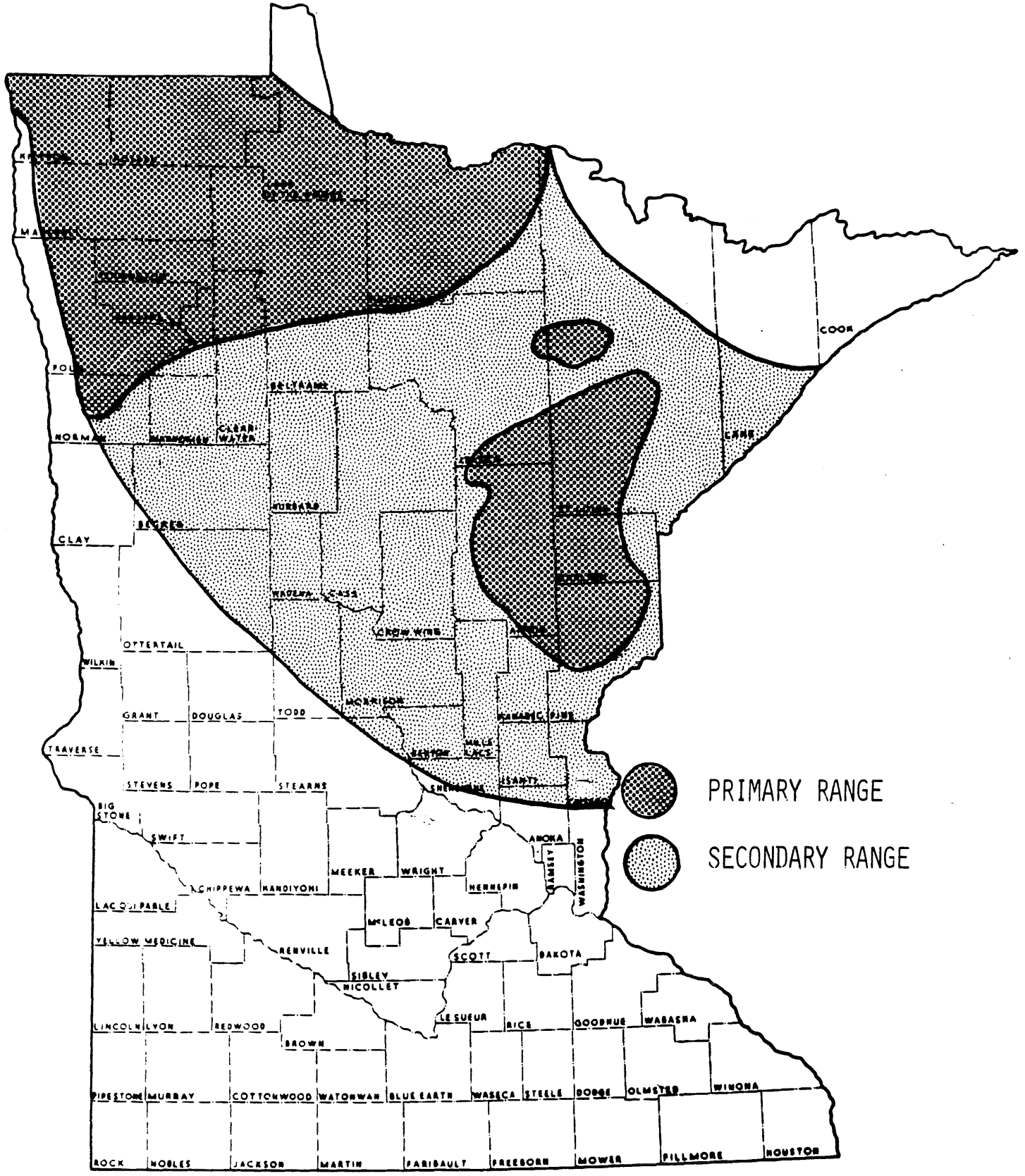


Figure B1. Sharp-tailed grouse range in Minnesota. Sharptails occur in most of the Primary Range, in brushland habitats scattered throughout the Secondary range, and as remnant populations in the remainder of the state. Map by B. Berg, 1984

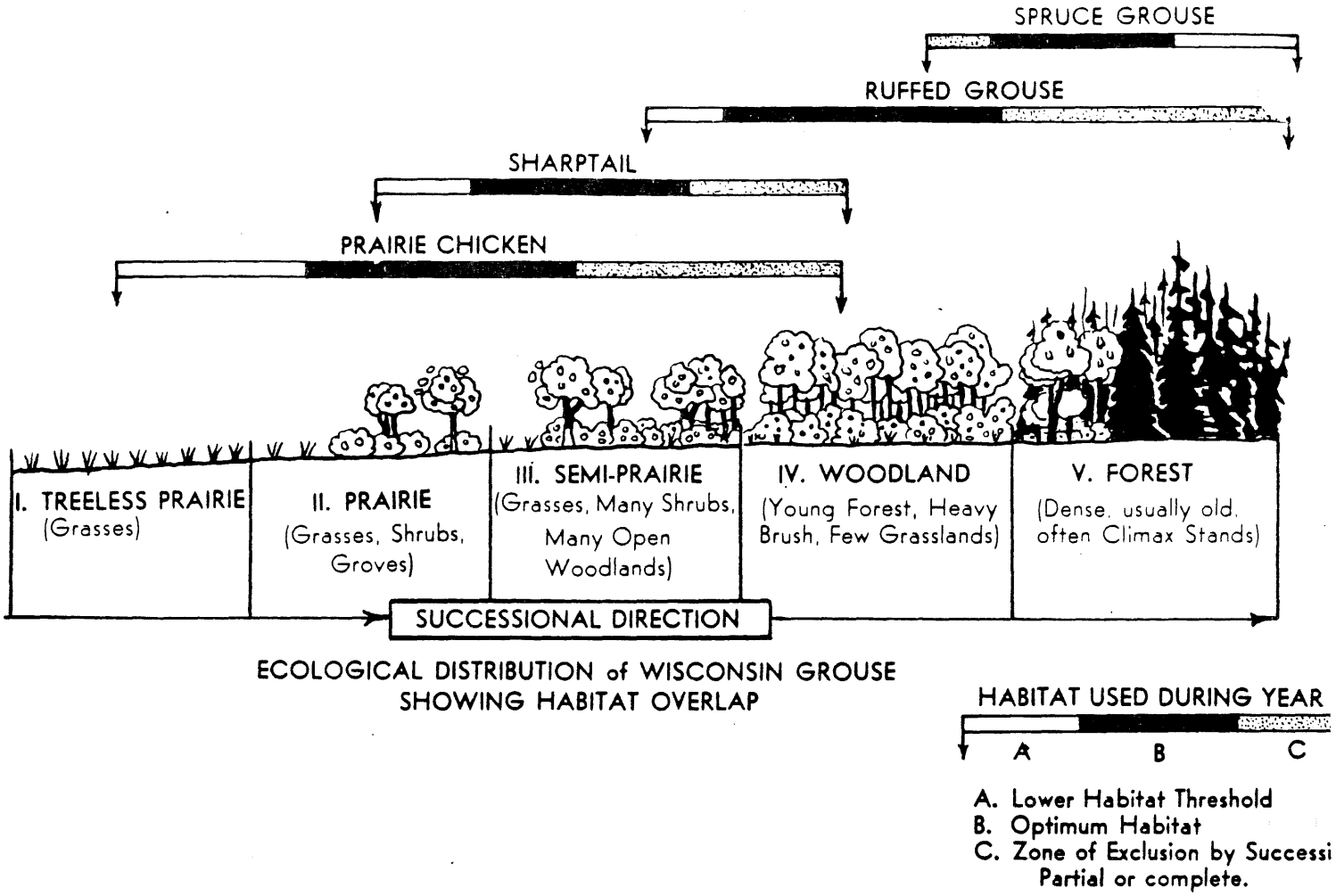


Figure B2. Habitat requirements for four grouse species in Minnesota, Wisconsin, and Michigan. (Adapted from Grange, W. B. 1948. Wisconsin Grouse Problems. Wisconsin Cons. Dept. Pub. No. 328. Madison. 318 pp).

Management of brushland is multi-species in scope, not just for sharptails. Brushland is the principal habitat for moose in northwestern Minnesota, and is heavily used by deer statewide during spring and summer. It is also a main habitat for snowshoe hares, waterfowl, and furbearers. Nongame species relying on the seral stages of succession include sandhill cranes, yellow rails, sharp-tailed sparrows, raptors, and a host of others. The value of this habitat to wildlife in general was substantiated by the Chippewa National Forest's vertebrate survey. In this survey, the permanent opening community was ranked first, shrub-sapling second, shrub swamp sixth, and sedge meadow twelfth in the overall importance ranking of 24 plant communities.

Habitat specifics. The minimum size of the sharp-tailed grouse habitat complex depends on its configuration. Where suitable habitat is remotely scattered throughout the sharp-tail's range, the habitat islands must be minimally 2 mi. square, and preferably at least 4 mi. square. Where habitat exists rather uniformly in scattered but connected blocks, these blocks must be at least 1/2 mi. square. The optimum habitat composition of these blocks is 35% grass-legume, 15% small grain cropland, 7% sedge-marsh, 16% willow, 9% lowland brush and scattered trees, and 18% off-site aspen-birch. Not all criteria (e.g., cropland, legumes, etc.) need to be present, however, to maintain populations.

The dancing ground, or lek, and adjacent brushland are the most important components of the sharptail habitat complex. Lek vegetation is critical, for it minimally requires a 1/8 mile diameter area relatively free of woody vegetation. Terrain of the lek is usually flat to slightly domed, and consists of grass, sedge, tame hay, stubble, open pasture, or plowed field. Average distances from the lek center to woody vegetation of various heights are: scattered brush (195 yds., 4 ft.), dense brush (230 yds., 7 ft.), brush-tree mixture (275 yds., 16 ft.), and trees (305 yds., 23 ft.). These data quantify the sharptail's need for open space (Figure B3).

The brushland around the lek, or 1/4-1/2 mile from the lek, satisfies most of the bird's needs for basic shelter, nesting cover, and food. Optimum brushland consists of shrubs in the 3-7 ft. range; it supports fewer birds or becomes abandoned entirely when brush becomes overmature and decadent. The sharptail's intolerance to planted or naturally occurring conifers is well documented. Except for an occasional small black spruce or tamarack, sharptails are totally intolerant of any conifers within 1/8 mi. of the lek center, and relatively intolerant of any conifer stand within 1/2 mi. from the lek. Once conifers approximately 1/4 mi. from the lek center exceed 20 ft. in height, or if conifers 1/2 mi. distant exceed 40 ft. in height, the habitat complex will in most cases be abandoned.

Both components of the sharp-tailed grouse habitat complex are necessary. The entire complex will be abandoned, should the

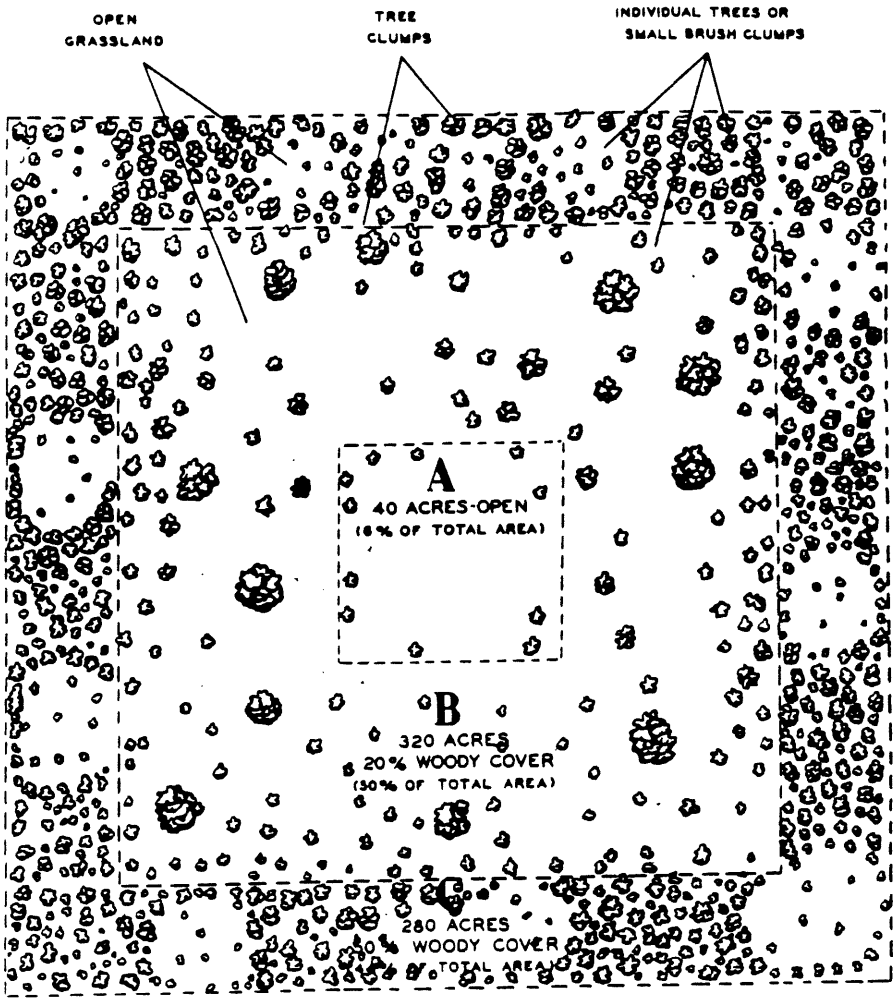


Figure B3. Suggested sharp-tailed grouse components and distribution in northern Minnesota, Wisconsin, and Michigan. Scale 4.5 in. = 1 mi. (From Ammann, G. A. 1957. The Prairie Grouse of Michigan. Dept. of Cons. Bull. Lansing. 200 pp).

vegetative composition of either the lek or the brushland become unsuitable.

