Ruffed Grouse in Minnesota: A Long-Range Plan for Management

Artwork by Noel L. Dunn

"Everybody knows that the autumn landscape in the north woods is the land, plus a red maple, plus a ruffed grouse."

Aldo Leopold

DRAFT

Division of Fish and Wildlife
Minnesota Department of Natural Resources
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The Minnesota Department of Natural Resources' Division of Fish and Wildlife Grouse Management Committee wrote this Ruffed Grouse Long-Range Management Plan. The Division's Management Team approved the plan on September 9, 2011.

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Executive Summary

Minnesota is regularly one of the top three states in total ruffed grouse harvest, alternating with Michigan or Wisconsin for the number one rank. The three to seven birds annually harvested per hunter in Minnesota are unsurpassed (MN DNR 2008a). The long-term average annual harvest in Minnesota is about 545,000 birds (since 1983). Minnesota harvested over 1.2 million ruffed grouse per year when the grouse population was at or near its cyclic peak (MN DNR 2002 and MN DNR 2004). Grouse populations and habitat suitability are strong in Minnesota, and the future of grouse in the state is encouraging.

Our **long-range vision** for ruffed grouse in Minnesota includes sufficient quantity, quality and spatial distribution of habitat to support robust grouse populations throughout the species' range in the state. We also envision a fairly stable number of hunters enjoying a range of quality hunting experiences, and having adequate access to public lands. With this ruffed grouse management plan, we strive to move Minnesota towards this vision.

A **guiding principle** of this management plan is the Minnesota Department of Natural Resources' (MN DNR) conviction that management strategies implemented for ruffed grouse will contribute to the overall health of Minnesota's forested landscapes. Forest management practices that are ecologically sound, and socially and economically beneficial to Minnesota citizens, will result in sustainable forests and sustainable ruffed grouse populations.

Long-term goals for ruffed grouse management in Minnesota are:

1. to ensure the viability of ruffed grouse populations and their forest habitat,
2. to manage ruffed grouse as an integral part of Minnesota's forested landscapes, and
3. to encourage and promote recreational opportunities for the enjoyment (hunting and observing) of ruffed grouse.

As **indicators and targets** of meeting ruffed grouse management goals: 1) annual harvest will be consistent with long term average annual harvest, 2) Minnesota will remain the top ranked state for average annual harvest, 3) satisfaction of ruffed grouse hunters, as measured through periodic surveys, will remain constant or improve, and 4) at least 65% of mixed hardwood/hardwood forest types of MN DNR timberland will be in a younger forest condition[1].

A **formidable array of challenges is shaping forests today**: fragmentation, invasive species, climate change, disease, and changes in forest-based economics and recreation. Global competition in the forest products industry is inducing changes in the species and size of timber used by forest industries, increasing demand for woody biomass, changing forestland ownership, and shrinking access to forestland for public recreational use (MN DNR 2009a).

In this plan, **management issues** that affect our ability to achieve management goals for ruffed grouse are discussed. **Management strategies,** measures taken to resolve or minimize management issues in order to achieve the goals, are also presented.

To better engage people in ruffed grouse management, we present a comprehensive review of **biology, ecology,** and **habitat needs** of ruffed grouse in Minnesota. Trends in grouse populations, recreation, and forest composition are also discussed.

[1] Younger forest condition means small or medium diameter size class, which is typically at or below normal rotation age, depending on forest type and geography.

Quality Hunting Issues

Issue 1: Hunters need access to grouse habitat that accommodates an array of hunter preferences and abilities.

Issue 2: In recent years the number of ruffed grouse hunters appears to be dropping. The cause of this decline is not fully understood.

Quality Hunting Strategies

Strategy 1: We will enhance the quality of hunting opportunities by providing more hunter access to grouse habitat and offering a balanced mix of hunting experiences.

Strategy 2: We will put programs in place to recruit new and retain existing grouse hunters.

Quality Habitat Issues

Issue 1: A percentage of aspen stands will be converted to mixed conifer-hardwood stands. The quality of ruffed grouse habitat in these stands will depend upon how they are managed.

Issue 2: Some current and emerging silvicultural practices (such as intensive thinning) may be incompatible with management for ruffed grouse habitat.

Issue 3: Not all forest management objectives consider ruffed grouse.

Issue 4: Surveys indicate a trend of declining ruffed grouse populations in southeast Minnesota.

Issue 5: Land managers do not consistently have clear recommendations for ruffed grouse habitat management in the context of sustainable forest management.

Issue 6: There exists an untapped potential to improve ruffed grouse habitat management on private lands. Landowners are not widely informed of ruffed grouse habitat needs and management practices.

Quality Habitat Strategies

Strategy 1: We will apply ecologically sound silvicultural practices to manage for ruffed grouse habitat.

Strategy 2: We will provide resource managers with science-based techniques and ensure the information is understood and applied.

Strategy 3: We will enhance emphasis of ruffed grouse management objectives in landscape-level management plans.

Strategy 4: We will encourage other landowners to manage for ruffed grouse habitat.

About This Document

Purpose

The purpose of this plan is to communicate the Minnesota Department of Natural Resources' (MN DNR) ruffed grouse long-range management goals, measurable management indicators and targets, identified conservation drivers, and management issues. Preliminary management strategies are also identified. This plan relies on the interest and participation of the public in finalizing goals, issues, strategies and specific actions.

The plan is presented in three parts. Part 1 (The Plan) outlines the resource management difficulties we face, and identifies management goals, indicators of progress, management issues, and strategies. Part 2 (Management Context) looks at conservation drivers (complex landscape trends that influence ruffed grouse management), as well as recreation, habitat assessment, economic, and research topics. Part 3 (Biology and Ecology) covers ruffed grouse life history and habitat needs in Minnesota. Grouse population information is also presented in Part 3.

Guiding Principle

A guiding principle of this management plan is MN DNR's conviction that management strategies implemented for ruffed grouse will contribute to the overall health of Minnesota's forested landscapes. Forest management practices that are ecologically sound, and socially and economically beneficial to Minnesota citizens, will result in sustainable forests and sustainable ruffed grouse populations.

Public Review Process

Early in the development of this document, MN DNR sought input and suggestions from the general public and resource managers. In 2006, an early draft of portions of this plan was made available on the MN DNR website and interested parties were invited to comment online or by mail. Comments were received from 70 individuals. These comments are summarized in Appendix B. Modifications consisted mostly of clarification of specific subjects (such as justification for current bag limits) and did not affect the direction of long-term ruffed grouse management.

The next phase of review will target further refinement of strategies to address management issues. This review will include grouse experts and stakeholders. Multiple opportunities for providing comments will be provided. Media and web-based releases will announce the timelines and other details for this input process.

To better meet the needs of stakeholders, we anticipate future focus group meetings to help identify specific actions. For example, we will seek input from disabled hunters on ways to provide more and better grouse hunting opportunities for all.

PART 1 - The Plan

2050 Vision Statement

In 2050, ruffed grouse habitat is of sufficient quantity, quality, and spatial distribution to support a robust grouse population throughout the species' range in Minnesota. Ruffed grouse are a leading small game species pursued by residents and the state is a favored destination for non-resident grouse hunters. Ruffed grouse hunters enjoy a range of quality hunting experiences, and have adequate access to public lands. The number of hunters participating in ruffed grouse hunting is near historical levels. Minnesota maintains adequate grouse habitat and large forested public land base – key components in providing quality hunting experiences. Hunter recruitment and retention efforts emphasize this aspect of grouse hunting in Minnesota. Local communities and the broader citizenry understand and appreciate the value of healthy forests and healthy grouse populations. This ruffed grouse management plan strives to move Minnesota towards this vision.

The Challenge Ahead

Minnesota is regularly one of the top three states in total ruffed grouse harvest, alternating with Michigan or Wisconsin for the number one rank. The three to seven birds annually harvested per hunter in Minnesota are unsurpassed (MN DNR 2008a). The long-term average annual harvest in Minnesota is 545,000 birds. Minnesota has harvested over 1.2 million ruffed grouse when the grouse population was at or near its cyclic peak (MN DNR 2002 and MN DNR 2004). The future of ruffed grouse in Minnesota is encouraging because the population and habitat suitability are strong.

Most ruffed grouse habitat management is accomplished in the course of forest management activities by federal, state, and county agencies. Additional habitat is managed when logging occurs on industrial and non-industrial private forestland. Managing ruffed grouse habitat via commercial logging is the most economical and efficient method, and affects the greatest amount of grouse habitat on an annual basis. Planning is typically at the landscape scale, where decisions are made to regenerate aspen forests through commercial clearcutting, or at the stand level when deciduous inclusions are retained in other forest types.

State and federal forest management plans prescribe altering forest types and age classes in a manner that will reduce aspen and increase conifers. Some hunters have expressed concern that these changes could prevent populations from reaching previous peaks in Minnesota (Dickson 2006). The 2007 North American Grouse Management Plan states that wise grouse management requires an ecosystem approach that provides a mosaic of ecological communities across a landscape (Association of Fish and Wildlife Agencies 2007). MN DNR agrees, and believes our commitment to sustainable forest management will bring a better balance to Minnesota forests, while still supporting the state's ruffed grouse population.

Aspen forest type is important for high quality ruffed grouse habitat, but management of aspen acres (not just the number of acres) is also very important. As discussed later in this document (page 14 and 23), aspen stands will be more actively managed and we believe this management will mitigate the reduction in overall acres of aspen forest type. For example, in the recent decade high percentages of aspen stands were very young (less than 10 years) or older (over 60 years); very little aspen acreage of middle ages occurred. Current and future management is balancing age-classes so there will be significantly more aspen acreage less than 60 years old. This balancing is positive for ruffed grouse.

Minnesota's commercial timber industry has produced forest habitat conditions that favor ruffed grouse. Forest products manufacturing shipments in 2008 were valued at approximately $8.6 billion and is the fourth largest manufacturing industry in Minnesota (based on employment). In 2009 Minnesota's timber industry consisted of: five pulp and paper mills, 3 recycled pulp and paper mills, 3 hardboard and specialty mills, 2 oriented strand/structural board facilities, over 500 sawmills, and nearly a thousand associated businesses and secondary manufacturers (MN DNR 2010a).

Recent **economic downturn in timber markets** has changed commercial timber activity on state, federal, county, industrial, and non-industrial private land. In 2007 total wood harvest from Minnesota timberland dropped below 3 million cords for the first time in ten years. Estimates for 2008 and 2009 indicate that harvest levels have remained in the 2.7 to 2.9 million cord range. Changes in commercial timber activity will change the amount and distribution of ruffed grouse habitat in Minnesota.

Woody biomass harvest is an ancillary change in the timber industry. Biomass (all forms, not just woody) is the largest source of renewable energy (MN DNR 2010a). When done in the right places and in the right manner, woody biomass harvest offers a growing opportunity to conduct commercially viable harvest and create suitable ruffed grouse habitat.

Distance from a mill, forest stand type and age, access, and current prices (etc.) all influence commercial harvest activity. In the coming years we may find there is a need to offset low rates of commercial

harvest activity (round wood and/or woody biomass) in some areas of the state. Ruffed grouse habitat projects that are not part of commercial operations can be accelerated and expanded if habitat project dollars are available. However, it will be impossible to carry out non-commercial activity at the same scale (number of acres) as commercial activity.

Growing knowledge (about grouse, forest communities, and silvicultural practices) and technology (G.I.S. mapping, G.P.S. positioning, and computer modeling) enables us to better focus habitat management (commercial and non-commercial). The most suitable practices can be implemented in forest stands where they will be most beneficial, and most likely to improve hunter opportunities.

As discussed later (page 26), ruffed grouse hunter numbers and hunter effort (days spent hunting) are declining. The decline is likely a natural outcome of the long term national trend of declining hunting participation. The suspected reasons include an aging hunter base, changing demographics, and a shift toward a more urban culture that has become disengaged from a hunting heritage. That said, future grouse hunters will likely have less competition for grouse on public lands and may as a result have greater overall satisfaction. We do not fully understand the reasons for the drop off. We need to engage people to better understand this change and plan future actions.

We do not know what the future will bring; nor do we fully understand the potential impacts on habitat for grouse and grouse populations. We do have challenges and hard work ahead of us. Timber markets, forest harvest activity, forest stand characteristics, and ruffed grouse population indicators will be continual monitored as we go through these uncertain times. In spite of the challenges, we look forward to a future of ecologically diverse forests, viable economic communities, and abundant recreational opportunities.