Management Recommendations. The sharp-tailed grouse, due to its relatively narrow range of habitat tolerance, is extremely responsive to both beneficial or adverse land management practices. Following are basic guidelines that will perpetuate portions of the brushland ecosystem necessary for the survival of sharptails and other wildlife species.

1. Area identification. A generalized sharp-tailed grouse range map was completed in 1970 and revised in 1984 (Figure B1). Since 1963 sharptails have been censused in portions of their northwestern and east-central Minnesota range. Census, occurrence, and other data concerning sharptails are available from the Area Wildlife Managers.

2. Habitat complex maintenance. Sharptails are managed by maintaining the habitat in the proper open and brushland components. These components can be managed most easily by prescribed burning or by wildfire under designated control status (see Forestry/Wildlife Prescribed Burn Policy). Mechanical treatment, such as shearing of decadent willow and invading tamarack, or hand-cutting of brush on a lek, may be viable alternatives to burning in some areas.

3. Conifers. Conifer plantings should be avoided in any forest habitat compartment where sharp-tailed grouse are among the target management species, or where suitable habitat exists but sharptail presence is uncertain. Sharp-tailed grouse and other open brushland species (e.g., sandhill cranes, sharp-tailed sparrows, yellow rails, etc.) will abandon the habitat complex when conifer plantations are improperly located. Natural stands of conifers, usually tamarack or black spruce invading open brushland due to fire control, should be eliminated in forest habitat compartments managed for sharptails.

4. Habitat complex restoration. Areas that historically supported sharptails and contain vestiges of remaining habitat and/or remnant sharptail populations can be restored to suitable habitat by combinations of prescribed burning, shearing, and logging. These areas can be further enhanced by planting sheep sorrel, red, white, or alsike clover, climbing false buckwheat, mountain ash, paper birch, ironwood and several other bud and berry-producing woody and non-woody shrubs. Small grains, mainly buckwheat or oats, can either be raised on the site, or more economically, baled and transported to the site.

Appendix C

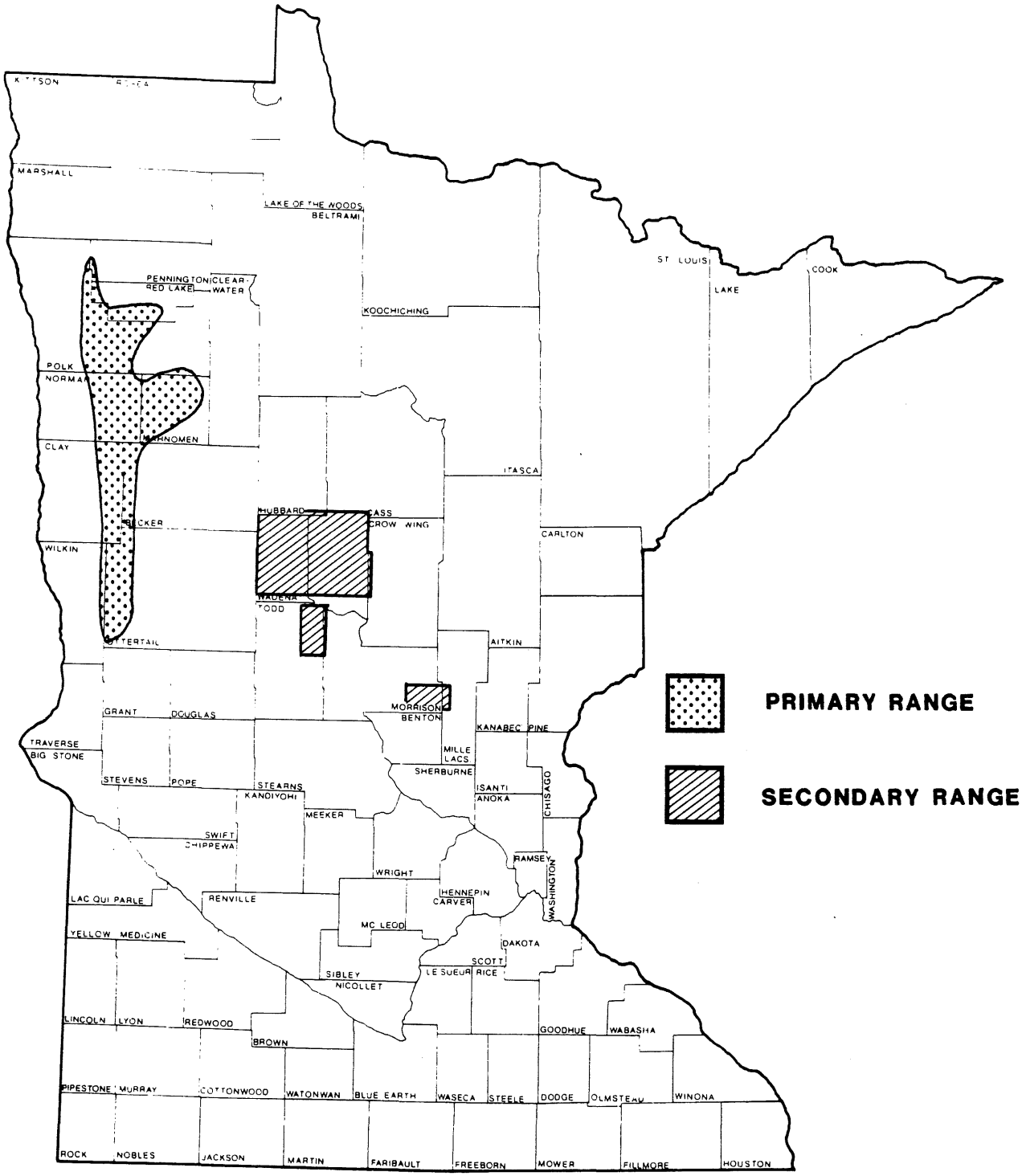


Figure C-1. **Minnesota prairie chicken range, 1982.**

APPENDIX D

Wildlife/Forestry Habitat Management Guidelines: Great Gray Owl

Steve Loch - 1981

The great gray owl is a rare inhabitant of the boreal forest ecosystem. In the central region of the North American continent, the southern limit of its breeding range extends into northern Minnesota. Although breeding populations were not confirmed until 1979, breeding densities of a significant proportion do occur here. The highest breeding density known for nesting great gray owls on the continent is in Aitkin County in 1980 where eight breeding pairs were found in five adjoining sections.

The intentions of this note are to inform concerned wildlife management and forestry personnel of the above facts, and to briefly discuss the ecological niche of this species so that suggestions regarding habitat maintenance are better understood.

The great gray owl is a predatory specialist. It hunts from a perch, using a prey base that in Minnesota is mainly comprised of three species: the meadow vole, the redback vole, and the southern bog lemming. These vole populations fluctuate cyclically. Thus, even when other habitat components remain relatively constant, the quality of habitat provided for this species by an area may vary considerably from one year to the next. In addition, various environmental factors, particularly snow conditions, significantly affect the extent to which a community is used by this owl.

To compensate for yearly variations in the quality of habitat and, in some cases, adverse environmental conditions, the species has apparently acquired a behavioral adaption similar to nomadism. Hence, it seems that the existence of this owl in Minnesota as a breeding species is dependent on the availability of large tracts of potential habitat with connecting corridors between these tracts.

Habitat

Good great gray owl habitat in Minnesota appears to be a mosaic of the following communities:

1. Tamarack and tamarack-black spruce communities

   Of utmost importance are large stands of dense tamarack or mixed tamarack and black spruce; large sapling and pole timber are preferred over other available size classes. The paucity of sawtimber stands precluded evaluation of the size class; however, it seems that such stands would fulfill the habitat requirements of the species. These forests provide the owl with ample hunting perches of varying heights and,

in some years, a copious prey base. Additionally, the forest provides a covert from potential predatory and/or harassing species.

2. Hardwood and conifer-hardwood communities

Pole timber and sawtimber stands of these cover types in proximity and particularly adjacent to large conifer swamp systems are valuable as nesting habitat.

Great gray owls do not build or repair the nests they use. Since the growth form of tamarack in dense forests is not conducive to nidification, useable nests in that cover type are scarce. Hence, the species often nest in nearby hardwood forests using vacant nests constructed in preceding years by hawks, crows, and ravens. Also, these forests are used as supplementary hunting areas sometimes for extended periods.

Forests predominated by black ash are used heavily by the species both for nesting and for hunting. This community, especially when in proximity to a large conifer swamp system, is an important component of the great gray owl habitat complex.

3. Open communities

Examples are grassy openings that result from fire, recent logging activity, powerline rights-of-way, man-made wildlife openings, and other open or semi-open situations. These areas are used for supplementary hunting, especially when prey availability is low elsewhere. Open communities can best be used when an abundance of hunting perches is available. In addition, a nearby forest covert is required; the use of an open area is likely proportional to the proximity of a forest covert.

THE STATUS OF HABITAT MAINTENANCE TO DATE

Human activities that have converted tamarack and tamarack-black spruce forests to other cover types have reduced the acreage of this habitat type. To assess the impact of such conversion, note that tamarack forests are not comparable to other serial stages that naturally convert to another cover type in due time. Tamarack forests are self-perpetuating subclimax communities that, once established, yield to further succession very slowly. Hence, the destruction of this community produces a loss of potential habitat of sizeable proportions.

The suppression of fire has reduced the occurrence of natural openings. In some areas, certain types of logging activity, powerline rights-of-way, maintained wildlife openings, abandoned agricultural clearings, natural openings, and other open situations suffice for this habitat component.

The demands for energy, agricultural land, forest products, and game species resources pose a threat to existing tracts of great gray owl habitat. Peat mining, encroachment by agricultural operations, and cover type conversion by certain forestry and wildlife management practices on tamarack, mixed tamarack and black spruce, and some adjacent hardwood communities will render realization of this threat.

HABITAT MAINTENANCE

Crucial to perpetuating the species are forestry and wildlife management practices that assure the existence of tamarack and black ash cover types.

Specific data is needed about the ratio and arrangement of size classes compatible with the needs of the great gray owl, that yet allow for adequate tamarack and black ash timber harvest. However, it appears that a rotation scheme maintaining 60-80% of a stand in large saplings, pole timber, or sawtimber is desirable.

When harvesting, seed tree or shelterwood cuts (where ample seed trees function as hunting perches) are suggested in lieu of clearcuts or other cutting methods. All stumps, snags, or other forms of nonmerchantable trees should be left in place to provide additional hunting perches. Perches of varying heights, 30 per acre or more, are desirable. Most hunting perches range in height from 0.5-50 ft.; those used most often range from 5 to 30 feet.

Cuts of forty acres or more are best conducted on a rectangular area as opposed to a square area. Cuts under 40 acres may be of any shape but rectangular cuts are suggested. Cuts 10 chains wide are desirable; whereas cuts wider than 20 chains are less beneficial.

Hardwood and conifer-hardwood forest within 0.3 mile of the tamarack component are best managed by maintaining large pole timber and sawtimber throughout most (preferably 60% or more) of the stand. Strips of fire-maintained wildlife or other comparable openings further enhance the area by creating additional hunting areas for the great gray owl greater raptor species diversity and/or density. The latter equates to increased nest availability for the owl.

Management of hardwood and mixed forests 0.3 to 1.25 miles from the tamarack component is less critical. Large pole timber and sawtimber stands covering approximately 40% of the area are probably sufficient. The value of openings for hunting increases as the distance from the tamarack component becomes greater.

The Hawk Owl, Connecticut Warbler, Black-backed Three-toed Woodpecker, and Boreal Chickadee are other species that reside in the conifer swamp communities. The habitat maintenance suggested above for the tamarack and tamarack-black spruce communities provides for the needs of these species as well.

APPENDIX E
Minnesota Department of Natural Resources
Management Guidelines for Bald Eagle Breeding Areas

These guidelines were developed to provide minimum criteria for protecting bald eagles at their breeding areas from human disturbance and to preserve and enhance important habitat features of these areas. The basic criteria and information contained in these guidelines are adopted from Appendix E of the Northern States Bald Eagle Recovery Plan and the U.S. Forest Service - Eastern Region Management Guidelines.

The bald eagle population in Minnesota is now stable, with some recent indications suggesting that the species may be expanding its current range and numbers within the state. Although eagles often use particular nests for several years, the turnover of existing nests from losses to wind, changes by the eagles, and other natural factors may be as much as 12% of the sites per year. Thus, the conservation and management of nesting habitat is more important than the identification and preservation of specific nest sites.

Eagle Sensitivity to Human Disturbance

Eagle tolerance of human presence varies highly, both seasonally and among different individuals or pairs of eagles (Mathisen 1968). Some bald eagles accept people, boaters, hikers, cabins, roads, and other human presence in very close proximity to their nests, possibly as a result of habituation. On the other hand, some may be extremely intolerant and readily disturbed. Management should be conservative and assume that intolerant birds may be present now or in the future.

All nesting eagles are disturbed more easily at some times of the nesting season than at others. Because eagles tend to breed earlier farther south, Minnesota has been arbitrarily divided into north and south by State Highway 210. The dates provided are to be used as guidelines. The actual nesting dates for each specific breeding area may vary. Four periods of sensitivity to disturbance can be identified for nesting areas. These are as follows:

1. Most critical. Prior to egg laying, bald eagles engage in courtship and nest building activities. During this and the incubation periods, they are most intolerant to external disturbance and may readily abandon the area. The most critical period for disturbance, therefore, extends from approximately one month prior to egg laying through the incubation period.

   Dates: Northern Minnesota March 15 - May 15
   Southern Minnesota Feb. 10 - May 1

2. Moderately critical. This period extends from about one month prior to the above period to about four weeks after hatching. The earlier period of moderate sensitivity provides a buffer period for early birds coming into physiological condition for breeding. After hatching, the chicks require frequent brooding and feeding. Disturbance can keep adults from nesting and thus weaken or kill chicks. Disturbance at this time is less critical, although still potentially detrimental, than during the pre-laying and incubation period.

Dates:	Northern Minnesota	Feb. 15 - March 15
		May 15 - June 15
	Southern Minnesota	Jan. 10 - Feb. 10
		May 1 - June 1

3. Low critical. This period extends from the time chicks are about one month of age until six to eight weeks after fledging. During this time adults are still quite attached to nesting areas but tolerate moderate amounts of human presence. Restriction should be decided on a case by case basis.

Dates:	Northern Minnesota	June 15 - Oct. 1
	Southern Minnesota	June 1 - Sept. 15

4. Not critical. The existence of this period depends on whether adults are permanent residents in their nesting areas. In most regions adults leave the vicinity for a few weeks or months each year. During the time they are gone, be concerned only with activities that alter the habitat in ways that would make it unsuitable for future nesting.

Dates:	Northern Minnesota	Oct. 1 - Feb. 15
	Southern Minnesota	Sept. 15 - Jan. 10

SITE SPECIFIC MANAGEMENT ACTIONS WITHIN ONE BREEDING AREA

Active Nest Sites

In order to minimize disturbance of eagles during critical nesting periods, each nest within a breeding area will be protected by three zones that become less restrictive to human activity as the distance from the nest increases. These buffer zones must be established around all nest sites in the breeding area regardless of their activity status, since alternate nests are often used as feeding platforms or roosting sites.

1. Primary Zone. The boundary of this zone should be 330 feet (5 chains) from the nest. All land use except actions necessary to protect or improve the nest site should be prohibited in this zone. Human entry and low-level aircraft operations should be prohibited during the most critical and moderately critical periods, unless performed in connection with eagle research or management by qualified individuals. Motorized access into this zone should be prohibited. Restrictions on human entry at other times should be

addressed in the breeding area management plan, considering the types, extents, and durations of proposed or likely activities.

2. Secondary Zone. This zone should extend 660 feet (10 chains) from the nest. Land use activities that result in significant changes in the landscape, such as clearcutting, land clearing, or major construction should be prohibited. Actions such as thinning tree stands, pruning, permanent opening maintenance, or maintenance of existing improvements can be permitted, but not during the most and moderately critical periods. Human entry and low-level aircraft operations should be prohibited during the most critical period unless performed in connection with eagle research or management by qualified individuals. Roads and trails in this zone should be obliterated, or at least closed during the most and moderately critical periods. Restrictions on human entry at other times should be addressed in the breeding area management plan, considering types, extents, and durations of proposed or likely activities.

3. Tertiary Zone. This zone should extend one-quarter mile (20 chains) from the nest, but may extend up to one-half mile (40 chains) if topography and vegetation permit a direct line of sight from the nest to potential activities at a distance. The configuration of this zone, therefore, may be variable. This is the least restrictive zone. Major land use activities such as clearcutting, land clearing, or major construction will only be permitted during the noncritical period. Other activities are permissible in this zone except during the most critical period. Each breeding area management plan may identify specific hazards that require additional constraints.

Inactive Nesting Sites

1. When a tree containing an eagle nest has blown down or has been damaged so that it can no longer support a nest, all buffer zones can be removed.

2. When a nest structure disappears but the tree remains standing, the buffer zones should remain in effect through at least the following three breeding seasons. If the nest is not rebuilt, the zoning should be removed but the area should still be considered essential habitat and protected accordingly.

3. When a nest is classified as a remnant, that is, one that has been unoccupied for five consecutive years, and is not being maintained by eagles, only the primary zone should be retained.

Essential Habitat

In Minnesota, essential nesting habitat for eagles may be found within one-half mile of a major river or lake supporting an adequate prey base. Efforts should be made to identify essential nesting habitat, and where possible, the following guidelines should be used in land use management to preserve or enhance important habitat features.

1. Four to six overmature trees for every 320 acres within one-quarter mile of a major river or lake larger than 40 acres should be maintained as potential nest trees. These trees should be either super canopy trees or located at the edge of a forest stand with clear flight paths.

2. Additional super canopy trees (preferably dead or with dead tops) located in the area or near the shoreline providing commanding views of the area should be preserved as possible perching or roosting trees.

3. Artificial nest structures may be provided where suitable nest sites are unavailable in occupied or potential habitat. Structures may be placed in trees containing delapidated nests; in trees without existing nests, but which otherwise appear suitable; or in manmade structures such as powerlines or tripods. Nest platforms should be approximately 5 to 6 feet in length and width (25-36 square feet and be made to last for several years. Roosting structures may be erected power poles with several horizontal perches near the upper end.

MANAGEMENT CONSIDERATIONS FOR CONTIGUOUS BREEDING AREAS

Management of nesting areas will depend on the amount of suitable habitat, numbers of pairs present, extent of the areas used by nesting eagles, and present land uses. Individual plans should be prepared for each breeding area, but planning should encompass larger units when habitat is suitable and many nesting pairs are present. In planning for a large region, particularly if major changes in land use or development are anticipated, the following major items should be addressed:

1. Distribution of habitat modification. Large contiguous areas of habitat should remain suitable, not just small specific sites where nests are currently located.

2. Upper limit to habitat modification. Limits on habitat modification should be clearly established in advance, and unplanned development should be discouraged or prohibited. Limits set in advance are generally more acceptable to persons desiring further development; the process permits reasonable negotiation and compromise and limits are easier to enforce.

3. Rate of development. Development should only be allowed to approach the upper limit slowly, over a period of years. Sudden, large-scale development should be prevented if possible.

4. Seasonal timing of human activity. Construction and related activities should be confined to the low or non-critical periods of the year as described above.

5. Human attitudes toward eagles in the area. Much human-eagle interaction depends on the predominant attitude of human residents of each area. Residents and visitors of some areas are very favorably disposed toward the birds, if not proud and quite protective. They may be careful not to disturb the birds and may help prevent disturbance or destruction by other persons. Such attitudes should be encouraged through education and law enforcement.

POTENTIAL HABITAT

Potential habitat contains the necessary habitat features and conditions that are described in essential habitat, but there are presently no eagles utilizing the area. Management strategies for potential eagle habitat should acknowledge its status as such, and if compatible with land use objectives, manage as for essential habitat.

DEVELOPMENT OF BREEDING AREA MANAGEMENT PLANS

Site specific management plans will serve to preserve and enhance the important habitat features of a breeding area and should address such factors as feeding areas, nest success history, potential nest trees, essential habitat, buffer zone configuration, and special hazards. The management plans will be prepared by the Regional Nongame Specialist with the cooperation of the Area Wildlife Supervisor and the District Forester. The County Wildlife Biologist will also be included if county land is involved. If private land is involved, the landowners will be notified. A field review of the site with a discussion of management strategies and special problems will be held prior to the development of the plan and will include all interested parties.

Management plans will be developed according to the following priorities. Eagle breeding areas that are located on:

1. State forestry or wildlife lands that are currently involved in developing a management plan for the entire area.
2. Private lands that are threatened by some type of development or disturbance.
3. State, county or private lands that are near areas of land development or disturbance.
4. State, county or private lands that are contiguous with other eagle breeding areas.

5. State lands that are not threatened by development or habitat disruption.
6. County lands that are not threatened by development or habitat disruption.
7. Private lands that are not threatened by development or habitat disruption.

The management plans will be maintained by the Regional Nongame Specialist who will also have responsibility for updating the plans as necessary. Each management plan should be reviewed at three-year intervals to determine if management constraints are being complied with and if modifications are needed. Copies of the plans and any modifications will be sent to the Nongame Supervisor, Area Wildlife Supervisor, District Forester, U.S.F.W.S. Biologist, and if County land is involved, the County Wildlife Biologist.

APPENDIX F
Black Bear Habitat Considerations

Black bears are an important game species in Minnesota and also are a cause for concern in some areas due to their attraction to artificial food sources such as garbage, crops, livestock, and beehives. It is important to maintain good bear habitat in the state both to ensure the perpetuation of a huntable population and also to deter nuisance activity. Bears also represent an important species to many non-consumptive recreational users of the forest who enjoy seeing these animals, whether in a garbage dump, a blueberry patch, or darting across a road or trail.

The bear population in Minnesota is primarily within the northeastern third of the state, dominated by forest. Prime bear habitat in Minnesota has yet to be identified, but two long-term studies of bears in the state (L. Rogers and an ongoing DNR study) have documented the importance of various vegetative parameters to bears. The following outlines some of the vegetative aspects important to bears that should be considered when managing forests in Minnesota.

FORAGING AREAS

It has clearly been demonstrated that food shortages can cause increased reproductive failures in bears and increased mortality in young age classes. Furthermore, food shortages prompt increased bear nuisance activity. Important food sources for bears in Minnesota include grasses, forbs, young leaves, and insects in the spring, various kinds of berries during the summer, and berries and nuts in the fall. Maintaining a high diversity and abundance of these foods in the forest should buffer the bear population against fruiting failures of a particular species, thereby preventing widespread reproductive failures and minimizing nuisance activity.

The major species of berries consumed by bears include sarsaparilla, cherries, blueberries, raspberries, blackberries, dogwood, highbush cranberries, wild plums, mountain ash, juneberries, strawberries, elderberries, and swamp buckthorn. Nuts consumed include red and white oak acorns and hazelnuts. Some of these species are found mainly in relatively open areas, such as clearings or spot failures in plantations, whereas others are more abundant in forested stands of various ages or along forest edges. Bears, therefore, benefit from a heterogeneous habitat in which forest stands of diverse types and ages are interspersed with natural or manmade open areas. The following are some management considerations for specific forest types that would benefit bears.

Aspen-Birch

Management of aspen-birch stands for white-tailed deer and ruffed grouse, as outlined in this manual, is also advantageous for bears. An interspersion of regeneration stands of different age classes is desirable. Young stands (less than 10 years) provide suitable habitat for fruiting of species requiring fairly open to medium canopy, such as raspberries, blackberries, and sarsaparilla. Other species such as hazel and dogwood require more years to reach fruit-bearing age and produce better in older regeneration and more mature stands. Often the best fruiting of hazel, dogwood, and sarsaparilla occurs along edges of medium-aged to mature stands, adjacent to openings, trails, clearcuts, or young regeneration stands and plantations.

Red, white, and jack pine

Properly managed pine plantations and natural pine stands can provide a good source of bear foods at different stages in their development. Improperly managed, however, they can become virtually devoid of foods beneficial to bears. Young plantations, in particular, can provide an abundance of such species as raspberries, strawberries, blueberries, and blackberries, depending upon site conditions and soil disturbance at the time of planting. Use of herbicides for site preparation or in subsequent release operations eliminates these species. In older plantations, slash piles, windrows, and spot failures provide openings where fruit-bearing shrubs such as cherries, arrowwood, juneberries, and hazel can become established. Plantation release with herbicides or mechanical means should be done in such a way as to allow these species to remain in pockets, or if possible, throughout the plantation.

As pine stands mature and the canopy begins to close, fruiting success of bear food species drops dramatically. Some fruitings can be maintained, however, by thinning activities which result in 50-75% canopy coverage, and thereby permit enough light to reach the understory and forest floor. As in aspen-birch stands, much fruiting in mature stands occurs close to the forest edge, so harvest and thinning activities that increase the amount of edge are beneficial. Thinning of pole and sawtimber stands should be conducted so as to minimize disturbance to herbaceous ground cover and the shrub understory.