Management Goals, Indicators, and Targets

Long-term goals for ruffed grouse management in Minnesota are to:

- ensure the viability of ruffed grouse populations and their forest habitat,
- manage ruffed grouse as an integral part of Minnesota's forested landscapes, and
- encourage and promote recreational opportunities for the enjoyment (hunting and observing) of ruffed grouse.

Indicators and Targets

We will know we are reaching our ruffed grouse management goals, if:

1) annual harvest (number of birds) is consistent with long term average annual harvest trend,
2) Minnesota remains the top ranked state for the long term average annual harvest (number of birds per hunter),
3) satisfaction of ruffed grouse hunters, as measured through periodic surveys, remains constant or improves, and
4) at least 65% of mixed hardwood/hardwood forest types of MN DNR timberland are in a younger forest condition.[2]

[2] Younger forest condition means small or medium diameter size class, which is typically at or below normal rotation age, depending on forest type and geography.

Management Issues and Strategies

Issues are problems that affect the ability to achieve our management goals and can be affected with direct and timely strategies. **Strategies** are direction taken to resolve or minimize issues in order to achieve the goals. Some strategies address multiple issues. Strategies will be implemented by undertaking specific actions that will be outlined in **annual work plans**. Strategies outlined in this plan will be implemented over the next decade.

Quality Hunting Issues

Issue 1: Hunters need access to grouse habitat that accommodates an array of hunter preferences and abilities.

The quality of a hunting experience is influenced by a number of factors and is unique to an individual hunter's expectations. Influential factors include: access, mode of travel, use of dogs, density of hunters, hunter skill, and number of grouse flushes per outing.

Issue 2: In recent years the number of ruffed grouse hunters appears to be dropping. The cause of this decline is not fully understood.

Small game license sales have fluctuated between 250,000 and 330,000 for the past 25 years. Hunter numbers fluctuate with the grouse population cycle, but are fairly stable over a longer time period (MN DNR 2008a). However, in 2009 hunter numbers did not rebound with the upswing in the grouse population cycle (MN DNR 2009c and 2010b). Factors like an aging hunting population, changing demographics, and increased urbanization, negatively impact hunting participation.

Quality Hunting Strategies

Strategy 1: We will enhance the quality of hunting opportunities by providing more hunter access to grouse habitat and offering a balanced mix of hunting experiences.

- Use multiple methods judiciously to enhance forest access. MN DNR is currently using several tools to maintain and enhance public access to the forest in the face of changing land ownership patterns, including conservation easements, fee title acquisition, land exchange, prescriptive road easements, tax policies, and cost share programs. This work will be expanded.

- Assess distribution of Wildlife Management Areas (WMAs) across the ruffed grouse range. Identify spatial voids. Pursue acquisition of new WMAs where opportunity exists.

- Plan for and manage various modes of travel. The diversity of access options should ensure that all forest users find a portion of the forest that suits their preference. Motorized use of forests is changing as MN DNR and other resource agencies develop Off Highway Vehicle (OHV) policies. Some roads and trails are closed to motorized use for resource management concerns, some have

access limited to certain vehicles, some are seasonally closed, and others are closed to motorized vehicles to provide quality non-motorized opportunities.

- Establish new Hunter Walking Trails (HWTs), maintain HWTs, and expand efforts to inform the public of HWTs. HWTs are trails through mixed forest types (where motorized vehicles are not permitted).

- Promote Ruffed Grouse Management Areas (RGMAs) by providing maps of their locations, improving signage within the RGMAs, and issuing media releases. RGMAs are areas of forestland (often several sections in size) where management is prescribed in a manner to benefit ruffed grouse. RGMAs on state-owned lands are identified and management prescribed, during the Subsection Forest Resources Management Planning (SFRMP, page 21) process. Planning teams will identify additional RGMAs.

- Increase management in RGMAs to improve bird density in these special areas.

Strategy 2: We will put programs in place to recruit new and retain existing grouse hunters.

- Better understand the reasons for declines in grouse hunting participation through surveys and/or research. Use this understanding to design and implement programs in an effort to recruit new and retain existing hunters.

- Promote grouse hunting in existing Hunter Retention and Recruitment programs (e.g., Becoming an Outdoors Woman, mentoring programs, etc.).

- Develop and implement basic grouse hunting skills training for hunters new to grouse hunting.

- Develop and promote “where to” and “how to” grouse hunting guides.

Quality Habitat Issues

Ruffed grouse habitat management is typically directed at increasing young forest stands. Timber harvest is the standard method for creating early successional forest types and increasing young aspen, although shearing aspen (with no wood product utilization) has occurred in the past.

Issue 1: A percentage of aspen stands will be converted to mixed conifer-hardwood stands. The quality of ruffed grouse habitat in these stands will depend upon how they are managed.

These conversions are part of current forest management strategies (as outlined in our SFRMP plans) to restore forest composition (of cover types and ages) to a composition more closely reflecting vegetation that developed under natural disturbance regimes. The overall result of conversion on ruffed grouse habitat will depend on stand management. Better age class diversity – in aspen and other forest types – will mitigate loss in habitat quality due to a reduction in acres of aspen forest type. For example, abundant older aspen stands (over 60 years) are now being harvested and will result in an improvement in ruffed grouse habitat in existing aspen acres.

Issue 2: Some current and emerging silvicultural practices (such as intensive thinning) may be incompatible with management for ruffed grouse habitat.

Issue 3: Not all forest management objectives consider ruffed grouse.

Resource managers need to balance multiple forest management objectives. Priorities vary temporally and spatially across Minnesota's forested landscapes.

Issue 4: Surveys indicate a trend of declining ruffed grouse populations in southeast Minnesota.

Geographically focused research and habitat actions are needed in response to this trend.

Issue 5: Land managers do not consistently have clear recommendations for ruffed grouse habitat management in the context of sustainable forest management. Recommendations need to be more clearly identified and communicated.

Issue 6: There exists an untapped potential to improve ruffed grouse habitat management on private lands. Landowners are not widely informed of ruffed grouse habitat needs and management practices.

Quality Habitat Strategies

Strategy 1: We will apply ecologically sound silvicultural practices to manage for ruffed grouse habitat.

- Use Ecological Classification System silvicultural interpretations to produce a dynamic composition of early growth stages across the landscape and through time.
- Promote mixed stands (inclusions of aspen and birch) during aspen cover type conversions.

- Where appropriate, apply silvicultural practices that create high stem densities in early growth stages (e.g., winter harvest, clumped residual trees, etc.).

- As acres of aspen decrease, increase active management in other cover types to provide good grouse habitat.

- Continue to adhere to *Sustaining Minnesota Forest Resources: Voluntary Site-Level Forest Management Guidelines* (MN Forest Resources Council 2005).

- Apply appropriate management actions in "non-timber" forest types and inclusions containing alder, hazel, etc.

- Implement more habitat projects on WMAs.

- In southeast Minnesota, incorporate strategies that favor grouse habitat while managing at a larger scale for oak. Strategies to consider include: controlling invasive species (such as buckthorn and honeysuckle), encouraging native shrub and tree saplings to provide high stem density and vertical structure, leaving clumps of brush or aspen, and use non-commercial habitat management techniques such as mowing, prescribed fire, or shearing to improve age class diversity and distribution.

Strategy 2: We will provide resource managers with science-based techniques and ensure the information is understood and applied.

- Develop and communicate best management practices (BMPs) for ruffed grouse. Consider customizing BMPs for southeast Minnesota. Provide BMPs to resource managers in multiple MN DNR Divisions and provide training.

- Strengthen implementation of the *Interdisciplinary Forest Management Coordination Framework* (MN DNR 2007a) in order to improve cooperation across MN DNR ownerships and to achieve multiple objectives.

- Strengthen coordination between resource managers and research specialists.

- Continue to update the Forest Inventory Module (FIM) data and support efforts to complete native plant community evaluations.

Strategy 3: We will enhance emphasis of ruffed grouse management objectives in landscape-level management plans.

- Assist SFRMP team members in being well informed to appropriately advocate for ruffed grouse objectives in the planning process.

- Encourage SFRMP team members to appropriately incorporate BMPs into stand management planning.

- Identify stands in the SFRMP process where ruffed grouse habitat management objectives are a priority, and exclude non-compatible silvicultural treatments from these stands.

- Identifying additional Ruffed Grouse Management Areas.

Strategy 4: We encourage other landowners to manage for ruffed grouse habitat.

- Working with others in MN DNR and partner organizations, provide private landowners with information on ruffed grouse habitat management information (including BMPs) and opportunities for assistance programs.

- Provide technical guidance on ruffed grouse habitat management (including BMPs) to other forest resource agencies.

- Serve as a liaison to coordinate partnership projects on non-state lands.

Plan Implementation and Evaluation

Implementation

The MN DNR Section of Wildlife has lead responsibility for implementing this plan. We will work with staff in other MN DNR Divisions, other public land management agencies, and other conservation organizations. Strategies outlined will be implemented over the next decade and will be incorporated into staff and program work plans as specific assigned actions.

Quality Habitat Strategies that require a change in forest vegetation will be planned and temporally sequenced in the SFRMP process. Annually a list of forest stands is examined and a decision made on future treatment. This work is on-going.

Quality Hunting Strategies will be implemented by the key MN DNR Section of Wildlife staff; including the Grouse Coordinator, and the Hunter Recruitment and Retention Specialist. Work will start once the plan is approved.

MN DNR Section of Wildlife staff, especially those associated with the Wildlife Research program, will ensure that scientifically valid research is conducted to address important uncertainties about habitat and population management for ruffed grouse in Minnesota (e.g., Research Needs, page 42).

Evaluation

At approximately three-year intervals, the MN DNR Section of Wildlife will evaluate progress towards goals and targets, as well as the appropriateness of this long-range plan for ruffed grouse. The Section's Grouse Management Committee will compile and assess available data on indicator targets (page 11): grouse population; hunter effort, success, and satisfaction; and forest management. A report summarizing the evaluation will be completed and made available on the MN DNR website. Plan goals and strategies will be amended as appropriate.

PART 2 – Management Context

Conservation Drivers

Conservation drivers are large-scale, complex trends that influence ruffed grouse management and are not easily influenced. Wildlife managers must consider drivers when making management decisions and planning management strategies. The following trends have been identified as having a significant bearing on ruffed grouse management.

Landscape Changes

Minnesota's forests provide a broad range of goods and services, including forest products, recreation, fish and wildlife habitat, clean water, clean air, and carbon sequestration. The convergence of many factors is leading to the breakup of Minnesota's industrial forestlands. Timber and mining companies are selling thousands of acres of forests to financial investors not only as a source of wood products, but also to provide financial returns through real estate development and other options. Industrial forestlands are being sold to the general public at unprecedented rates (Kilgore and MacKay 2007). Southern Minnesota's already fragmented forest cover is being further reduced by the development of key parcels (MN DNR 2008c).

Increasing development pressure has the potential for numerous consequences on forest landscapes, including: increasing human population, increasing forestland prices, land ownership changes, timber industry restructuring, and parcelization. These consequences are likely to diminish the forest value by reducing public access for recreation, access for management of public lands, and competitiveness of timber industries. Furthermore, as forest conversion and fragmentation continues, one can expect a reduction in wildlife habitat quality (including ruffed grouse habitat), water quality, responsiveness to climate change, and an increase of invasive species (MN DNR 2008c).

Climate Change

During the next 100 years average temperatures in Minnesota are projected to increase by 6 to 10 ^{o}F in winter and 7 to 16 ^{o}F in summer (Kling et al. 2003, Intergovernmental Panel on Climate Change 2007). Precipitation is projected to decline by 0 to15% during summer but increase by 5 to 30% overall (Kling et al. 2003, Intergovernmental Panel on Climate Change 2007). The frequency of extreme precipitation events is projected to increase by 50 to 100% (Kling et al. 2003), which will result in greater surface runoff and less percolation into the soil. Increasing temperatures and declining soil moisture during summer will have dramatic effects on plant communities.

Vegetation patterns are expected to adjust in response to climate change (MN DNR 2008d). A shift in the boundary between grassland and deciduous forest biomes is likely. Tree species composition in forests will change. Climate change may affect forest disturbances by changing the frequency, duration, and severity of fires, tornadoes, outbreaks of insects and pathogens, thunderstorms, and drought (Dale et al. 2001).

Several climate change models predict warmer, drier conditions for existing deciduous forests. Under this scenario, if managed with fire, deciduous forests will tend toward savanna types (fire dependent hardwood systems) and the range of mesic (moist but well drained) hardwood forests will likely contract. If not managed with fire, these areas will likely become brushlands or become dominated by non-native woody invasive species (Hansen et al. 2001). Iverson and Prasad (2001) predict expansions of oak-hickory and oak-pine forests (fire dependent drier forest types) as well as reductions in aspen/birch forests (a mesic hardwood type).

Climate change will be beneficial for some species, but is likely to be detrimental for many species. Ruffed grouse are likely less sensitive to climate change than habitat specialists (such as spruce grouse). Nonetheless, areas of vulnerability include the potential changes in aspen/birch forests, less snow depth for winter roosting and more frequent and extreme rain events that effect chick survival.

Trends in Forest Recreation

All-terrain vehicles (ATVs), along with ATV use while hunting, are becoming more popular each year. In 2007, Minnesotans registered 263,640 recreational ATVs, up from 86,184 ten years earlier (MN DNR 2008e). This upward trend for motorized recreation in Minnesota's forests may create conflict with traditional forest users. Minnesotans are concerned about potential environmental damage caused by ATVs and other OHVs. MNDNR recently completed a forest-by-forest review of Minnesota State Forests to determine their appropriate classification with regard to OHV use. Road and trail access was also evaluated for a variety of both motorized and non-motorized recreational activities.

Potential impacts of ATV hunting on grouse populations and habitat have not been investigated. Some grouse hunters likely conclude that ATV use impacts the quality of their hunting experience. This may be more of a concern in areas that have larger numbers of hunters and less forested public land base. Classification of State Forests as limited and closed for ATV use may help to ease these concerns. National Forests, where ATV use is more limited, provide a huge land base for grouse hunting. Monitoring and enforcement of OHV rules are critical.

Trends in Forest Management

MN DNR's Conservation Agenda outlines the agency's vision for Minnesota forests: an interconnected expanse of healthy forestland that is substantial and protected; healthy and resilient; and sustainably managed to provide a diversity of benefits (MN DNR 2009a). A formidable array of challenges is shaping forests today: fragmentation, invasive species, climate change, disease, and changes in forest-based economics and recreation. Global competition in the forest products industry is inducing changes in the species and size of timber used by forest industries, increasing demand for woody biomass, changing forestland ownership, and shrinking access to forestland for public recreational use. MN DNR is responding to these escalating pressures on forestlands with an increased application of science-based tools, public awareness, and a strong commitment to sustainable forest management that is guided by third-party forest certification (MN DNR 2009a).

Forest target goals and indicators of success (text box, MN DNR 2009a) have been set to respond to pressures on forestlands. Additional information on selected targets follows.

DNR Conservation Agenda Targets for Forest Management

- Maintain certification on 4.8 million acres of state-administered forestlands.
- Complete and implement Subsection Forest Resource Management Plans (SFRMPs).
- Offer cords of timber for sale from DNR lands at levels established through the SFRMP process.
- Maintain a 44,000-acre network of designated DNR old-growth forest sites.
- Maintain extended rotation forest on DNR lands at levels established through the SFRMP process.
- Maintain early successional forest on DNR lands at levels established through the SFRMP process.
- Significantly improve wood fiber production on DNR forestlands.

- **Forest certification** is a credible system to evaluate and verify sustainable forest management practices. It is becoming a common benchmark for forest management organizations. Certification is helping MN DNR continually improve its forest management practices, ensuring a sustainable supply of forest resource products and services within diverse, healthy, and productive forests.

- MN DNR is a significant source of materials for the **forest products industry**. Sales of timber from MN DNR lands generate funds for schools and public services, and also create habitat for many kinds of wildlife. A target of 800,000 cords offered for sale annually from MN DNR lands through 2013. Demand for woody biomass, primarily for use as a biofuel, is a growing. Strong markets for aspen and a competitive timber products industry in Minnesota over the last decades have provided the mechanisms to manage forests for early successional forest types.

- **Biomass** remains the nation's largest source of renewable energy. Expanded use of biomass is being pursued to replace natural gas, provide the feedstocks for production of advanced biofuels, and generate dispatchable power. Woody biomass markets normally use portions of the traditional forest product, such as tops and limbs, small diameter timber, and sometimes brush. MN DNR will take advantage of new opportunities for managing habitat, while meeting emerging markets for biomass energy and carbon storage.

- Long-term (50 plus years) and short-term (10 years) vegetation management on MN DNR-administered forestlands is planned through **Subsection Forest Resource Management Plans** (SFRMPs). SFRMPs are based on Ecological Classification System Subsections rather than administrative boundaries and are the primary tool for determining the mix of values and products (such as wildlife habitat, rare features, timber) that will be provided and sustained through management.

SFRMPs are vegetation management plans not wildlife plans. However, since forest management greatly influences the type of forest habitat on the landscape, wildlife populations are affected by these plans. During the development of SFRMPs, wildlife staff is part of a planning team in order to ensure that the needs of wildlife are considered in these plans. All forest wildlife species are important, and their habitat needs are diverse. Therefore, these SFRMPs must be balanced. In other words, the habitat needs of ruffed grouse must be considered just as those for deer, eagles, bears, forest interior birds, etc. Given those sideboards, there are several things SFRMP team members do to incorporate ruffed grouse management objectives into SFRMP plans.

One major step is the identification of existing and new Ruffed Grouse Management Areas (RGMAs). On RGMAs the habitat requirements of ruffed grouse become the primary consideration when the vegetation is managed. Ruffed grouse management objectives are considered during the SFRMP process (for example, when establishing rotation age, placing extended rotation forest (ERF) acreage, balancing age classes, setting cover type conversion goals, etc.). All these aspects affect the amount of grouse habitat on the landscape. For example, aspen conversion and ERF are focused away from RGMAs. Balanced age classes in the aspen cover type is a particularly important goal for ruffed grouse as it helps provide the mix of young and older aspen that grouse need.

- **Old-growth forests** are a rare type of old forest (usually over 120 years) that provide habitat for plants and wildlife, serve as scientific benchmarks, and have aesthetic appeal. Before European settlement, about half of Minnesota's forests were old-growth; today the figure is less than 4%. As an element of sustainable forest management, MN DNR has established a network of old-growth forest stands across the forested regions of the state. These old-growth stands are reserved from timber harvest.

- **Early successional forests and young age classes** provide conditions important for a variety of forest values, including plant and wildlife habitat, wood production, forest health, and aesthetics. Early successional forests complement MN DNR's older forest efforts by maintaining diverse forest age classes across Minnesota's forested landscapes. Desired amounts of early successional forest on MN DNR lands are established through the SFRMP process. Timber harvest is the primary management tool used to create early successional forest types and young age classes.

  Seven of eight completed or drafted SFRMPs prescribe a conversion from an aspen cover type to another cover type on MN DNR administered lands (Table 1) (MN DNR 2010c). The Blufflands SFRMP in southeastern Minnesota plans for a relatively constant acreage of aspen and birch, and strategies to minimize the loss of oak through natural conversion to northern hardwoods. Recent plans for the Chippewa and Superior National Forests also call for reducing the extent of the aspen cover type (U.S.D.A. Forest Service 2004a, U.S.D.A. Forest Service 2004b).

  This reduction of aspen is a strategy to achieve a forest composition more closely reflecting vegetation that developed under natural disturbance regimes. The proposed changes reflect acreage increases of cover types that have declined, generally longer-lived conifers such as white pine, from cover types that are currently over represented, such as aspen. This approach is an example of the agency's management for multiple forest and ecological values.

  The overall effect of aspen cover type conversion on ruffed grouse habitat is likely not positive. However, stands included in the aspen cover type often contain a mix of species (Figure 8, page 35). It is possible for an aspen stand to contain less than 50% aspen as long as aspen makes up the plurality of total volume (i.e. 45% aspen, 20% birch, 20% balsam fir, and 15% spruce). In addition, the ratio of aspen to other species within a stand changes over time. Young stands often contain a higher ratio of aspen, while other species (such as conifers) increase as the stand ages. Management emphasis is often the conversion of aspen stands to mixed stands, not necessarily to stands without an aspen component.

Management of aspen acres (not just the number of acres) is also very important. SFRMP plans call for aspen stands to be more actively managed and we believe this management will mitigate the reduction in overall acres of aspen forest type. For example, in the recent decade a high percentages of aspen stands were very young (less than 10 years) or older (over 60 years); very little aspen acreage was in the middle age classes. Current and future management will balance age-classes so there will be significantly more aspen acreage less than 60 years old. This balancing is positive for ruffed grouse.

Forest Management Plan	Beginning Acres	10-Year Change		50-Year Change	
		Acres	Percent	Acres	Percent
Agassiz Lowlands SFRMP	256,600	-2,700	-1.1	-13,000	-5
Border Lakes SFRMP	117,670	-7,000	-5.9	-39,200	-33
Mille Lacs Uplands SFRMP	99,110	-3,700	-3.7%	-5,000	-5
North Shore area SFRMP	67,400	-4,800	-7.1%	-14,800	-22
CP/PMOP SFRMP	182,745	-2,800	-1.5%	-14,370	-8
North Four SFRMP	260,992	-9,044	-3.5%	-40,000	-15
Aspen Parklands SFRMP*	85,958	-8,128	-9.5%	-16,227	-19
Blufflands SFRMP	Comparable figures not available				
Total	**1,070,475**	**-38,172**	**-3.6%**	**-142,597**	**-13.3%**

*drafted for public review, not final; most of the conversion in the Aspen Parklands is to non-forested cover types; goal is to maintain aspen stands ages $\leq$ 20 in nearly 25,000 ac.

Table 1. Planned 10-year and 50-year conversion of stands from the aspen cover type (includes balsam poplar).

Recreation and Economic Value

Harvest Trends

Ruffed grouse are Minnesota's most popular game bird. During the last 10-year cycle of ruffed grouse abundance, an average of 115,000 hunters harvested an estimated 519,000 ruffed grouse annually (Figures 1 and 2). During each of the past two peak years (1989 and 1998) approximately 150,000 hunters harvested an estimated 1,076,000 ruffed grouse. For comparison, 101,000 hunters pursued pheasants in Minnesota annually from 1998 to 2007, and the annual harvest averaged 441,000 pheasants during 1987 to 2000. There are also fewer waterfowl hunters than ruffed grouse hunters in Minnesota.

Many factors contribute to the popularity of ruffed grouse hunting, but a high harvest success rate (64 to 84% of hunters annually) is certainly among them (MN DNR 2004). Annual ruffed grouse harvests are similar between Minnesota, Wisconsin and Michigan (565,696, 517,251, and 421,247 annual mean harvest respectively, 1983 to 2007). However, the harvest/hunter is higher in Minnesota (5.17 harvest/hunter) than in Wisconsin or Michigan (4.02 and 3.19 harvest/hunter, respectively) (MN DNR 2008a, Wisconsin DNR 2008, and Michigan DNR 2008). Subsequently, Minnesota is a hunting destination wherein hunters can expect a high number of grouse flushes and a successful harvest.