Oak

Acorns, wherever they occur in Minnesota's bear range, are a very important food because of their high caloric content. In some areas they are likely the single most important food item for bears in terms of survival and reproduction. Bears sometimes travel great distances (30-75 miles) in the fall in pursuit of acorns. Management of oak for sawlogs or firewood should encourage the maintenance and enhancement of oak stands. Where

oaks occur in small unmerchantable stands, especially if these are scattered or isolated, they should be allowed to remain because of their great value as food producers.

Northern Hardwoods

Little is known of the extent to which bears use northern hardwoods for food. Almost no fruiting species of herbs or shrubs grow in mature stands because of the dense canopy cover. However, in the fall bears forage in the soil around the base of large trees in maple-basswood stands.

Openings

Natural and manmade grassy openings are beneficial to bears, particularly in the early spring (mid April to mid June) when grasses and herbs comprise 90-100% of their diet. During this period bears continue to lose weight after hibernation, and some young bears may starve. Openings such as logging trails and landings that are closed to vehicular traffic and seeded to clover are heavily used by bears during spring and could be important to their survival.

Openings also provide the best sites for strawberries, the first of the wild fruits available to bears in late spring (late June). Furthermore, openings and grassy trails in sandy areas are heavily colonized by mound-building ants, another important spring and early summer bear food, which sometimes comprises over 65% of the bear's diet from mid-June to mid-July.

ESCAPE COVER

There is some evidence that bears may use lowland conifers for escape cover when threatened or pursued. Young cubs often climb large trees for escape; adult females with cubs commonly forage in the vicinity of such large trees. Allowing scattered large trees to remain in cutovers or plantations may make them more attractive as foraging areas to females with cubs.

DEN SITES

The availability of den sites for bears appears to influence bear movements and likely affects weight loss and reproductive success. Various habitats are used for denning, from upland mature forests, to brush piles in clearcuts, to dense lowland conifers. In some parts of the state, male bears seem to have a particular affinity for lowland areas. The maintenance of thickly-wooded, mature lowlands (cedar, black spruce, or tamarack) is therefore beneficial to bears. In upland clearings, the construction of very large brush piles, as opposed to narrow rows, is advantageous to bears for denning.

APPENDIX G
Reptile and Amphibian Habitat

Two development activities to improve habitat for reptiles and amphibians have been implemented in other states. The first creates and manages small fishless shallow water ponds for amphibians. The second constructs hibernacula. The guidelines presented below are adapted, respectively, from Johnson (1983) and Frier and Zappalorti (1983).

Management Recommendations

Ponds (see Figure G1). Building several ponds in and near the edge of timber lands is a valuable practice for management of woodland amphibians and reptiles.

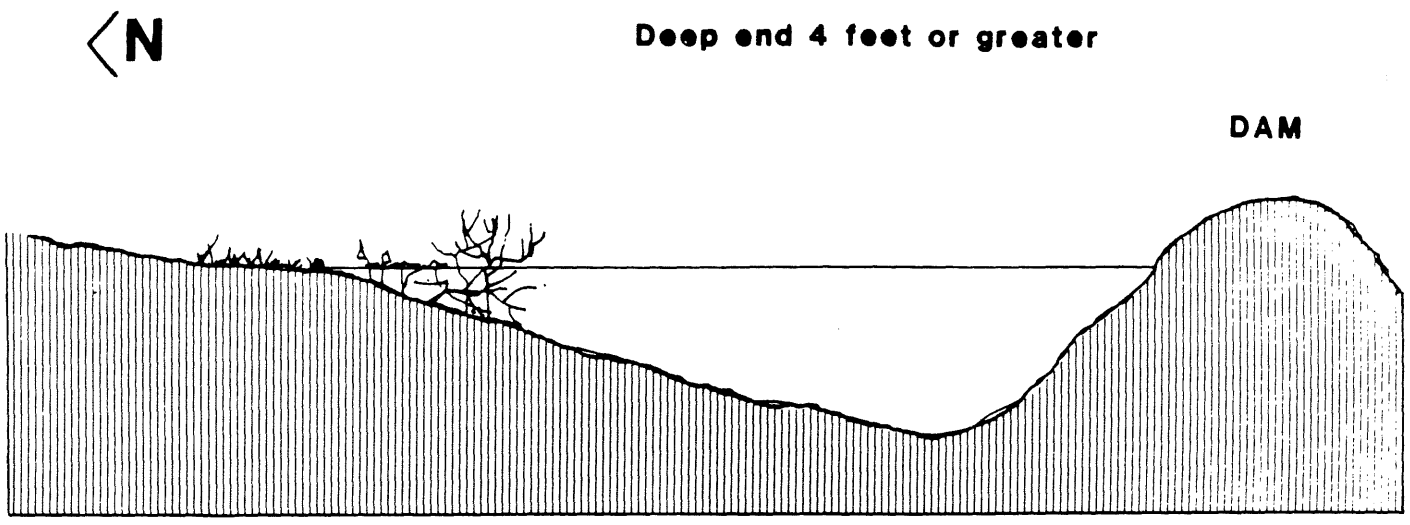
1. Construction. The size and overall shape will be dictated by the local topography.
   a. At a minimum, a pond should be no smaller than 30 or 40 feet across.
   b. 1/3 of the bank must have a gradual slope toward the deepest point.
   c. The deepest part of the pond should be 4 feet or more.

2. Management. Besides fishless conditions and shallow water, these small ponds can be improved by providing brush piles, logs and rock piles.
   a. A number of properly constructed brush piles should be placed at the edge and at various distances from the pond to provide shelter.
   b. Place from 5 to 10 logs, each from 5-8 feet long and a minimum of 6 inches in diameter along the edge. Part of each log should be in the water. As much of the underside of each log should be in contact with the ground as possible.
   c. Avoid extensive clearing around woodland ponds. Any trees and brush cut away from a pond bank should be allowed to fall into the water except for red cedar or pine trees.
   d. Placing rock piles or riprap along the north bank of larger ponds (one acre) adds shelter. Rocks from "football" size to large pieces 3 feet across should be dumped along the water's edge and up the bank 3 or 4 feet, and below water level 2 to 3 feet.

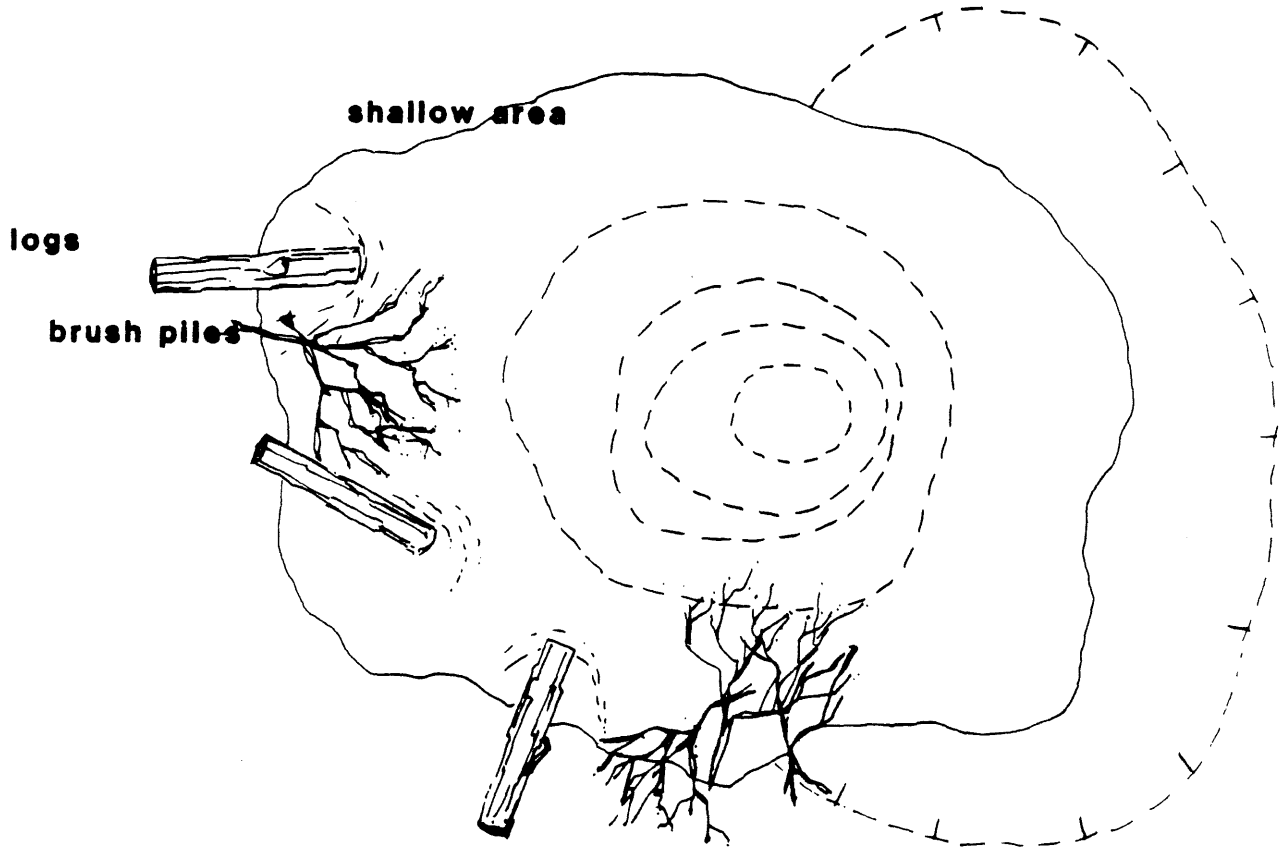
This technique is valuable for ponds in open areas along a forest edge, near a food plot, or on a prairie.

3. Maintenance. Woodland ponds may eventually become filled in with dead leaves or an overgrowth of acquatic vegetation. Maintain the habitat by digging out a 4 foot hole along one side of the old pond.

FIGURE G1. Fishless Shallow Water Pond



CROSS SECTION



Birds eye view of pond

Snake Mounds (winter hibernacula or nesting areas, see Figure G2). Designed to provide safety for hibernating snakes, the mounds are composed of heavy logs, rocks, and stumps located below the frost line and intermixed with earth. Additional timber cuttings are placed above ground and covered with 0.3 soil.

1. Location. These mounds can be made in conjunction with construction of forest openings, road cuts, timber landings or any land clearing which removes stumps and large rocks. The mounds should be positioned on the north side of the clearings to receive the sun.

2. Site Preparation - guidelines for tree removal.
   a. Cut the trees approximately 12" to 18" above ground level.
   b. Cut trunks into 10' - 13' lengths; remove all large branches.
   c. Remove stumps and large rocks from ground and stockpile materials at location of "denning" sites.

3. Mound Construction - (see Figure G2).
   a. Dig trenches about 8' deep and 9' across.
   b. Stockpile excavated soil along edge of trench.
   c. Place logs, butting up to one another along bottom of trench.
   d. Deposit branches and some of the rocks and stumps into the trench.
   e. Cover the branches and stumps with soil.
   f. Lay the 10' logs, side by side, across the trench for its full length.
   g. Place additional soil over the logs.
   h. Place additional stumps and large rocks on top of the logs.
   i. Cover the entire mass with soil and large rocks until the mound is about 10' in height.

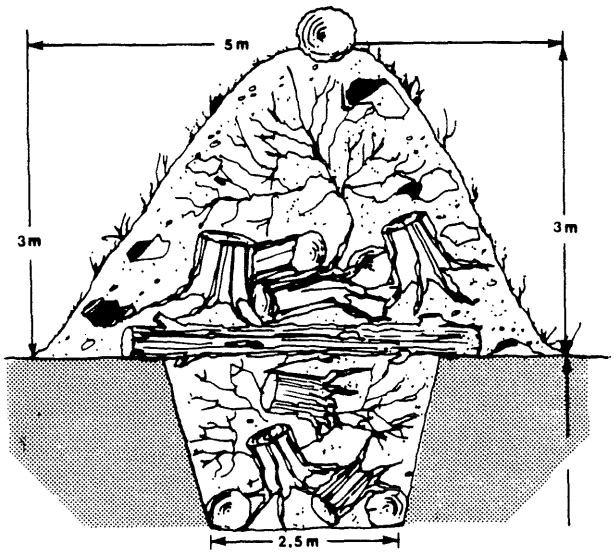


Figure G2. Cross section of man-made snake hibernaculum.

APPENDIX H
Minnesota Wetlands Classification

Following is a classification system for wetlands and lakes of Minnesota, which is presently being used by personnel of the Fish and Wildlife Survey Unit, Section of Research and Planning. This system is a modification of the classification system established in Special Scientific Report No. 20, Classification of Wetlands of the United States, U.S. Department of the Interior, the Wetlands Classification Committee of the Fish and Wildlife Service. Alexander C. Martin, Chairman, Neil Hotchkiss, Francis M. Uhler, and Warren S. Bourn. June 1953.