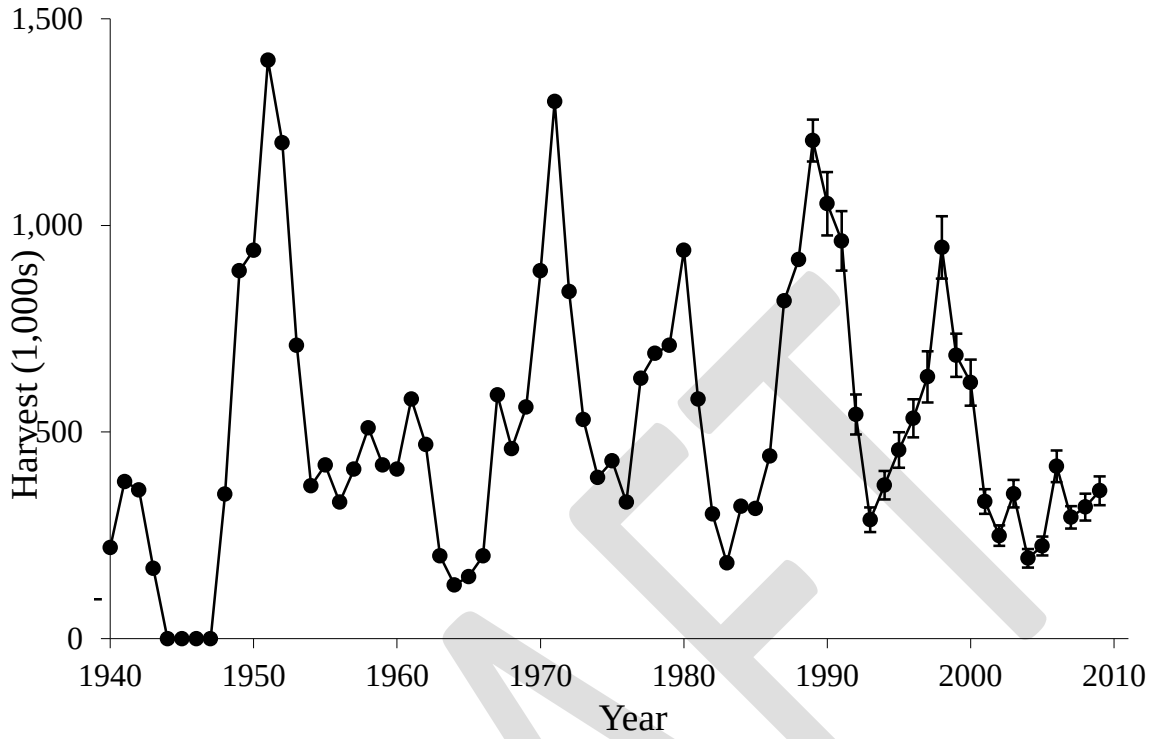


Figure 1. Estimate of Minnesota's ruffed grouse harvest, 1940 to 2009 (MN DNR 2009b). No data were available for the mid 1940s.

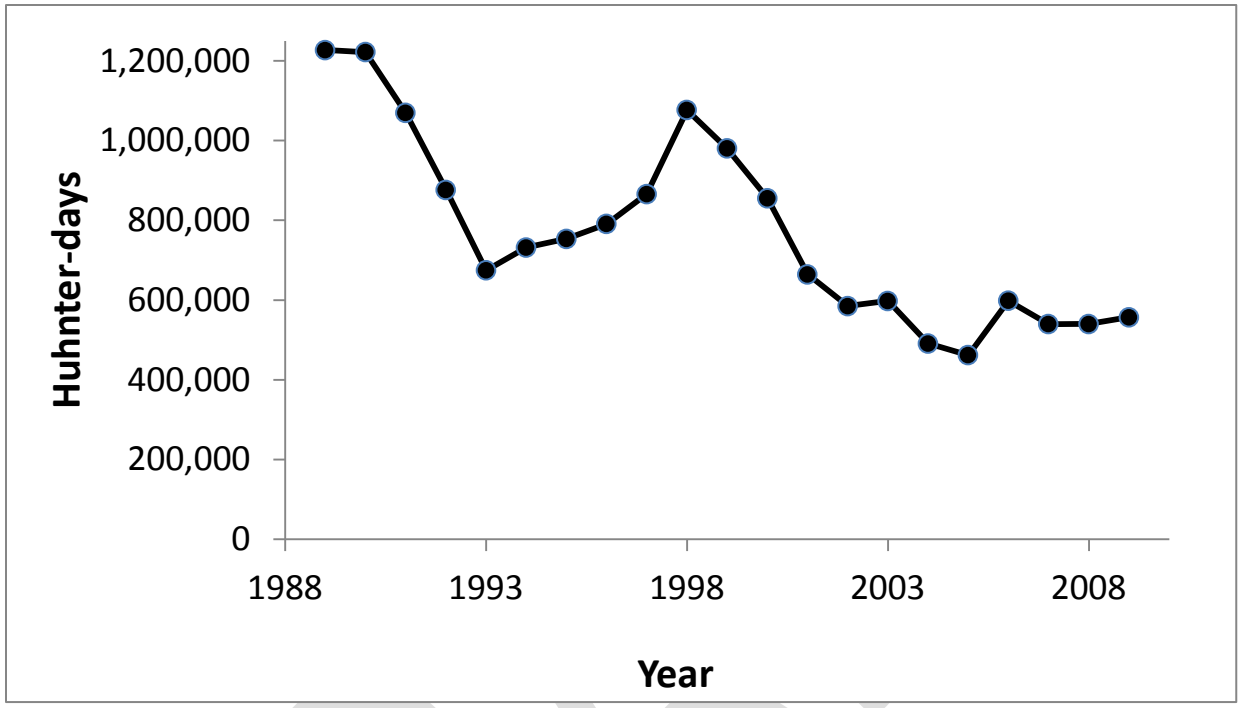


Figure 2. Estimated abundance of ruffed grouse hunters in Minnesota, 1990 to 2008 (MN DNR 2008a)

Hunter Numbers

When ruffed grouse numbers are at or near their cyclic peak, the number of hunters (and harvest) also peaks. At least this has been the historic pattern (Figure 3). But recently grouse hunter numbers have not tracked the upward swing in the grouse population cycle. While the grouse population was at or near peak in 2009 (MN DNR 2009c), only 88,000 hunters were afield (MN DNR 2009b). In comparison, the 1989 and 1998 peak seasons saw approximately 150,000 hunters each. Surveys show the number of days a hunter is spending in the field hunting is also decreasing (MN DNR 2009b).

A ruffed grouse hunter satisfaction survey is currently being conducted to gather data on reasons for the decline in grouse hunters. Once results are evaluated, MN DNR will take steps to curtail barriers that are keeping people from hunting.

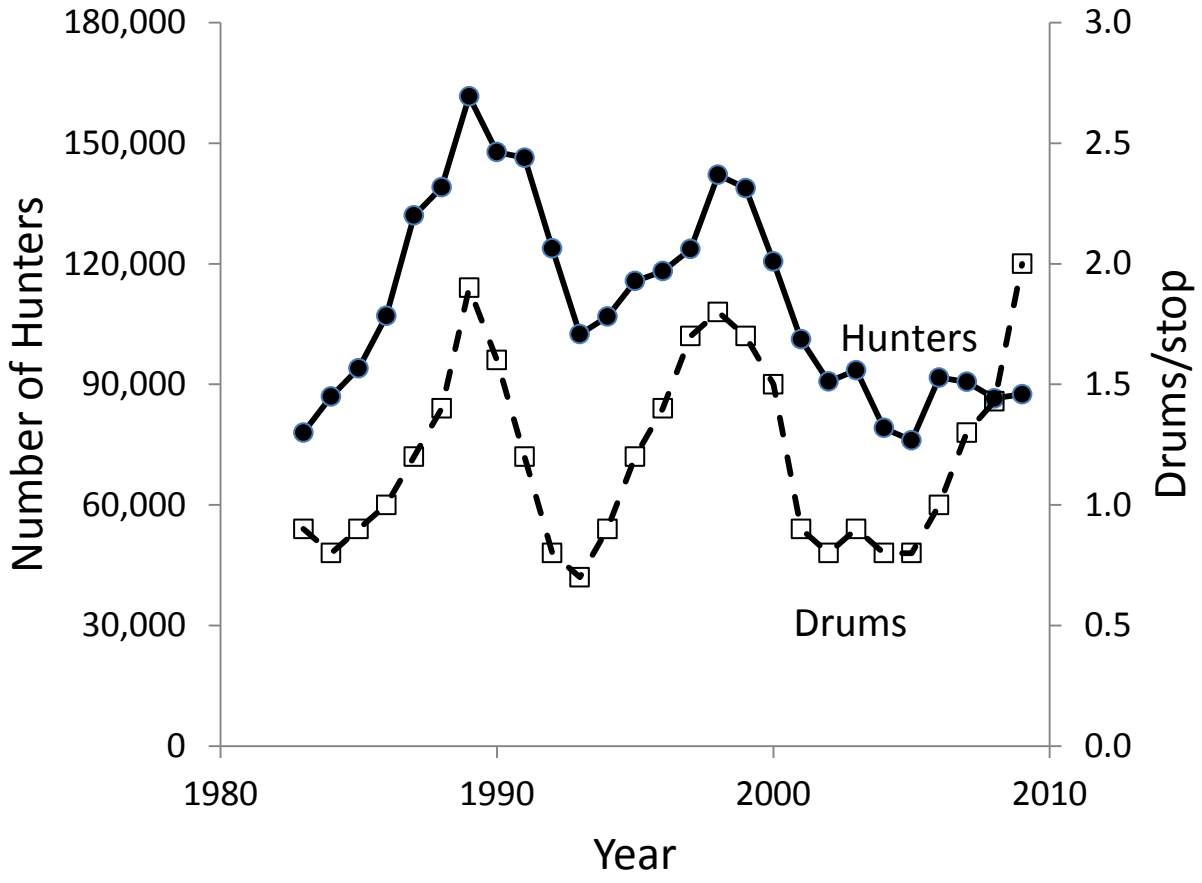


Figure 3. Estimated number of hunters and drumming survey results (drums/stop) through 2009/2010 in Minnesota (MN DNR 2009b and MN DNR 2009c).

Economic Value

Small game (combining grouse, pheasant, rabbits, squirrels, etc.) hunters spent over $90 million (trip and equipment expenditures) in Minnesota for their small game hunting activities during 2006 (U.S. Fish and Wildlife Service 2008). Most of these hunters were seeking ruffed grouse (MN DNR 2008a). This is a significant economic component for Minnesota. During peaks in grouse abundance more hunters spend more time afield. Retail expenditures in Minnesota for ruffed grouse hunting likely exceed $60 million during these peak years. The full economic impact of grouse hunting — including license revenue, employment, and sales taxes, federal excise tax on arms and ammunition, and income taxes— is much greater.

As an appealing forest bird, ruffed grouse also provide enjoyment for wild bird observers. During 2006, 1.4 million people participated in wild bird observation in Minnesota (0.5 million traveled away from home to do so) (U.S. Fish and Wildlife Service 2008). Those participating in Minnesota wildlife watching activities spent nearly $700 million on travel and equipment to watch wildlife (U.S. Fish and Wildlife Service 2008).

Hunting Opportunities

If you prefer to walk *on* a trail rather than *off*, there are thousands of miles of trails on public land in Minnesota that are suitable for grouse hunting. Hunter Walking Trails (HWTs) are a specific type of trail designated by county, state or federal agencies. These trails are off limits to motorized vehicles. The main purpose of these HWT's is to provide a place to hunt small game where hunters can be assured they are on public land where hunting is legal. Once familiar with an area, hunters often find there is an abundance of good hunting to be found on nearby forests that are away from designated trails.

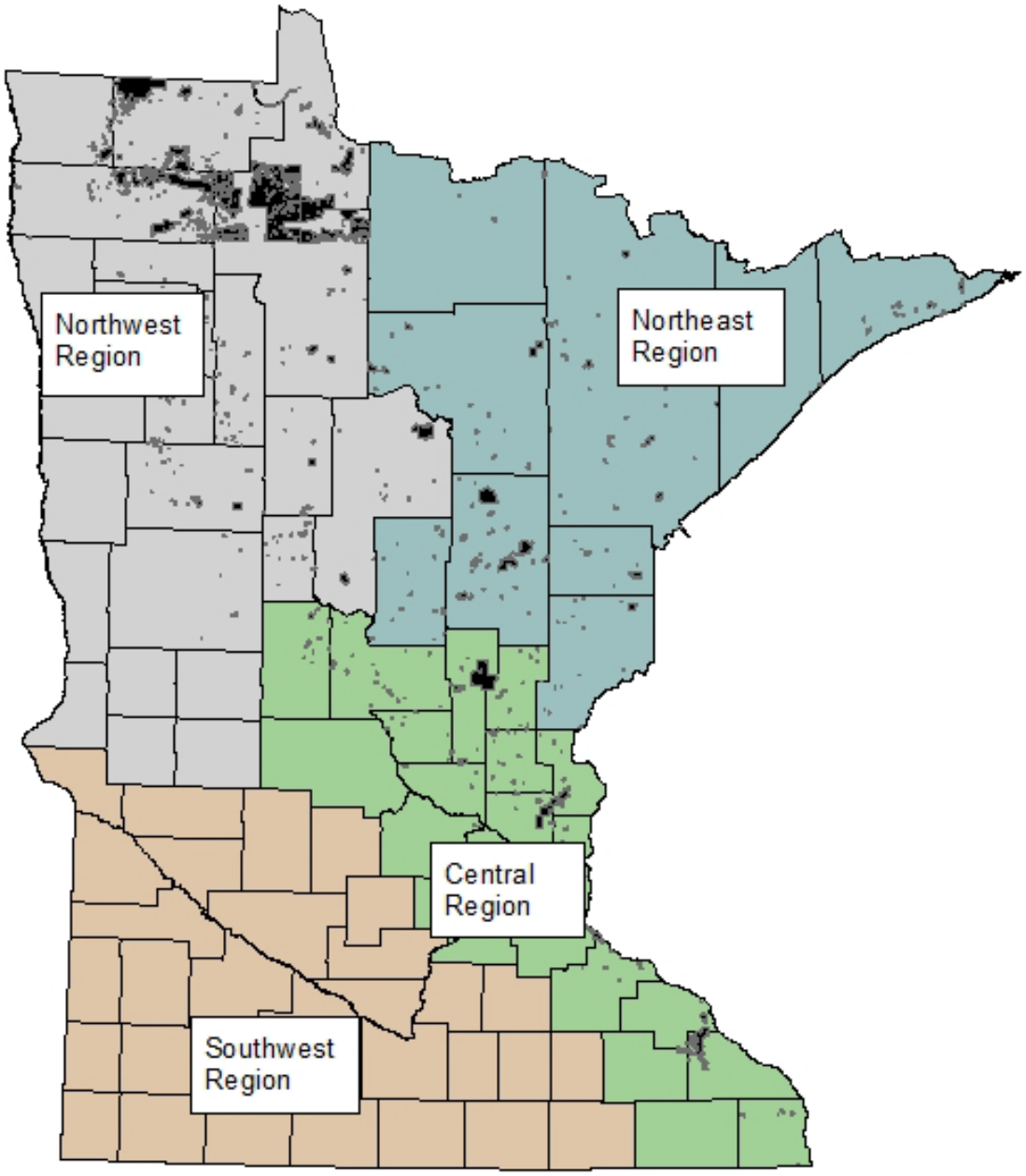
On state administered lands, there are more than 600 miles of designated hunter walking trails. These trails, most of them with signs, provide access to areas where small game such as grouse and woodcock may be found. Many of the trails are gated, helping to prevent OHV access. Some have parking lots, while others simply have places to just pull off the road. Enhancements on the trails vary. Some feature clover planted along the trail, others have forest openings that tend to attract wildlife and some are mowed annually. Many of the trails follow the courses of old logging roads. Forests change over time as the succession of forest growth progresses. Because of this natural cycle, the forest along the trails and the wildlife that inhabit the area change with time.

There are 528 Wildlife Management Area (WMA) units containing 998,415 acres of public land within ruffed grouse range in Minnesota. While not all of the acres are ruffed grouse habitat, the Areas are open to public hunting.

The State of Minnesota currently has 43 designated Ruffed Grouse Management Areas (RGMAs) (page 29) ranging in size from 214 to 3,900 acres (total acres in excess of 68,000). HWTs and RGMAs are very often in close proximity. Figure 4 depicts the distribution of WMAs and RGMAs in Minnesota.

There are thousands of acres of state forest and WMA land that, although not designated as RGMUs, have ongoing timber management that provides excellent ruffed grouse habitat. Counties and federal agencies (such as the U.S. Forest Service) also have areas that are managed for young, early-successional forests that ruffed grouse prefer. Most of this land is open to public hunting and numerous options (and thousands of miles) exist for access.

Figure 4. Wildlife Management Area units (almost 1 million acres) and Ruffed Grouse Management Areas (over 68,000 acres) located in the ruffed grouse range of Minnesota.



Habitat Assessment

Spatial Distribution of Habitat

A ruffed grouse habitat assessment model was developed for this plan using the Minnesota Gap Analysis Program (MNGAP) land use/land cover (hereafter in this section, cover type). This coarse assessment was done to show the spatial distribution of ruffed grouse habitat in the state. Habitat characteristics other than cover type (stand age, juxtaposition, diversity, etc.) were not taken into account in this coarse assessment. Members of the Grouse Management Committee assigned each MNGAP cover type a ruffed grouse habitat score, based on habitat requirements, ranging from 0 to 4, with 0 being non-habitat and 4 being the best habitat. Habitat scores from 12 committee members were pooled to calculate an average ruffed grouse habitat score for each MNGAP cover type.

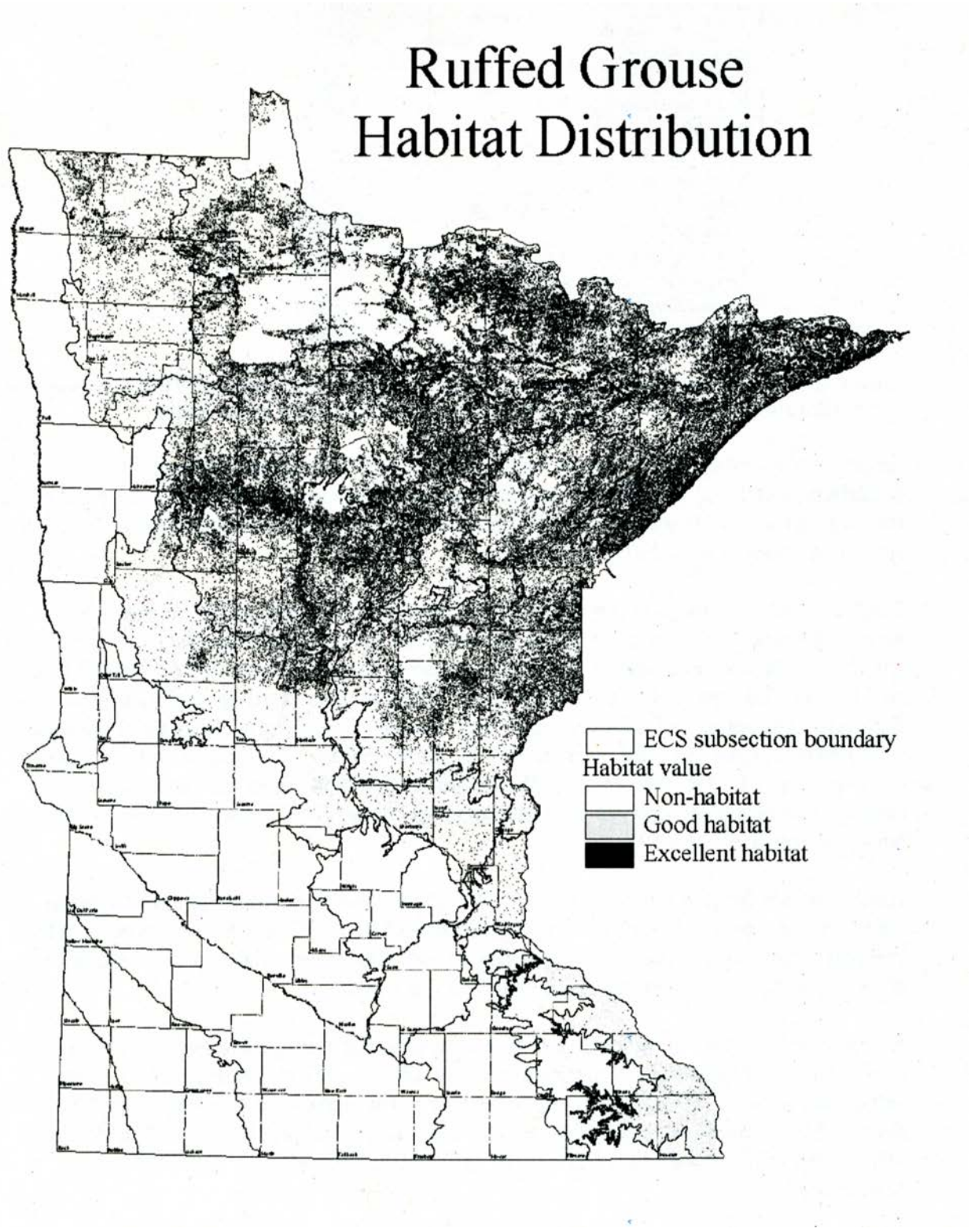
All cover types with a mean score of 2.0 and greater are considered ruffed grouse habitat. These 14 cover types and their associated habitat scores are presented in Table 2 (page 31) and mapped in Figure 5. Areas of these cover types by Ecological Classification System Subsection, as well as statewide acreage totals and percentages, are presented in Appendix A.

The habitat assessment model indicates that over 11,517,000 acres of ruffed grouse habitat exists throughout Minnesota. The aspen/white birch type represents 60.7% of the available ruffed grouse habitat.

Table 2. Cover types with a mean ruffed grouse habitat score greater than or equal to 2 on a relative index scale from 0 to 4. For the purposes of the ruffed grouse habitat model, these cover types are considered ruffed grouse habitat.

MN GAP Cover Type	Score
Lowland Deciduous Shrub	2.000
Red Cedar-Deciduous mix	2.000
Balsam Fir mix	2.111
Upland Deciduous	2.222
Red/White Pine-Deciduous mix	2.333
Red Oak	2.555
Bur/White Oak mix	2.555
Northern Pin Oak	2.778
Upland Coniferous/Deciduous mix	2.889
White/Red Oak	3.000
Jack Pine-Deciduous mix	3.000
Spruce/Fir-Deciduous mix	3.111
Upland Shrub	3.333
Aspen/White Birch	4.000

Figure 5. Distribution of ruffed grouse habitats with a mean habitat score greater than 2.0. Good habitat is defined as greater than or equal to 2.0 and less than 3.0. Excellent habitat is defined as greater than or equal to 3.0.



Forestland Area

Minnesota contains 16.2 million acres forestland. Aspen, pine, and spruce/fir types predominate in the north and the oak and elm/ash/cottonwood types predominate in the south (Miles et al. 2007). Prior to European settlement the area of forestland was estimated to be 31.5 million acres (Marschner 1930).

Ownership

Forest ownership does influence access for grouse hunting. According to Miles et al. (2007), over half of the forestland in Minnesota is publicly owned (Figure 6). The State of Minnesota owns 24% of Minnesota's forestland.

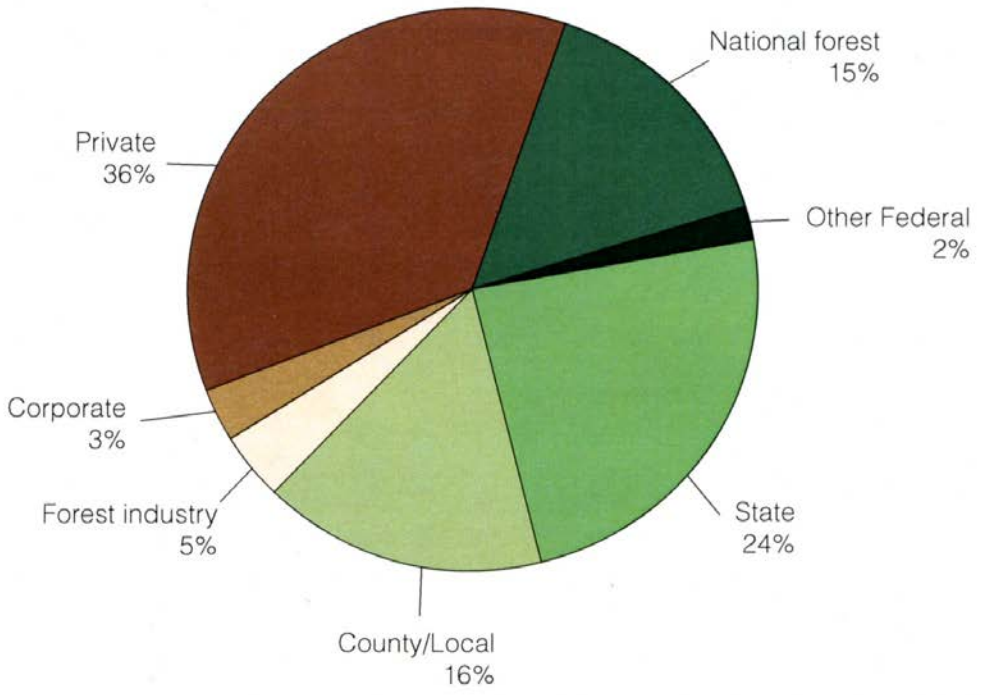


Figure 6. Forestland ownership in Minnesota, 2003 (Miles et al. 2007).