Type I
Seasonally flooded basins or flats. Shallow depressions that contain standing water for only a few days in the spring or after heavy rains. IA - Seasonally flooded meadow basin - seasonally flooded basin in a meadow, pasture, or idle land. May have scattered wetland plants such as smartweeds, sedges, spikerush, whitetop, and burreeds.
IB - Seasonally flooded barren basin - seasonally flooded basin in cultivated land. Usually no vegetation is present.

Type II Meadows. Shallow depressions that contain standing water for a few days in the spring or after heavy rains. Soils may be waterlogged within at least a few inches of its surface during the growing season. Vegetation is primarily sedges, grasses, smartweeds, rushes, and docks and beggartick, etc.
IIA - Sedge meadows - entirely or predominantly wide or narrow leaf sedges. May have other thinly scattered plants such as cane or occasional willow shrubs.
IIB - Fine grass meadow - predominantly thin-stalked marsh grasses such as redtop grass, blue-joint, manna grasses, some bluegrasses, slough grass, squirrel tail grass, whitetop grass, and cord grass. Cover is usually under 5 feet.
IIC - Coarse grass meadow - predominantly thick-stalked grasses such as reed canary grass, but may have other thick-stalked marsh vegetation such as dock, beggartick, smartweeds, or occasional upland plants such as goldenrod or sunflower. Height is from three to six feet.

Type III Shallow marshes. Marshy depressions that may have variable water depths up to 30 inches or which may be merely waterlogged. They are usually covered with heavy-stalked emergents of varying density and height. The emergents may form a dense cover or there may be scattered open water areas.
IIIA - Cattail-cane marsh - predominantly stands of tall, heavy-stalked emergents such as cattail and cane. Height is usually from 5 to 7 feet.

IIIB - Bulrush-flag marsh - predominantly stands of shorter, heavy-stalked emergents such as sweet flag, blue flag, river bulrush, threesquare, woolgrass, rice cutgrass, and hard and soft stem bulrush. Height usually varies from 2 to 6 feet.

IIIC - Mudflat emergents - predominantly short marsh emergents such as arrowheads, wapatos, spike and needle rushes, and occasionally swamp aster, marigold, water plantain, and water parsnip. Often found in a fringe around open water or on mud flats. Height is usually under 2 feet.

Type IV

Deep marshes. Water depths to 4 or 5 feet. Emergent vegetation, if present, is either confined to a fringe or to scattered plants or clumps of bulrush or cane. Submerged aquatic vegetation may be present.

IVA - Open water marsh - emergents limited to a variable (relatively narrow width) fringe of cattail, cane, bulrush, and to rare individual spears of bulrush, cattail, or cane in the open water.

IVB - Open water with emergents marsh - predominantly open water but with occasional to common stands of bulrush, cattail, or cane. IVC - Rice-waterlily marsh - this type may be open water early in the growing season, but usually overgrows with wild rice or water lilies later in the year. This type may be difficult to classify early in the growing season.

Type V

Fish lakes. Open water of sufficient depths to be normally capable of supporting a permanent game fish population.

VA - Marginal fish-game lakes - water depths from 6 to 15 feet. Includes freeze-out fish lakes but have excessive depth for optimum game use.

Type VI

Shrub swamps. Soils normally waterlogged during the growing season, but may occasionally have water depths to one foot. Predominant shrubs are willows or alders. Height of shrubs is usually 5 to 15 feet. There may be an understory of sedge, cattail, reed canary grass, ferns, cane, or grasses.

Type VII

Wooded swamps. Soils waterlogged, but may occasionally have water depths to one foot. Usually mature trees or over 15 feet in height.

VIIA - Wooded deciduous swamp - predominantly deciduous trees such as elm, ash, or mature willow. May have an understory of grasses or smartweeds.

VIIB - Coniferous swamp - predominantly coniferous trees such as spruce, cedars or balsam fir, but also including tamarack. May have an understory of mosses, leatherleaf, or brush.

Type VIII
Shrub bogs. Vegetation is predominantly such shrubs as leatherleaf or Labrador tea. Height is usually limited to 3 feet or less. There may be an understory of mosses and occasionally sedges.

Uses of this system:

Typing marshes by this system should be limited to actual field use with typing by such means as aerial photos not being broken down finer than Type II, III, IV, etc.

Marshes are often of more than one type. For example, a Type IV marsh may have bays of Type III or II. These marshes should be divided into two or more types.

APPENDIX I
GUIDELINES FOR MANAGING PEREGRINE FALCON HABITAT

Standard guidelines have previously not been prepared for the management of peregrine falcon habitat because of the inherent variability in the behavior of nesting pairs, as well as the variations in the physical attributes of the nest sites and the terrain of the breeding territories. However, peregrine falcons are long-lived, traditional nesters, returning annually to reoccupy previous nest sites and territories. Additionally, in Minnesota, availability of suitable breeding territories and nest sites may be a limiting factor. Therefore, conservation and management of specific nest sites and breeding territories is important and a management plan should be individually designed for each occupied breeding territory and selected unoccupied historic aeries.

I. BACKGROUND

Status - The peregrine falcon has been designated as both a state and federally listed endangered species. The statewide breeding population once totaled 30 to 40 pairs located in two regions (Fig. 1). This species was extirpated from the state, primarily by DDT poisoning, between 1946 and 1962. However, peregrines from Arctic populations have continued to pass through Minnesota during migration.

A substantial reintroduction effort was initiated in 1982 with the intent of reestablishing a self-sustaining population of 15-20 pairs of peregrine falcons by 1995. In 1986, one pair reoccupied an historic aerie, but no young were produced. By 1988, five pair, three of these hatching young, and one adult male had established territories in Minnesota. Preparations are underway to reintroduce 31-34 fledglings during the summer of 1988.

Nesting Phenology and Behavior - At the northern latitude of Minnesota, the peregrines first appear at the nest cliffs in early spring (February - April). Territories are established and eggs are laid by late March through late April. Incubation requires 28-31 days. The young fledge at 5-6 weeks of age and are dependent on the adults for another month (Fig. II).

Within the breeding territories, peregrines vigorously defend only the immediate vicinity of the aerie, defined for our purposes as the nest containing eggs or young and the ledge or cavity where it occurs. The number of alternative nest sites used by a single pair (or it successors) through the years have varied from one to eight at a single nesting cliff. Alternative nest sites may also occur on different cliffs separated by considerable distances within a territory.

The nest cliff is usually the "center" of a larger foraging area. Peregrines not only forage over large areas (10 - 20 miles) but are known to hunt primarily at a few selected spots within the foraging area Prey species are usually hunted over open habitat such as waterways, wetlands and fields. The perimeters of these foraging areas depend upon dispersal of habitat types, prey density, general land use, and behavior of the resident peregrines.

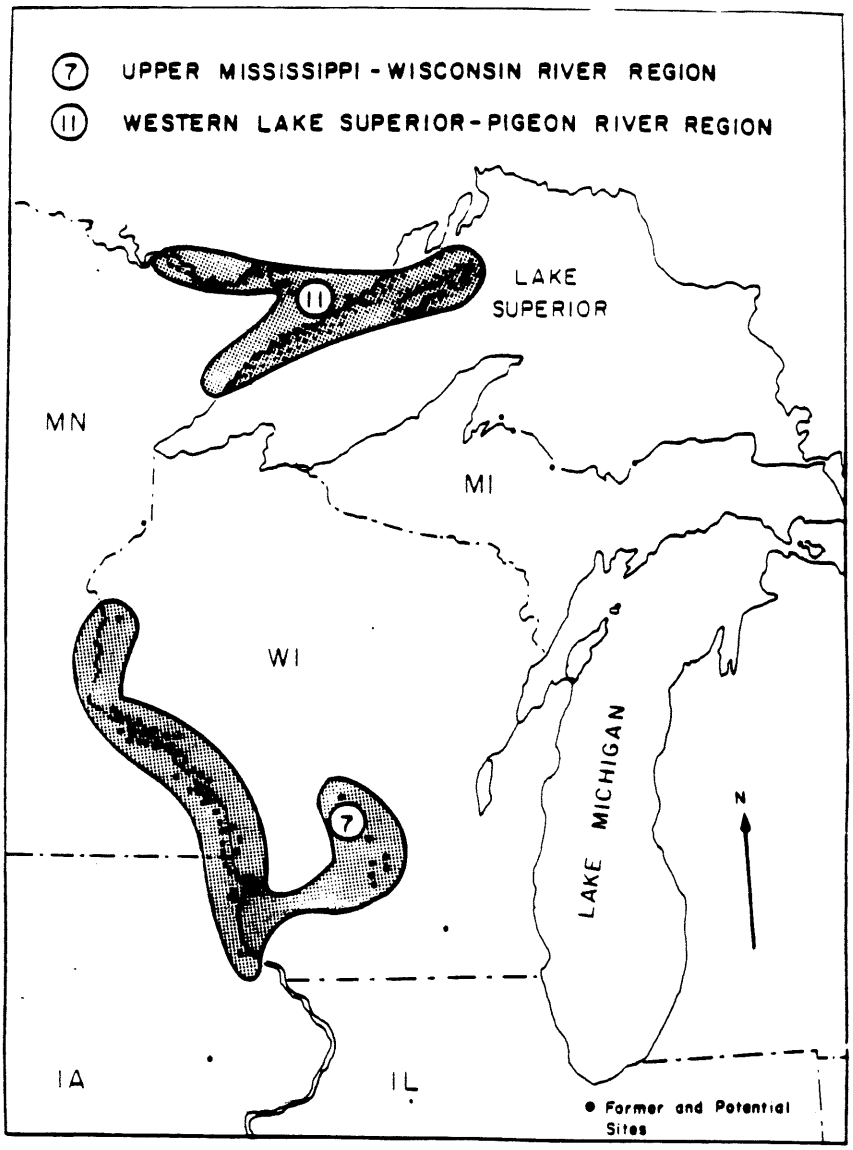
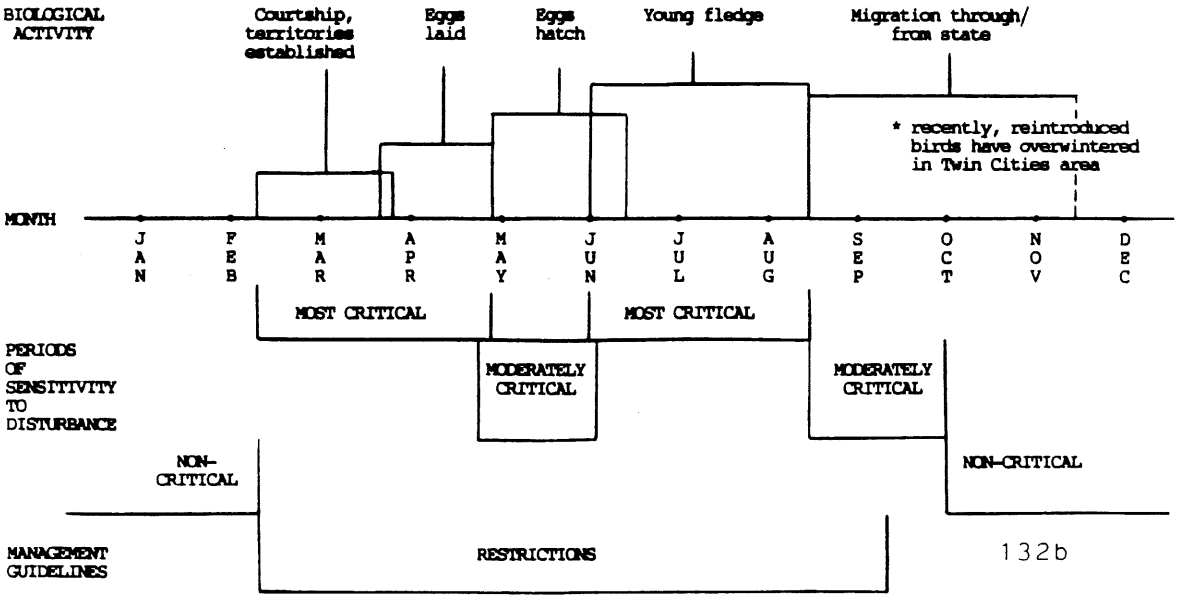


Figure 1. Geological regions that contain suitable habitat for occupancy and release of peregrine falcons in Minnesota. (U.S. Fish and Wildlife Service, 1979).

Figure II

PEREGRINE FALCONS
Phenology of activity in Minnesota



Tolerance to Human Disturbance - Studies have shown that peregrine falcons are sensitive to human activity within their territory. However, not all peregrines react in the same manner, and individual or pair tolerance can be extremely variable. The effects of disturbance vary with the timing and the proximity of the disturbance to the aerie. Also, the accessibility and height of the nesting cliff make a difference in the peregrines' tolerance to disturbance.