Forest Type Assessment

Aspen is an important component of ruffed grouse habitat. Based on 2003 Forest Inventory and Analysis (FIA) data, 95% of Minnesota's forestland is comprised of 12 forest types (Figure 7). Aspen is the predominant forest cover type and tree species in Minnesota (MN DNR 2008b), accounting for 31% of Minnesota's forestland (5.1 million acres); followed by the northern hardwood type (12%) and the black spruce type (10%) (Miles et al. 2007). Aspen is an opportunistic, short-lived pioneer species that moves into many sites after disturbance (including logging).

The aspen cover type is made up of a wide mixture of species. Predominant secondary species include balsam fir, paper birch, and oak (Figure 8). Aspen is also a significant component in many other upland cover types.

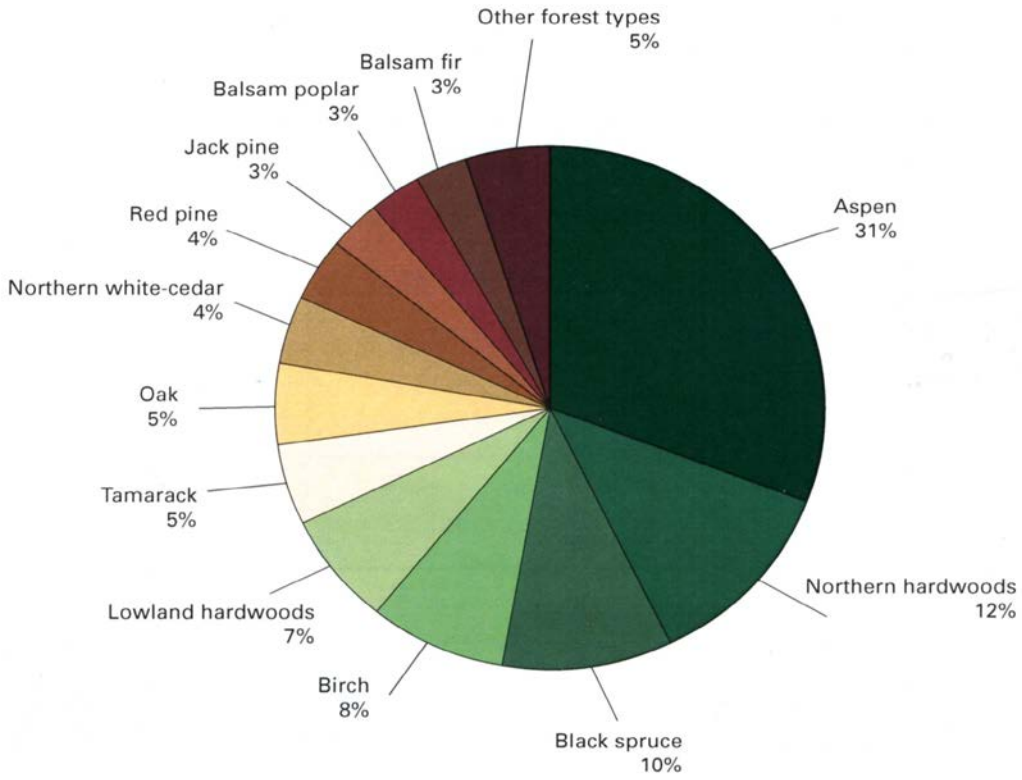


Figure 7. Percentage of forest land area by forest type in Minnesota, 2003 (Miles et al. 2007).

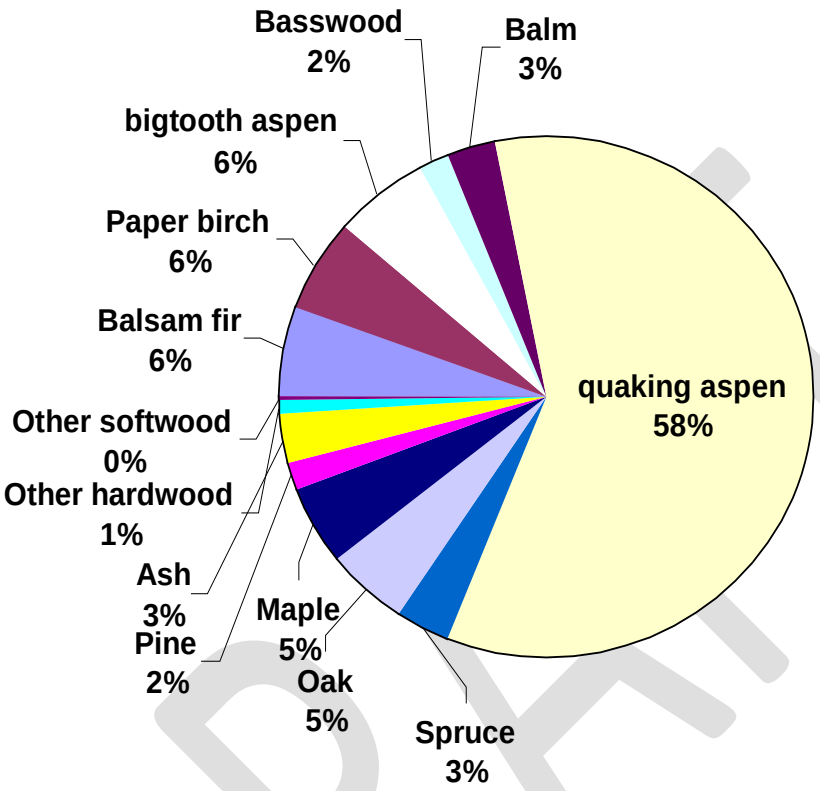


Figure 8. Volume (%) of all live trees in the aspen/balm (balsam poplar) cover type on timberland in Minnesota based on 2007 FIA species data (MN DNR 2008b).

Tree Number and Diameter Size Class Assessment

As described in the section on Habitat Requirements (page 36), young and older age classes of hardwoods in general (and aspen/birch in particular) are important to ruffed grouse. There are currently an estimated 12 billion trees on Minnesota forestlands: more than 81% are saplings (1 to 5 inches diameter), 15% are poletimber (5 to 9 inches for softwoods and 5 to 11 inches for hardwoods), and 4% are sawtimber-size (larger than poletimber) (Miles et al. 2007). Aspen alone accounts for over 30% of all the trees in Minnesota.

Stands are field-assigned a size classification based on predominant diameter class of live trees (U.S. Forest Service 2010a). Large diameter trees are at least 11 inches diameter for hardwoods and at least 9 inches diameter for softwoods. Medium diameter trees are at least 5 inches diameter and smaller than large diameter trees. Small diameter trees are less than 5 inches diameter. In 2009, 67% (7,484,200 ac) of all Minnesota timberlands and 75% (1,353,033 ac) of DNR timberlands were in the small and medium size classes (U.S. Forest Service 2010b).

Timber Stand Treatments

Dahlman and Phillips (2003) monitored 334 randomly selected timber harvest sites across Minnesota. The average timber harvest area for all ownerships was 24 acres. Harvest area ranged from approximately three acres to over 200 acres. Ninety-eight percent of these sites were managed using even-aged silviculture. A stand is considered even-aged if the youngest and oldest trees do not differ in age by more than 20% of the rotation length (Smith 1962). Seventy-eight percent of the even-aged sites were harvested using clearcuts or clearcuts with reserves. Clearcut with reserves, either single scattered or clumped trees, occurred on 73% of total clearcut sites. Clearcut harvests are important in creating young, dense forest stands preferred by grouse for drumming and brood habitat.

As aspen suckering increases with percent basal area removed. Residual canopy cover should not reduce aspen regeneration below 12,000 stems per acre when optimizing grouse habitat. Huffman et al. (1999) suggests that for every one percent increase of residual canopy cover left at harvest, predicted aspen regeneration stem density decreases by 519 stems per acre. Harvest sites with 20% residual canopy cover appeared to provide adequate stem densities for grouse. Palik et al. (2003) reports that aspen sucker densities in 40% residual basal area treatments were well below stocking levels in similar aged single-cohort stands, whereas densities in the adjacent clearcuts fall within the range of adequate stocking. Regeneration stem densities can also be significantly impacted by the diameter of residual trees. Shade cast by the combined crowns of small diameter trees may more significantly impact regeneration than the canopies of larger trees (Dessecker and McAuley 2001). The intention on state lands is to follow voluntary site-level forest management guidelines (MFRC 2005) for leave trees. The leave tree guidelines do not predict poorly stocked regenerated stands, nor do stem densities unsuitable for grouse (MFRC 2006).

Forest Trends

Assessing changes in forest habitat over time allows us to predict future suitability. However, this assessment is difficult. To better understand Minnesota's forest resources, the U.S. Forest Service, through its FIA program and in partnership with MN DNR, inventoried forests in 1935, 1953, 1962, 1977, and 1990. Several changes in FIA procedures and definitions have occurred since the last Minnesota inventory in 1990, and while these changes will have little effect on statewide estimates of forest area, timber volume, and tree biomass, they may have significant effects on variables such as forest type (acres) and stand-size class (age). Some of these changes make it inappropriate to directly compare 2003 data tables with those published for 1990 and earlier (Miles et al. 2007).

Forestland Area Trends

A 2007 U.S. Forest Service report (Miles et al. 2007) describes the changes in Minnesota's forestland area since the early 1900s. The largest decline in the area of forestland occurred before FIA data was first collected in the 1930's, and was due to logging followed by homesteading and land clearing (Zon 1935). The decline continued until forest inventories picked up a small increase in the area of forests between 1977 and 1990. Since 1990 the area of forestland has declined about 4% (Miles et al. 2007). A declining forest base is a concern for ruffed grouse sustainability.

Forest Type Trends

Aspen has not always been a dominant species in the state and was a minor component of the forest before the logging boom in the late 1800s to the early 1900s (Leatherberry et al. 1995). The 2004 Minnesota's Forest Resources report (Miles et al. 2006) discusses forest type for the years 1990, 2003, and 2004. In 2004 the aspen/birch forest type, with 6.3 million acres of timberland, was the dominant forest type in the state. Areas for 1990 and 2003 were within the margin of error of the 2004 acres (Miles et al. 2006). Forest type trends indicate a continued dominance by aspen.

The U.S. Forest Service conducted a more intensive inventory of the Minnesota Aspen-Birch Unit (Koochiching, St. Louis, Lake, Cook, and Carlton counties). Originally this area supported pure coniferous forests of white pine, red pine, jack pine, black spruce, white spruce, balsam fir, tamarack, and northern white cedar. Today the Unit is generally dominated by hardwoods and especially by aspen. In 1990 nearly 34% of the Unit was in the aspen type and this was nearly the same as the percentage of aspen in 1977 (Kingsley 1991).

Tree Number and Diameter Size Class Trends

A 2007 U.S. Forest Service report (Miles et al. 2007) describes changes in trees from 1977 to 2003. The total number of trees increased, as did the number of sapling and sawtimber trees. The number of poletimber trees decreased (Figure 9). The number of saplings increased (1977 – 2003) for the 12 most common tree species (the 12 species are identified in Figure 8, page 35). This trend was especially true for aspen, which increased from 1.2 billion saplings in 1977 to 3.0 billion saplings in 2003 (Figure 10). Half the increase in the number of all saplings was due to just the increase in aspen. During the same time period, the number of poletimber aspen trees decreased significantly. There are currently far more young aspen than existed 20 years ago (MN DNR 2008b). This is a positive trend for ruffed grouse.

A trend in stand diameter size class is not clear. Stands are classified based on predominant diameter class of live trees (U.S. Forest Service 2010a). Large diameter trees are at least 11 inches diameter for hardwoods and at least 9 inches diameter for softwoods. Medium diameter trees are at least 5 inches diameter and smaller than large diameter trees. Small diameter trees are less than 5 inches diameter. On all Minnesota timberlands, the percent acres in small and medium diameter size classes were 72% in 1977, 62% in 1990, and 67% in 2009. The percent acres in small and medium size classes on DNR timber lands were 78% in 1977, 69% in 1990, and 75% in 2009 (U.S. Forest Service 2010b).