Many disturbances can be tolerated during the non-breeding season. However, in early spring, people and low flying aircraft above or near the nest site or aerie can cause desertion, particularly during courtship and egg laying. Another critical period occurs just prior to fledging when disturbance may cause premature departure of the young from the nest site. Even if human activities occur in a dispersed manner, the cumulative effect may be abandonment.

In the Eastern United States, peregrines appear more tolerant of human activity below than atop a nesting cliff. The local topography as well as the personality of the individual falcons also effects their tolerance to human activity.

For management purposes in Minnesota, three periods of sensitivity to disturbance can be identified:

1. Most critical - Courtship and egg laying (February 1 through May 1); and fledging (May 15 through July 15).

2. Moderately critical - Incubation and hatching through fledging and two months post-fledging when adults and young are still associated with the nesting cliffs (April 15 to May 15 and June 30 through August 30).

3. Noncritical - The non-breeding period from September 1 to February 1, provided adults are not year-round residents in their breeding territory.

As a general guideline for management purposes, human activity in the vicinity of the nest site will be restricted in the "most" and "moderately" critical periods from February 1 to September 1.

II. SITE SPECIFIC MANAGEMENT ACTIONS

These present guidelines establish minimum criteria for the protection and enhancement of peregrine falcon habitat in Minnesota.
Site specific management plans are intended to preserve and enhance important habitat features in a breeding territory. They should consider feeding areas, active and alternative nest sites, buffer zone configuration, special hazards, and previous breeding history. For planning purposes, three categories of habitat have been defined based on the habits and history of peregrine falcon nesting activity:

A) Active breeding habitat--those territories which have been reoccupied by peregrine falcons;

B) Essential habitat--historic aeries presently suitable for reoccupancy, and;

C) Potential habitat--seemingly suitable sites not previously known to have been active aeries.

The management plans will be prepared by the Regional Nongame Wildlife Specialist. A field review of the site and a discussion of management strategies with all interested parties will be undertaken prior to plan development. If private land is involved, the landowners will be notified and consulted.

Priority for management plan development includes:

1. Active breeding habitat on public and/or private lands.

2. Essential habitat on public or private lands that is threatened by some type of disturbance or development.

3. Essential habitat on public lands for which other management planning is being or has been accomplished.

4. Other essential or potential habitat on public lands in urban areas.

5. Private lands that are not threatened by development or habitat disruption.

6. Portions of the landscape that may or may not contain one or more peregrine territories and could provide a well-balanced ecosystem preserve (see item III. MANAGEMENT FOR CONTIGUOUS BREEDING AREAS).

A. Active Breeding Habitat - defined as those territories which have been reoccupied and/or hold a pair of breeding peregrines, or a single adult falcon. A site specific management plan will be prepared in order to minimize disturbance of active aeries during critical periods. Each known nest site will be protected by delineating three zones of management activity. These management zones must be established around all nest sites in a breeding territory regardless of the activity status, since alternate nest sites are an essential component of successful territories.

1. Primary zone - This should encompass the aerie as defined by the peregrine's defensive behavior and be at least 700 feet around the active and historic aeries within the breeding territory. Changes in land use or natural habitat should be prohibited in these zones except: 1) as necessary to protect or improve the nest site 2) for the management of other significant natural resources as described in the site specific management plan or 3) to provide for public observation as specified in the plan. Such actions shall only be conducted in the noncritical time or as prescribed in the management plan.

Public property in the zone should be designated as Scientific and Natural Areas or Natural Heritage Registry sites as recommended in the management plan. Owners of private property within the primary zones should be informed of The Nature Conservancy's Private Lands Registry Program and encouraged to register tracts with active or historic aeries. Such tracts shall also be considered for public ownership as Scientific and Natural Areas, as circumstances warrant.

2. Secondary Zone - This zone should extend for 1/4 mile from the nest site excluding the primary zone. Land use activities such as residential development and major construction that would result in changes in the sites' suitability for peregrine occupancy should be discouraged. Possible actions which maintain or enhance habitat, such as cutting live trees to "lengthen" the cliff face, can be permitted and should be encouraged. When feasible, such actions should not take place during the most and moderately critical periods. Human entry and low-level aircraft should be restricted and secondary roads and trails temporarily closed or rerouted in this zone during the critical periods, or permanently closed or rerouted as necessitated by the topography or behavior of resident birds and prescribed in the site specific management plan. Observation sites may be allowed in this zone as described in the management plan. Important foraging areas and alternative nest sites should be identified and protected. The suitability of the food supply should also be maintained by monitoring for toxic substances. Sources of pesticides or other contaminants should be eliminated.

3. Tertiary Zone - This zone may extend 10 miles or more if necessary to include the known foraging areas within the breeding territory. The configuration of this zone, therefore, may be variable. This is the least restrictive zone. The management plan should 1) address major land use activities to be monitored and 2) identify potential alterations detrimental to the success of the breeding territory that should be discouraged. Each site specific management plan should identify other hazards in this zone that may require additional considerations. Monitoring suitability of the prey supply should be undertaken in this zone as well (see also section IV).

B. Essential Habitat - In the United States, peregrines nest almost exclusively on cliffs, usually near water. The most preferred sites appear to be sheer cliffs at least 150 feet high with vertical faces of 40 feet or more and containing numerous small caves or overhung ledges. Generally, the cliffs are adjacent to a river or lake and sometimes rise from wooded talus slopes. In Minnesota, such habitat occurs primarily along the Mississippi River and its tributaries from Hastings south to Iowa, along the St. Croix River, and on the cliffs along the North Shore of Lake Superior, and in the Boundary Waters Canoe Area (Fig. 1). It is coincident with the peregrine falcon's historic breeding range in the state. Therefore, for purposes of planning in Minnesota, all historic

aeries which are unaltered by development or intense recreation and remain suitable for reoccupancy by breeding peregrines shall be considered. These historic nest sites, in combination with potential foraging areas, constitute the future "breeding territories" which are essential habitat for peregrines.

In Minnesota, such essential habitat may be found within one half mile of all historic aeries. The following guidelines should be applied in these areas in order to preserve and enhance habitat features important for the peregrines and to encourage reoccupancy.

1. Sites determined to be essential habitat should be:

   a. Registered with The Nature Conservancy's Minnesota Registry of Natural Areas (private land) or

   b. Acquired and/or designated as a state Scientific and Natural Area or Natural Heritage Registry site by the DNR's Scientific and Natural Areas Program (public land).

2. The private property owner should be encouraged to undertake the following actions which shall be required on public land.

   a. Leave the top and bottom of the bluff undeveloped.

   b. Preserve snags along the bluffs. The live trees on the nest cliff may be cut to "lengthen" the cliff face. However, cutting should be conducted only during fall or winter at active sites.

   c. Avoid disturbing the historic nest sites between February and July. Restrict hiking, rock climbing, off-road vehicles, timber harvest, hang gliding, bird watching, photography, shooting, airplane flights, or other activities near the cliff face.

   d. Through 1990, allow control of predators or nest site competitors to facilitate reoccupancy by peregrine falcons.

   e. Be informed on the potential for toxic substance contamination of the prey base in these areas.

   f. Monitor the site for peregrine use and report any activity to the Peregrine Falcon Recovery Program hotline (612-379-2134).

3. If reoccupancy of the site occurs or seems imminent, the Nongame Wildlife Specialist shall initiate a site specific management plan as prescribed in IIA., in cooperation with the property owners.

C. Potential Habitat - Potential habitats are those seemingly suitable cliff sites not previously known to have been active aeries. Selected urban areas with suitable tall buildings such as the Twin Cities,

Duluth, and Rochester are also considered potential habitat in Minnesota. These sites must have adequate food resources free from toxic contamination.

Management strategies for potential habitat in urban areas should include curtailment of the use of pesticides for pigeon control. An education and information effort to inform governmental officials and city residents of any intentional release or known occurrence of peregrines in the urban areas should also be undertaken to encourage public support and protection of the birds. In rural areas, potential sites should be identified and monitored for use by peregrines.

III. MANAGEMENT CONSIDERATIONS FOR CONTIGUOUS BREEDING AREAS

Planning should also encompass larger units where habitat is suitable for a number of nesting pairs. Two such management units have already been delineated for Minnesota (Fig. 1). The following actions should be accomplished for the management of peregrine habitat in these units.

1. Establish interstate cooperative agreements for the restoration of peregrines and the protection of essential habitat.

2. Inventory essential habitat and register or acquire such areas to promote proper management and protection.

3. Determine minimum number of territorial pairs desired in each unit and assure an adequate number of suitable nest sites for these birds.

4. Create a blufflands preserve zone that results in total ecosystem protection.

IV. ADDITIONAL MANAGEMENT CONSIDERATION FOR ALL HABITAT CATEGORIES

Major changing land use and development activity in the areas delineated by the management plans necessitate additional considerations in plan development as follows:

1. Distribution of habitat modification - Large contiguous areas of habitat should remain suitable, not just small specific sites where nests are currently located.

2. Upper limit to habitat modification - This should be clearly established in advance, and unplanned development should be discouraged or prohibited. Limits set in advance are generally more acceptable to persons desiring further development; the process permits reasonable negotiation and compromise and limits are easier to enforce. Large-scale development should be phased in over a period of years.

3. Human attitudes toward peregrines - The type of human wildlife interactions that occur depend on the predominant attitudes of local residents. Residents and visitors of some areas are very favorably disposed toward the birds, if not proud and

quite protective. They must be careful not to disturb the birds and help prevent disturbance or destruction by other persons. Such attitudes should be encouraged through education and law enforcement.

GLOSSARY

Aerie - A raptor nest containing eggs or young. As applied to peregrines the term describes the nest (normally a "scrape" or shallow depression in the earth) and the ledge or cavity where it occurs.

*Breeding territory - Generally the observable defended area. For peregrines (as described by Ratcliffe) it may be conceptualized as the share of country which appears to belong to each (peregrine) pair or ". . . the area defined by hypothetical boundaries lying mid-way between a nesting pair and its neighbors."

Nesting cliff - A term used to describe the rock face or range of crags frequented by a breeding pair.

Nest site - The actual position of the nest on the rock. For purposes of these guidelines, the term refers to historic, previously used sites, where we might anticipate reoccupancy by peregrines.

Phenology - the study of seasonal biological activity.

* Defined as used by Ratcliffe 1962.

Zone Reference

Agricultural Woodlots/River Bottom	Driftless	Transition and Prairie	Northern Forest	
x	x	x	x	agricultural leases, 57-58
x	x	x	x	amphibians (see reptiles)
x	x	x	x	ash, type management, 35
x	x	x	x	aspen/paper birch, type management, 27-28
x	x	x	x	as snags, 78-80
		x		Baird's sparrow, 96
	x	x	x	bald eagle, 120-123
		x	x	balsam fir, type management, 38
		x	x	in deer winter complexes - north, 62
x	x	x	x	basswood, type management, 31-32
		x	x	bear, 124-126
x	x	x	x	beaver, in lowland hardwood types, 35
x	x	x	x	in riparian zones, 22
x	x	x	x	belted kingfisher, 73
x	x			Black Hill spruce, 41
		x	x	black spruce, type management, 39
	x	x	x	Blanding's turtle, management for, 90-91
	x	x	x	range, 97
		x	x	bog (see wetlands, forest)
		x		bog lemming, 39
x	x	x		boxelder, 35
	x	x	x	browse regeneration, management for, 56
	x	x	x	in northern hardwood stands, 32
x	x	x		brush piles, 52
	x	x	x	buffer strips, 18
x		x		burrowing owl, 88-89
	x	x		butternut, 33
	x	x	x	central hardwoods, type management, 33
	x	x	x	cherry, 32
x		x		chestnut-collared longspur, 96
x	x	x	x	clearcutting, 19
x	x	x	x	colonial tree-nesting waterbirds, management for, 81
x	x	x	x	in riparian zones, 73
x				conifers, 41
	x			conifers, 40
		x	x	conifers, 36-39
x	x	x	x	cooperative farming agreements (see ag. leases)
x		x		cormorants, 81
x	x	x		cottonwood, 35

Zone Reference

Agricultural Woodlots/River Bottom	Driftless	Transition and Prairie	Northern Forest	
x	x	x	x	dead and down material, wildlife use of, 78
x	x	x		deer wintering complex, 64-65
		x	x	deer wintering complex, 62-63
x	x	x	x	in relation to TSI, 23
x	x	x	x	in relation to oaks, 29
x	x	x	x	in lowland hardwoods, 35
		x	x	deforested areas, 42
x	x	x	x	den trees, management for, 78-80
x	x	x	x	reserved in timber harvest, 18
x	x	x	x	in oak management, 25
x	x	x	x	in lowland hardwoods, 35
x	x	x		eastern red cedar, 81
x	x	x	x	edge, 44
x	x	x		egrets, 81
x	x	x	x	elm, management for, 35
x	x	x	x	snag considerations, 78-79
x	x	x	x	endangered species, raptors, 88
x	x	x	x	reptiles, 90
x	x	x	x	other animals, 96
x	x	x	x	fire utilization, guidelines for, 100
x	x	x		for prairie wetlands, 68
x	x	x		for native prairie, 69
		x		for prairie chickens, 87
		x	x	fisher
x	x			five-lined skink, 91
x	x	x	x	floodplains, 35
x	x	x	x	foodplots
x	x	x		in regards to prairie wetlands, 68
x	x	x		in regards to native prairie, 69
x	x	x		in regards to prairie chickens, 87
x	x	x	x	fruit trees, 53
			x	goshawk, 88
x	x	x	x	gravel pits, 75
x	x	x	x	grazing, 58
x	x	x	x	in regards to oak, 30
	x	x	x	in regards to central hardwoods, 33
x	x	x		in regards to native prairie, 69
x	x	x	x	in regards to reptiles, 90
		x	x	great gray owl, 115-117