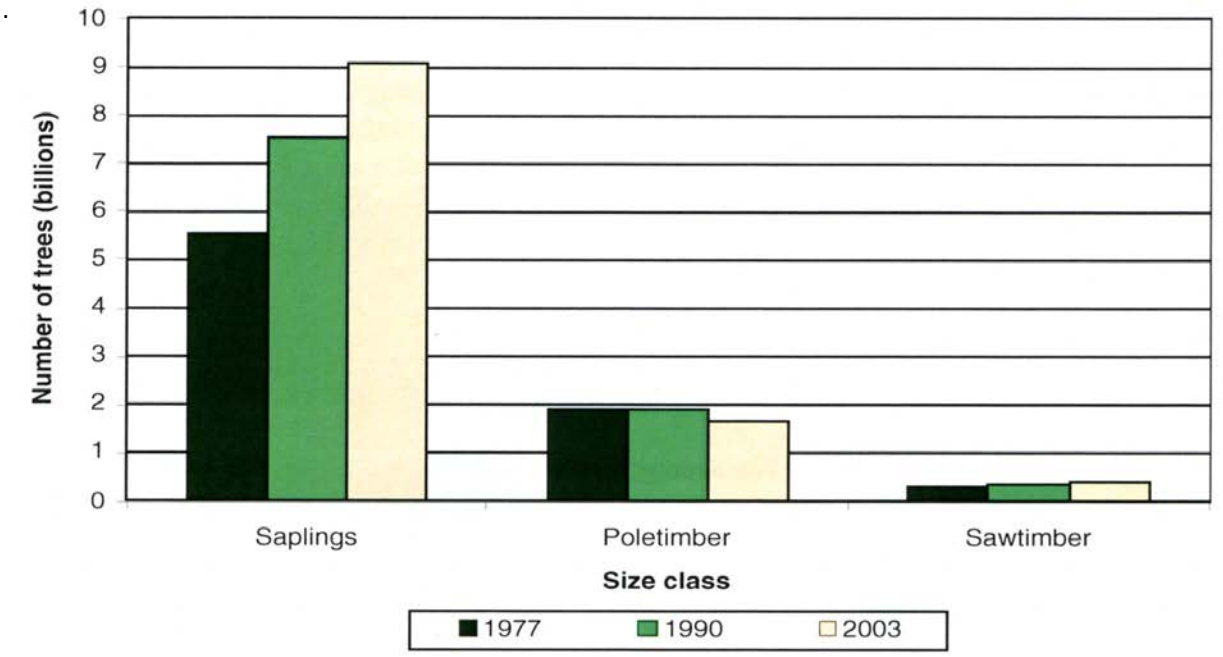


Figure 9. Number of trees by size class in Minnesota, 1977, 1990, and 2003 (Miles et al. 2007).

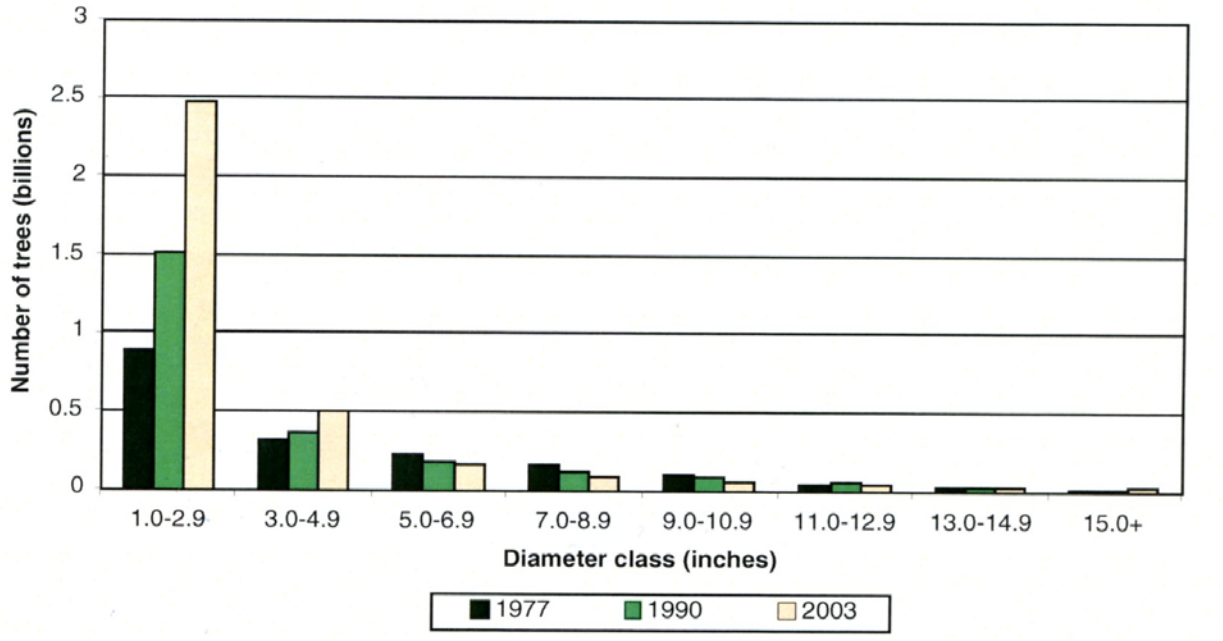


Figure 10. Number of aspen trees by diameter class in Minnesota, 1977, 1990, and 2003 (Miles et al. 2007).

Harvest Trends

Harvest of the aspen and balsam poplar (balm) forest type exceeded two million cords annually from 1990 – 2005 (MN DNR 2008b). Although harvest levels have declined (in 2006 1.7 million cords were harvested (MN DNR 2008b)), current harvest levels are still much higher than those prior to the early 1990's (MN Forest Resources Council 2006). Changing economic conditions will undoubtedly affect timber markets considerably.

Timber Stand Treatments Trends

Puettmann et al. (1998) reported that in Minnesota clearcut harvests with reserves increased from 41% to 77% of total clearcut harvests from 1991 to 1996. This may reflect increasing sensitivity of the public to snag, residual tree, and other visual concerns. This trend continued following the 1999 release of MN Forest Resources Council's Voluntary Site-level Forest Management Guidelines (MN Forest Resources Council 2005).

Patch analysis from White and Host (2003) indicate that in northern Minnesota mean timber harvest patch size has shown an overall decline from the 1930's to present. Mean fire patch sizes for the pre-European settlement period were substantially larger than either harvest patches or fire patches from the 1930's to present (Frissell 1973, Heinselma 1973, White and Host 2008).

For nine studied Ecological Classification System subsections in northern Minnesota, the average fire-generated patch size during the 1990s was approximately 100 acres (White and Host 2003). The settlement period (1900 to 1930) produced a short-term increase in fire frequency, followed by a dramatic decrease by the 1990s. By the 1970s, timber harvest replaced fire as the primary disturbance factor in northern Minnesota (Manolis 2003). This trend towards decreasing patch size over time is a positive trend for ruffed grouse.

Minnesota forests are providing abundant ruffed grouse habitat and, based on the age class distribution of the aspen forest type in particular, will likely continue to do so into the future. However, key to maintaining important young age classes into the future is a healthy, active forest products industry.

Funding for Management

Most ruffed grouse habitat management is accomplished in the course of forest management activities by federal, state, and county agencies. Additional habitat is managed when logging occurs on industrial and non-industrial private forestland. Managing ruffed grouse habitat via commercial logging is the most economical and efficient method, and affects the greatest amount of grouse habitat on an annual basis. Planning is typically at the landscape scale, where decisions are made to regenerate aspen forests through commercial clearcutting, or at the stand level when deciduous inclusions are retained in other forest types.

The Ruffed Grouse Society (RGS) sponsors ruffed grouse habitat projects, forest access routes, and hunter walking trail projects, and RGS occasionally administers outside grants. These sponsored grouse habitat projects are beneficial in local areas. However, management is needed on thousands of acres. The "biggest bang" for the hunter dollar is to continue to perform ruffed grouse management through commercial forest management, with coordination between land managers and loggers.

The passage of the Clean Water, Land and Legacy Amendment in 2008 provides the opportunity for increased funding of grouse habitat management. A number of non-commercial habitat management techniques (e.g., mowing, shearing, and prescribed burning) can be used to improve age class diversity and distribution, and patch size. With new funding opportunities, this work can be done at a scale beyond a few hundred acres.

Stamps purchased to hunt pheasants and waterfowl provide funding dedicated to improve habitat for those species. Minnesota does not have a "grouse stamp" that would provide similar funding for ruffed grouse habitat. Stamp programs can be costly to administer. A net monetary gain would need to be assured before MN DNR pursues this avenue.

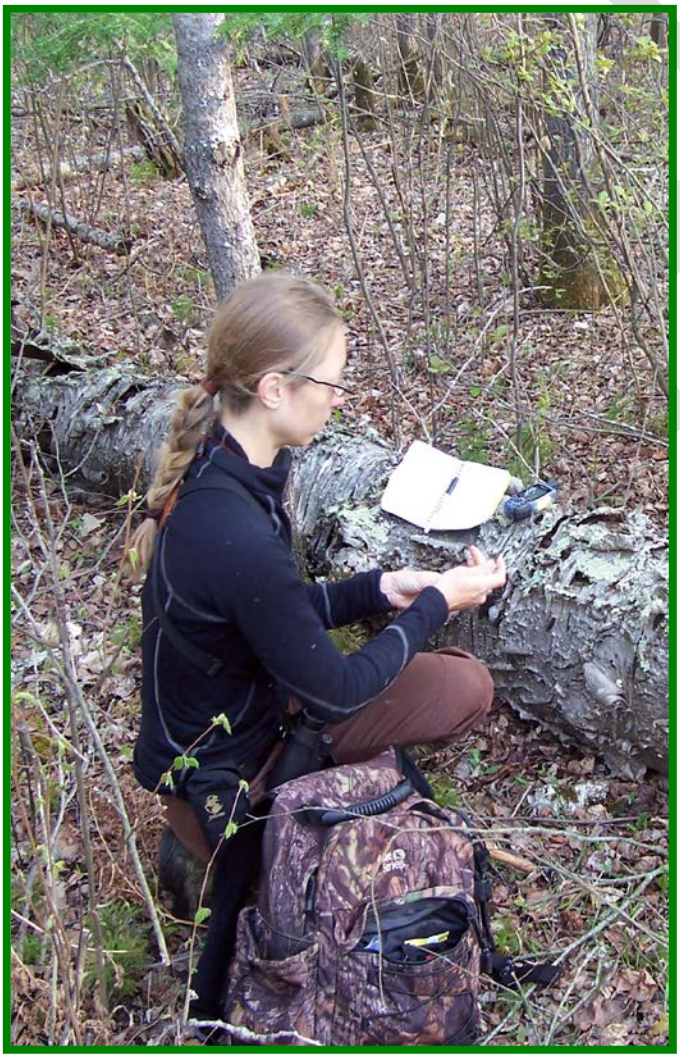
Research Needs

Research is needed to answer important questions about how to manage ruffed grouse habitat and populations in Minnesota. The following list of management questions includes topics that are of high interest and priority.

1. How do the proportions and types of conifers in aspen forest stands, and the proportions and juxtaposition of aspen and conifer cover types in the landscape affect ruffed grouse habitat and populations in Minnesota?

2. What effects do timber management decisions about individual aspen stands (e.g., dispersed residual overstory trees, mechanical thinning) have on ruffed grouse habitat and populations in Minnesota?

3. How have the quantity and quality of ruffed grouse habitat (e.g., forest overstory cover types and age classes) in Minnesota changed during the last 30 to 40 years, and have ruffed grouse populations responded to changes that have occurred?



4. What are the relative impacts of various management techniques for increasing the quality and quantity of ruffed grouse habitat in southeastern Minnesota?

5. What are the effects of motorized and non-motorized trails on hunters (success and satisfaction), ruffed grouse habitat, and grouse populations in Minnesota?

6. What effect is West Nile Virus having on ruffed grouse populations in Minnesota? Studying diseases is recommended under the North American Grouse Management Plan as well (Association of Fish and Wildlife Agencies 2007).

7. What are the likely motivations for and barriers to grouse hunting?

8. How is climate change going to affect ruffed grouse and their habitat in Minnesota?

PART 3 - Biology and Ecology

General Life History

Ruffed grouse are distributed throughout deciduous and coniferous forests of North America, but is most abundant in disturbance-related early successional forests dominated by aspen and poplar trees (Rusch et al. 2000). Historically, natural ecological processes, primarily windstorm and fire, maintained these early successional habitats (Gullion 1984a). Timber harvesting has become the principle forest disturbance that maintains early successional forests.

In most of Canada, Alaska, and the Great Lake states, ruffed grouse populations experience dramatic and synchronous fluctuations at approximately 10-year intervals (Keith 1963). This is known as the 10-year cycle.