Agricultural Woodlots/River Bottom	Driftless	Transition and Prairie	Northern Forest	
x				hackberry, 22
x	x	x	x	hard maple, type management, 31
x	x	x	x	herbicides, in regards to release, 22
x	x	x	x	herons, 81
x	x	x		hickory, 29
	x	x	x	jack pine, type management, 40
	x	x	x	reforestation, 22
x	x	x	x	lakes (see wetlands, forest)
x	x	x		loggerhead shrike, 96
	x	x	x	log landings, as wildlife openings, 49
x	x	x	x	lowland hardwoods, type management, 35
		x	x	low-quality hardwoods, 32
		x	x	lynx
x	x	x	x	management integration rationale, 14
x	x	x	x	marsh (see wetlands)
x	x	x	x	mast, 30
x	x	x	x	in TSI, 23
x	x	x	x	in aspen type, 27-28
	x	x	x	in central hardwoods, 33
		x	x	merlin, 88
		x		moose, habitat management for, 86
			x	moose, habitat management for (being developed)
x	x	x		native prairie, management for, 69
x				Norway spruce, 41
x	x	x	x	oaks, type management, 29-30
		x	x	old growth (being developed)
		x	x	osprey, 88-89
x	x	x	x	paper birch (see aspen)
	x	x	x	peregrine falcon, 88
x	x	x		pheasants, in ag. leases, 58
	x	x	x	pileated woodpecker
		x	x	pine marten
			x	piping plover, 96
x	x	x	x	plantation release, 22

Zone Reference

Agricultural Woodlots/River Bottom	Driftless	Transition and Prairie	Northern Forest	
x	x	x	x	planting, conifer, 22
x				ponderosa pine, 40
x		x		prairie chicken, habitat management for, 87
x	x	x	x	raptors, management for, 88-89
x	x	x	x	in wildlife openings, 44
x	x	x	x	in riparian zones, 73
	x	x	x	red pine, type management, 40
	x		x	red-shouldered hawk, 82
x	x	x	x	reforestation, 20-22
x	x	x	x	regeneration, natural, 22
x	x	x	x	regeneration, non-commercial, 51
x	x	x	x	reptiles and amphibians, management for, 90-91
x	x	x	x	in reforestation, 20
x	x	x	x	in brush piles, 52
x	x	x	x	in riparian zones, 73
x	x	x	x	riparian zones, 73-74
x	x	x	x	river bottoms (see riparian zones)
x	x	x	x	roads and trails, 50
	x	x	x	ruffed grouse, management for, 102-107
		x		sandhill crane, habitat management for, 92
x				Scotch pine, 48
x	x	x	x	seeding, conifer, 22
x	x	x	x	shade-tolerant northern hardwoods, type mgmt., 31-32
x		x	x	sharp-tailed grouse, 93
	x	x	x	shelterwood cut, in northern hardwoods, 32
	x	x	x	in oaks, 29
x		x	x	short-eared owl, 88-89
x	x	x	x	site preparation, conifer, 22
x	x	x	x	slash, in timber sales, 18
x	x	x	x	in riparian zones, 73
x	x	x	x	snags, management for, 78-80
x	x	x	x	in timber harvest, 18
x	x	x	x	in reforestation, 20
x	x	x	x	in TSI, 23-24
x	x	x	x	in aspen type, 28
x	x	x	x	soft maple, 35
x	x	x	x	soils evaluation, 16
x	x	x	x	special concern species, raptors, 88
x	x	x	x	other, 97
x	x	x	x	Sprague's pipet, 96
		x	x	spruce grouse, 36
x	x	x	x	swamps (see wetlands)

Extended Rotation Forest

GUIDELINE

July 1994

Department of Natural Resources
500 Lafayette Road
St. Paul, Minnesota 55155-4044

DNR EXTENDED ROTATION FOREST GUIDELINE

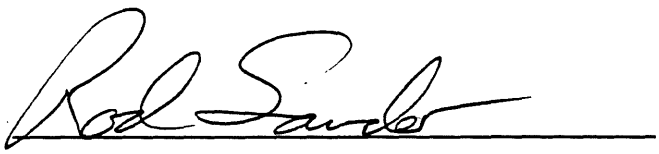
COMMISSIONER'S APPROVAL

This guideline provides DNR resource managers with the means to identify and designate DNR administered timberlands to be managed as extended rotation forest. The Extended Rotation Forest Guideline is intended to be implemented primarily through a landscape-based DNR region planning process. Identification and management of extended rotation forest areas on DNR administered lands is part of broader efforts in Minnesota to manage forest lands to provide benefits that are associated with older forests. The guideline should be considered as an interim policy as planning efforts at the landscape level evolve to integrate goals and coordinate management on all ownerships.

Development of the Extended Rotation Forest Guideline for DNR administered lands evolved out of the DNR's response to old growth issues raised through public reviews of DNR Area Forest Resource Management Plans. The DNR established an Old Growth Forest Committee to develop an old-growth forest policy. The committee saw the need for a guideline which would encourage older forests through timber management as well. Subsequently, the settlement of a lawsuit between the DNR, several environmental groups, the PCA and several other parties over the construction of MacMillan Bloedel's parallel strand board plant at Deerwood, Minnesota required the DNR to circulate for public review and adopt an Old Forest (now called Extended Rotation Forest) Guideline.

A number of public meetings on the guidelines were conducted in the latter half of 1990. More recently, a revised version was reviewed by a group of stakeholders who participated in a series of roundtable meetings to revise the DNR Old-Growth Forests Guideline. The Extended Rotation Forest Guideline is intended to be applied in conjunction with the DNR Old-Growth Forests Guideline and the development of desired future conditions through a landscape-based planning process.

This guideline is hereby adopted.



7-22-94

Rodney W. Sando, Commissioner **Date**

Minnesota Department of Natural Resources

EXTENDED ROTATION FOREST GUIDELINE

July, 1994

EXTENDED ROTATION FOREST

I. General Statement

The goal of the Extended Rotation Forests (ERF) Guideline is to maintain designated areas of forest or stands beyond traditional harvest ages as important components of Minnesota's Department of Natural Resources (DNR) administered timberlands. Extended rotation forests are areas or specific sites that have been assigned a management prescription to lengthen the time to the ultimate harvest of the tree(s) or stand. This ERF designation can apply to timber types managed with either even-aged or uneven-aged management prescriptions. These areas are composed of stands, groups of stands of any age, or a particular site identified through a planning process to meet desired future conditions. ERF management will allow older forest stands to develop in meeting a variety of resource objectives within landscape regions (ie: subsection level of the Minnesota Ecological Classification System; see map in the Old Growth Forests Guideline). Within each landscape region, extended rotation forest prescriptions can help maintain natural forest communities commonly associated with the landscape region. Regeneration harvests of these stands will be accomplished with appropriate silvicultural considerations and harvesting techniques for the specific stand or stands to assure that regeneration to the desired forest cover types is not jeopardized. Designated sites will retain their ERF prescription as regenerating stands grow into the next forest.

A. Biological Diversity serves as an umbrella concept:

> Biological diversity refers to the diversity of life in all of its forms and at all levels of organization. Biodiversity encompasses a broad spectrum including the diversity of genes, species, communities, ecosystems, landscapes, and biomes. It also refers to the ecological structures, functions, and processes at all of these levels. " Biological diversity occurs at spatial scales that range from local through regional to global."[1]

Extended rotation forests make an important contribution to conserving biological diversity in Minnesota. Biological diversity conservation requires maintaining portions of forest communities in each successional stage. Extended rotation forests insure that an adequate acreage of forests older than rotation age are maintained on a continuing basis.

---

[1] Society of American Foresters,1991.

Extended rotation forests can be important to local economies where sawmills provide another justification for growing trees to a larger size than those needed for a pulpwood economy. Large trees are also important to a tourism industry that is sensitive to aesthetics in forest settings.

B. Identification Objectives

Identification of extended rotation forest areas should be done with complementary objectives in mind. For example, managing for large trees, sawlog production, forest interior species, and aesthetics may be complementary considerations. Likewise, management for cavity-nesting birds and mammals in an aspen stand would complement management for an understory conifer species. In this manner, extended rotation forest prescriptions are not used as a hard science, but rather a management tool or philosophy to achieve a desired future condition for a geographic area.

C. Purpose

The purpose of this document is to provide management guidelines that will produce benefits associated with forests older than rotation ages identified in Table 1 of this document. The guidelines:

- List management objectives that can be met through application of ERF prescriptions,
- Outline a process for incorporating ERF prescriptions into timber management plans,
- Provide criteria for selecting areas on which to practice extended rotation forest management,
- List modifications of standard management practices to obtain desired benefits from older forests, and
- Identify minimum extended rotation ages for affected forest cover types.

Conditions and products associated with older forests are similar to those found in old-growth forests (see Old-Growth Forest Guideline) including larger trees, larger snags, living decayed trees, downed logs, and greater structural diversity. These conditions can develop in all forest types, including aspen, birch, and other seral types that do not develop into old-growth stands as defined in the Old-Growth Forest Guideline. These older forest conditions normally develop at stand ages greater than the average recommended rotation ages for the following forest cover types on DNR-administered lands (Table 1, page 3).

Table 1. Average Recommended Rotation Age (1990)[2]

Cover Type	Rotation Age
Jack Pine	50
Red Pine	100
White Pine	100
Balsam Fir	50
White Spruce	60
Northern White Cedar	100
Northern White Cedar (mineral soil)	80
Black Spruce	90
Black Spruce (mineral soil)	70
Tamarack	90
Tamarack (mineral soil)	60[3]
Oak	80
Elm/Ash/Cottonwood	90
Maple/Basswood	80
Aspen	40
Paper Birch	40
Balsam Poplar	40

Older stands of most forest types are currently common in most areas of the state. Even at accelerated harvest levels, older forests will remain common in many areas beyond the year 2000. By 2010, and for a period of 15 to 20 years thereafter, older forests dominated by intolerant species may be less common in some areas, with or without harvest, due to existing age structure and successional trends. Application of ERF prescriptions will be required to maintain the benefits provided by these older forests.

II. Extended Rotation Forest Objectives

An extended rotation forest prescription may be appropriate in areas or individual stands where one or more of the following products or benefits are desired:

A. **Timber:** Selective harvest or deferring the ultimate harvest of the tree(s) or stand can provide for larger products such as sawlogs or enable an understory to become merchantable (e.g., balsam fir in an aspen stand) by allowing it to grow past the traditional rotation ages of the overstory species.

[2] Rotation ages adopted from the U.S.F.S. Managers Handbook series and modified by the Division of Forestry for planning purposes.

[3] Adopted from unpublished management guide by W.F. Johnson, 1982.

B. **Old-Growth Buffers:** Deferred or selective harvest in Special Management Zones surrounding old-growth or future old-growth stands minimizes disturbances adjacent to the old-growth stands while providing opportunities that encourage regeneration and development of preferred understory species (e.g., white pine understory in an aspen stand).

C. **Wildlife/Plant Communities:** Large snags, live decayed trees, and down logs provide important feeding sites, nesting sites, resting sites, and substrates for many forest species. Structural diversity resulting from a multi-layered canopy, canopy gaps, and conifer understories in hardwood stands provide important habitat requirements for species ranging from deer to wood warblers to vascular plants. Forests with larger, older trees of a variety of ages provide habitat for a broad spectrum of life forms including birds, mammals, invertebrates, epiphytic lichens, and fungi and other soil organisms.

D. **Recreation/Aesthetics:** Visitors to parks and forests are often attracted to campgrounds, picnic areas, and trails in areas with large trees where forest management activities are not obvious. The unique aesthetic experience associated with older forests, shaded campgrounds, and associated plants and animals are attractive to many recreation visitors. Managing for extended rotation forests near recreation areas will mitigate the likelihood of visitors taking exception to harvests adjacent to the developed recreational sites.

E. **Soil and Water:** Reducing the frequency of management activities on highly erodible or compactible soils and wetlands contributes to the conservation of site nutrients, increased protection to streams, and improvement of riparian values. (Also see Riparian Zones Guideline and Water Quality Best Management Practices).

The selection of an area for extended rotation management to provide one or more of the above objectives, recognizes that management prescriptions that optimize one objective may result in less than optimal values for other objectives. For example, managing primarily for aesthetics/visual quality may result in less frequent harvests and a modified distribution of dead snags and down logs that are used by many forest wildlife species. Therefore, a primary management objective that promotes the planned desired future condition of the area should be assigned to each stand, group of stands, or specific areas identified for extended rotation management so that appropriate timber marking guides, harvesting techniques, and other management activities are employed that result in the desired multiple benefits for each unit.

III. Specific Guidelines for Timber Management Planning

The minimum percentage of timberland to be managed with the ERF prescription, will vary among landscapes. A minimum of 10 percent of the timberlands administered by the DNR within each landscape region (sub-section level of the Minnesota Ecological Classification System) should be managed under ERF prescriptions regardless of cover type. In some landscape regions, it may be appropriate to manage more than 50% of the timberlands under

ERF. Desired future condition goals identified in region plans will guide the percent of each landscape unit to be managed as extended rotation forest. Extended rotation forest prescriptions will be applied to particular areas, a stand, or groups of stands to achieve the stated conditions. Application of ERF prescriptions should emphasize stands and stand groups where extended rotation management compliments other management objectives.

Specific sites on DNR-administered land to be managed as extended rotation forests will be identified in area timber management plans. Each area should prepare an assessment of old forest conditions by landscape unit on all ownerships in the area. Forest Inventory Assessment (FIA) inventory data and forest management plans of other public agencies should be reviewed to determine if older forests exist and how much is currently managed under guidelines that will maintain older forest benefits. The general location of lands managed as extended rotation forests should be indicated on appropriate maps. Cooperative Stand Assessment (CSA) inventory data will be analyzed to identify opportunity areas for extended rotation forest prescriptions on DNR-administered timberlands. Using this information and the extended rotation forest objectives in the regional plan, areas to be managed for older forest benefits will be identified by Area Forestry and Area Wildlife personnel in consultation with Wildlife Unit Managers and Park Managers who administer lands within the area, and other appropriate resource personnel or public land management agencies (see site selection guidelines below).

Identified areas of DNR administered lands to be managed under ERF prescriptions will be labeled on appropriate maps. Geographic Information System (GIS) applications run prior to the Timber Management Planning Information System (TMPIS) program can aid in identifying the location of probable ERF areas and stands for resource manager review. During timber management planning using TMPIS, stands retrieved to screen that lie within the designated ERF areas will be assigned the all-aged prescription. The all-aged prescription allows managers to carry identified stands beyond the normal economic rotation age. Periodic selective harvests as well as final clear-cuts can be designed to meet a variety of compatible goals such as providing for larger timber, enhanced aesthetics, and conservation of biological diversity.

IV. Specific Guidelines for Selection of Extended Rotation Forest Areas

Extended rotation areas should be selected in locations where it is likely that the desired objectives (see page 4) can be met. Factors to be considered in identifying areas include:

- Location/distribution across the landscape region
- Connectivity/relationship to other selected stands
- Site capability/productivity
- Size of identified area (distribution of small, medium, and large areas)
- Vegetation composition goals or desired future condition
- Management objective(s)/compatibility for multiple benefits
- Present stand conditions.

The following paragraphs give some examples of factors that favor or limit the ability of sites to meet specific extended rotation management objectives.

Timber - Areas selected to produce sawlogs on an extended rotation should have "good" current stand quality and good site productivity for the desired species. Stands to be managed to produce a merchantable understory must have the desired species present in the understory and an overstory that is likely to survive until the understory is established. Areas that should not be considered for extended rotation include those where the overstory is at high risk to insect, disease, or blowdown and there is no significant understory. Traditional insect and disease outbreak areas where extended rotations would increase the risk of insect and disease attack are also poor choices for extended rotation forest prescriptions. Extended rotations should not be prescribed if regeneration of the desired species is jeopardized.

Old-Growth Buffers - Special Management Zones within 330 feet of old-growth or future old-growth stands will be considered for ERF prescriptions, particularly when all-aged management prescriptions would contribute to maintenance or restoration of the adjacent old-growth species over a broader area.

Wildlife/Plant Communities - Areas selected should provide 1) habitats/habitat features for plants and animals characteristic of older forests or mixed coniferous-deciduous forests, 2) successional stages of forest communities that are uncommon on the landscape, 3) large blocks of mature/older forest as habitat for forest-interior species, 4)corridors linking patches of mature/older forest, and 5) buffers surrounding old-growth stands.

Recreation/Aesthetics - Stands containing or adjacent to designated recreational facilities or areas that are visually sensitive are well suited to extended rotation prescriptions. As an example, limiting the frequency of disturbance is appropriate for many stands adjacent to recreational trails, roads, or water bodies.

Soil and Water - Riparian zones are often ideally suited to extended rotation forest prescriptions for wildlife, aesthetic, and water quality protection objectives. Sites with erodible or compactible soils where it is desirable to reduce the frequency of management impacts may be suited to extended rotation forest prescriptions.

V. Extended Rotation Forest Management Practices

Management practices in forests managed on an extended rotation should retain or enhance the desired characteristics of older forests. The management practices will vary depending on the particular objectives for a given area. For example, timber harvest marking guidelines will be different in an all-aged northern hardwood stand managed for large sawlog production from those in an aspen stand where the objective is to manage for an understory of white pine or spruce/balsam. Suggested extended rotation ages for various types and site classes are listed in Table 2, page 7.

A. **Timber** - Timber harvest options for extended rotation forests include 1) intermediate and improvement thinning and regeneration harvests for even-aged stands or 2) periodic, selective harvests for all-aged stands. Regeneration and cultural treatments will be similar to those recommended in the North Central Forest Experiment Station's *Manager's Handbook* series for the common forest types unless more specific guides are available.

B. **Wildlife/Plant Communities** - Management practices will be highly dependent on the species or plant community for which the area is being managed. When ERF prescriptions are made primarily for wildlife benefits in the planning process, it may be desirable to carry the identified stand/stands to its ultimate harvest without intermediate treatments. Specific guidelines can be found in the "Special Area" and "Special Species" sections of the *Forestry - Wildlife Guidelines to Habitat Management* and the "Wildlife Considerations" sections of the *Manager's Handbook* series. Other management guidelines and publications should be considered where appropriate.

C. **Recreation/Aesthetics** - See the "Recreation" and "Aesthetics" sections of the *Manager's Handbook* series until more specific guidelines addressing aesthetics are developed and available. Special management techniques are required for stands containing developed recreation facilities that will develop substantial numbers of "hazard" trees if held beyond normal rotation. (See the DNR Hazard Tree Management Policy and Guidelines)

D. **Soil and Water** - See *Water Quality in Forest Management: Best Management Practices in Minnesota.*

Table 2. Minimum Extended Rotation Ages (Stand and individual tree age at final harvest)

Cover Type	Site Index	Rotation Age
Jack Pine	50 - 60	60
Jack Pine	> 60	70
Red Pine	55 - 65	120
Red Pine	> 65	150
White Pine	55 - 65	150
White Pine	> 65	180
Balsam Fir (upland, dry)	NA	60
Balsam Fir (transition, wet)	NA	70
Balsam Fir (swamp, wet)	NA	80
White Spruce	55 - 65	80
White Spruce	> 65	100
Northern White Cedar (mineral soil)	All	120 - 150
Northern White Cedar (organic soil)	>35	110 - 140
Northern White Cedar (organic soil)	<35	130 - 160
Black Spruce (mineral soil)	All	70
Black Spruce (organic soil)	>35	115
Black Spruce (organic soil)	<35	150
Tamarack (mineral soil)	All	70

Cover Type	Site Index	Rotation Age
Tamarack (organic soil)	>40	100
Tamarack (organic soil)	<40	120
Red Oak Family and White Oak Family	50 - 60	120
Red Oak Family and White Oak Family	> 60	150
Black Ash - Yellow Birch	50 - 60	120
Black Ash - Yellow Birch	> 60	130
Sugar Maple - Basswood	> 60	120
Aspen	50 - 60	50
Aspen	> 60	60
Paper Birch	50 - 60	60
Paper Birch	> 60	80
Balsam Poplar	50 - 60	50
Balsam Poplar	> 60	60

Manager's Notes

GLOSSARY OF TERMS

ALL-AGED: A stand in which all ages or age classes from seedlings to mature trees (may include old growth) are represented.

AVERAGE AGE: The average age of at least two dominant or co-dominant trees of the main species of the predominant size class within the stand.

AVERAGE DIAMETER: An observed average diameter of the predominant size class of the main species in the stand measured 4 1/2 feet above the ground.

CANDIDATE OLD-GROWTH STAND: A stand that exhibits certain age, average diameters, and stand size characteristics consistent with those observed in known old-growth stands of a similar community type.

CANOPY GAP: An opening in the forest canopy.

CLEAR CUT: The removal of all trees during harvest to permit the reestablishment of an even-aged forest. A management option used to regenerate shade-intolerant species.

COMMUNITY TYPE: An assemblage of native plants that tends to reoccur over space and time.

COOPERATIVE STAND ASSESSMENT (CSA): Stand by stand examination of condition, composition, size, age, health of trees on all DNR-administered lands for operational and planning purposes.

CORD: A unit of volume for stacked, round, or cleft wood; contains 128 stacked cubic feet.

FOREST INVENTORY AND ANALYSIS (FIA): A statewide forest survey of timber lands jointly conducted by the MN DNR and the U.S. Forest Service that periodically, through a system of permanent plots, assesses the current status of, and monitors recent trends in, forest area, volume, growth, and removals.

FOREST INTERIOR SPECIES: Forest species that require large areas of contiguous forest and are negatively affected by "edge effects."

GIS: Geographic Information System. Computer software used to manipulate, analyze, and visually display inventory and other data and prepare maps of the same data.

LANDSCAPE REGION: A geographic region of Minnesota that is defined by similar landforms, soils, climatic factors, and potential native vegetation. Landscape regions are equivalent to the subsection level in the Ecological Classification System Map of Minnesota.

MANAGEMENT: The implementation of planned activities designed to provide a certain product or amenity from an ecosystem or to develop or maintain a certain set of conditions

within that ecosystem. Forest management activities range from intensive silviculture to protection of natural areas from human disturbance.

MESIC SITE: A site intermediate between extremely dry and wet; soil and water relationships generally are favorable to tree growth.

NATURAL AREA REGISTRY SITE: A tract of public land managed to protect its rare and unique features, species, and/or communities under a memorandum of understanding between the administering agency and the Scientific and Natural Area Program.

NATURAL HERITAGE PROGRAM: A program within the DNR responsible for identifying and evaluating the status and quality of rare species, communities, and landscapes.

OVERSTORY: That portion of the trees in a forest that forms the upper or uppermost canopy.

PHYSIOGRAPHIC CLASS: A measure of available moisture on a site as it affects the suitability of the site for growing trees (see CSA - Phase II - manual for descriptions and codes).

RIPARIAN ZONE: That area of vegetation growing in close proximity to a watercourse, lake, swamp, or spring, and often dependent on the roots reaching the water table.

ROTATION AGE: The period of years required to establish and grow timber crops to a specified condition of maturity; this time period is an administrative decision based on economics, site condition, growth, or other factors.

SCIENTIFIC AND NATURAL AREA (SNA): Lands and waters dedicated by the DNR for protection of rare and unique features, species, and/or communities.

SELECTIVE HARVEST: Removal of single scattered trees or small groups of trees at relatively short intervals; the continuous establishment of reproduction is encouraged and an all-aged stand is maintained; a management option for shade-tolerant species.

SERAL TYPES: Forest types dominated by shade-intolerant tree species that tend not to regenerate themselves to the same cover type.

SHADE TOLERANCE: The measure of the genetic and physiological capacity of a plant species to develop in a given light regime; the capacity to withstand low light intensities due to shading by surrounding vegetation. Tolerant species are tolerant of shade, intolerant species require full sunlight.

SILVICULTURE: The theory and practice of controlling the establishment, composition, growth, and quality of forest stands
to achieve the objectives of management.

SITE INDEX: A measure of site class or quality, based upon the height of the dominant trees in a stand at a chosen age.

SNAG: A standing dead tree or a portion of such a tree.

STAND: A contiguous group of trees sufficiently uniform in age, composition, structure, site quality, or geography to be a homogeneous and distinguishable unit.

STRUCTURAL DIVERSITY: Diversity of structural characteristics in forest ecosystems. Structural characteristics include different types of life forms, tree sizes, vegetation layers, snags, down logs, canopy gaps, etc. Structural diversity can be assessed both horizontally and vertically within a forest.

SUCCESSION: The change in composition and structure of a natural community over time.

TIMBER STAND IMPROVEMENT (TSI): A loose term comprising all intermediate cuttings or other manipulations made to improve the reproduction, composition, structure, condition, and volume growth of a stand.

TIMBERLAND: Forest land producing or capable of producing crops of industrial wood and not withdrawn from timber utilization by statute or administrative regulation. Generally, this includes areas suitable for growing crops of wood in excess of 20 cubic feet per acre annually.

UNDERSTORY: Small trees and other vegetation growing under an overstory or canopy of taller trees.