The breeding season for ruffed grouse in Minnesota occurs in late March and early April when males perform their mating ritual known as drumming. Drumming consists of a repetitive and stereotyped wing beating sequence usually conducted on a downed, horizontal log. It is primarily an acoustic display that serves to advertise the location of the male in fairly dense forest cover (Johnsgard 1989). Females visit drumming males to mate, thereafter the female departs to lay eggs and raise young in absence of the male.

An average clutch of 11 eggs is laid over 17 days and incubated of 23 days (Bump et al. 1947, Larson et al. 2003). Renesting can occur if the first nest is depredated, however, a hen will only raise one brood annually (Maxson 1977a, Balzer 1995, Larson et al. 2003). Throughout the brooding period, home ranges of hens are relatively small (Maxson 1989). For the first several weeks after hatching, chicks feed primarily on invertebrates (Bump et al. 1947). The summer diet of adults consists of succulent plant material, fruits, and insects. Hens escort broods for the 12-week post-hatch period until brood break up and dispersal, which typically occurs in September (Rusch et al. 2000).

During the winter in northern climates, ruffed grouse feed primarily on the buds, twigs, and catkins of trees. In a Wisconsin study, important winter foods included the buds and catkins of aspen (big tooth and trembling), birch (paper and yellow), ironwood, hazel, and cherry (Vispo 1995). Many studies have noted the importance of mature male aspens as a winter food source (Bump et al. 1947, Edminster 1954, Huempfner and Tester 1988, Gullion 1977, Svoboda and Gullion 1972).

Physical Description

Ruffed grouse are a medium sized bird, approximately 15.5 to 19.5 inches in length (Johnsgard 1983), and weighing 1 to 1.5 pounds (Rusch et al. 2000). Compared to Minnesota's other three grouse species, ruffed grouse are slightly larger than the spruce grouse, while approximately 25% smaller in weight than both the sharp-tailed grouse and greater prairie chicken. It has relatively short wings and a long, rounded tail. On each side of the neck is a tuft of long feathers that is most often concealed but that can be erected into a ruff. Like other grouse, its tarsi (legs) are feathered. The plumage is a cryptic mottling of gray, brown, buff and black, and occurs in two predominate color morphs, often labeled gray and red

(Rusch et al. 2000). Many gradations occur between color phases. In Minnesota, males are 16% heavier than females (Ruffed Grouse Society 2001). The outward physical distinctions between males and females are subtle.

Reproduction

In looking at 1,431 initiated nests in New York, Bump et al. (1947) reported a mean nest success of 61.4%. Larson et al. (2003A) estimated survival of first nests 44% in Michigan. Average annual hatching success of eggs was 94% in the southern Appalachians (Rusch et al. 2000), and 96% in Michigan (Larson et al. 2003). Annual production of chicks was estimated to be 2.9 female chicks for each female in the spring breeding population in Wisconsin (Small et al. 1996) and 3.4 female chicks/female in Michigan (Larson et al. 2003). Predispersal survival of ruffed grouse chicks in Michigan was 32% from June 9 to September 7 (Larson et al. 2001). The percentage of juveniles in the harvest provides an index to nest success and chick survival. For Minnesota, long-term data indicates an average of 72% juveniles in the fall harvest, while North Dakota indicated an average of 67% juveniles in the fall and 69% in Manitoba (Ruffed Grouse Society 2001).

Mortality

Annual survival rates reported for adult drumming males in Minnesota over a 20-year period ranged from 28 to 65%, averaging 46% (Gullion 1984b). During the increasing phase of the population cycle in Michigan, annual (August 1 to May 15) survival rates were 0.07 to 0.47 for 568 juveniles and 0.13 to 0.70 for 351 adults, depending on year and study area (Clark 2000). There were no consistent differences in survival between males and females. Predation, including hunting by humans, is the largest source of mortality. In Wisconsin, among 563 radio-marked grouse with known fates, 29.8% were killed by hunters, 46.2% by hawks and owls, and 20.4% by small mammals (Rusch et al. 2000). Other mortality, including starvation, disease, and accidents, accounted for less than 4% of mortality. In Michigan, 12 to 35% of 277 radio-collared grouse were killed by hunters, 24 to 61% by avian predators, 6 to 28% by non-human mammals, 0 to 6% by disease, 0 to 6% by other causes, and 0 to 32% were unknown (Clark 2000).

Population Density

Ruffed grouse densities vary among habitats, years, and areas. Mean densities of drumming males on reported study sites in Canada, Wisconsin, and Minnesota range from 1.3 to 5.9 birds per 100 acres (Rusch et al. 2000). In northern Minnesota, Gullion (1984b) reported densities of 1.2 to 5.3 drumming males per 100 acres. Gullion (1984a) reported total spring densities of 16.7 birds per 100 acres on the Cloquet Forest during periods of peak grouse abundance. Gullion (1984a) expressed the opinion that excellent habitat could support 8.1 to 10.1 drumming males per 100 acres, with good habitat supporting 5.0, and poor habitat supporting 2.0 or fewer per 100 acres.

Grouse Cycle

Ruffed grouse populations exhibit periodic fluctuations with approximately 10-year periodicity, particularly in the northern portion of their range (Keith 1963) (Figure 11). Numerous studies have attempted to discern the driving factors behind this 10-year cycle. Gullion (1970) provided evidence that periodic declines in ruffed grouse were associated more with declines in recruitment of young birds than with declines in survival of adult birds in Minnesota. Keith and Rusch (1989), and Lauten (1995), suggested that the declining phase of ruffed grouse population cycle was correlated with decreases in overwinter survival associated with increases in local abundances of raptors. The effects of parasites (Hudson et al. 1998) and the chemistry of aspen buds (Jakubas et al. 1989) have also been investigated as possible explanations of the population cycles of ruffed grouse and similar species. Grange (1948) suggested that fluctuations in sun spot activity may cause the population cycles observed in grouse. Subsequent studies, however, have shown that even when correlations between animal populations and solar activity may serve primarily to synchronize cyclic fluctuations that are caused by other factors (Sinclair et al. 1993).

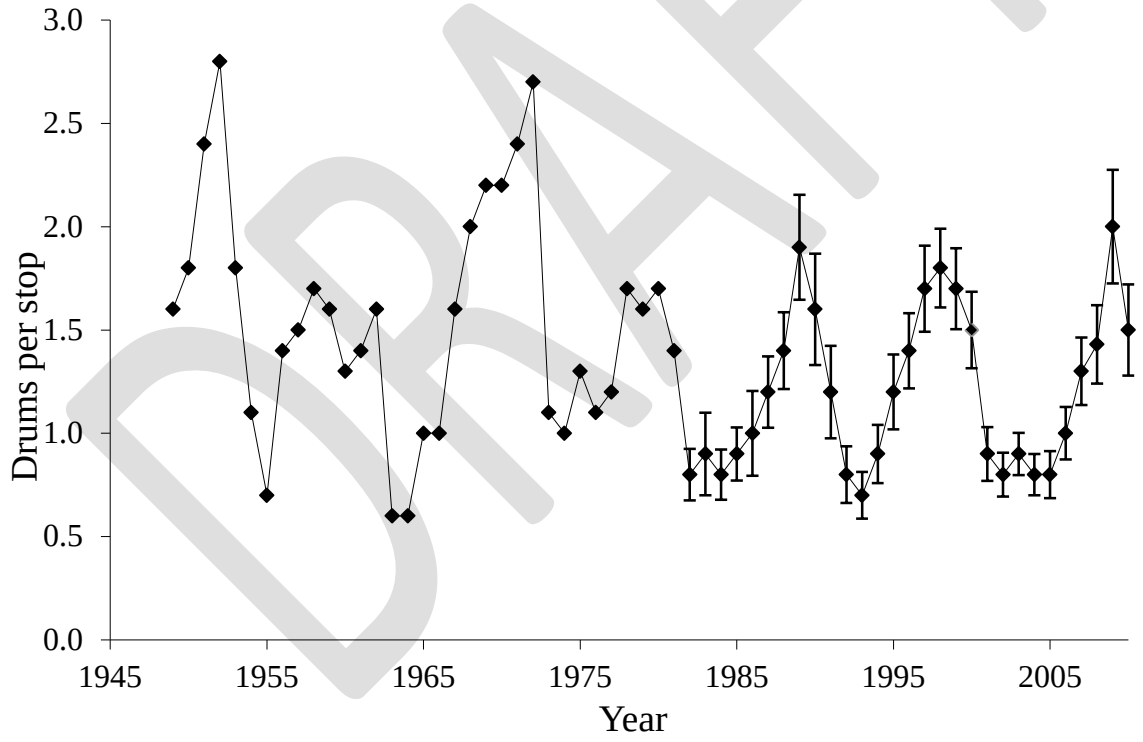


Figure 11. Ruffed grouse drum count index values in Minnesota, 1949 - 2010. Vertical error bars represent 95% confidence intervals based on bootstrap samples. Statewide means before 1982 were not re-analyzed with the current methods, so confidence intervals were not available. The difference in index values between 1981 and 1982 reflected a real decrease in drums counted, not an artifact of the change in analysis methods. (MN DNR 2010c)

Zimmerman et al. (2008) modeled many logical combinations of hypothesized factors to determine which were most highly correlated with cyclical variations in spring drum counts. The factors included goshawk abundance, weather during the breeding season, weather during the previous winter, defoliation of aspen trees by forest tent caterpillars, color phase ratios, weights of male grouse, and age ratios of both genders during the autumn, which is a common index of recruitment. The best model indicated that increased precipitation during cold winters (soft snow cover for roosting) was correlated with higher grouse population indices, but that increased precipitation during warm winters (snow crust effect) was correlated with lower spring counts. This best model, however, explained only 17% of the variation in counts over time. Zimmerman et al. (2008) concluded that several factors likely work in concert to cause the cycle, but the exact mechanisms remain unknown.

Habitat Requirements

In Minnesota, ruffed grouse occupy deciduous and mixed deciduous/coniferous forests (Gullion 1970). In southeastern Minnesota, ruffed grouse occupy forests dominated by oaks. Spruce grouse are typically more abundant than ruffed grouse in portions of northern Minnesota's conifer-dominated forest, particularly in jack pine and black spruce stands. Where forests give way to brushlands, prairie, and agricultural landscapes, sharp-tailed grouse are typically more abundant than ruffed grouse. Ruffed grouse appear absent from the riparian forests of southwestern Minnesota.

While ruffed grouse occur in forest stands not dominated by aspen and in regions where aspen is sparse or nonexistent (Devers et al. 2007), they reach their highest densities in aspen forests (Rusch et al. 2000). Classic grouse habitat consists of close juxtaposition of multiple age classes of aspen in relatively small patches (Gullion and Alm 1983, Gullion 1984a). In this context a "patch" is a contiguous area containing a single cover type in which the dominant trees are all the same age (e.g., a forest stand). It is ideal to have multiple different patches close together for ruffed grouse habitat so individual grouse can access their different daily and seasonal habitat needs within the smallest possible area. For example, patches of young trees have high densities of vertical woody stems that provide cover for escape and hiding from predators, whereas patches of older trees may provide more food in the form of aspen flower buds, buds and fruits of understory shrubs, and insects near the ground.

The early successional deciduous forests favored by ruffed grouse were historically created by wind, fire, or disease, etc. Today commercial timber harvests and other forest management practices create more early successional forest conditions than natural disturbance.

Drumming Habitat

The drumming log is considered a component of breeding habitat, offering the male grouse both an opportunity to advertise his presence to females and competitors, and providing security from predators. Drumming logs are typically eight inches in diameter, and greater than 78 inches in length (Rusch et al. 2000). Objects other than logs that elevate grouse above the ground are sometimes used for drumming (Gullion 1967), therefore suitable drumming logs are not typically considered a limiting factor to a grouse population (Rusch et al. 2000). Most primary drumming logs have guard object – a tree or stump that allows the male to hide – within 18" of the log (Gullion 1984a). Highly preferred logs have no other objects that could hide a mammalian predator within a 50-60 foot radius (Gullion 1984b).

Drumming sites occur in a variety of forested habitats (McBurney 1989), although in the Midwest the highest densities of drumming males occur in aspen dominated forests (Gullion et al. 1962, Kubisiak et al. 1980, Kubisiak 1984). A recent study in Minnesota found more drumming male grouse in young aspen stands and stands with low edge density, and fewer in mixed hardwood/conifer stands and mature spruce/fir stands (Zimmerman 2006). Vegetation structure around drumming sites has been described as early seral stage hardwood forests (Rusch et al. 2000), with stem densities between 1,400 to 14,000 stems per acre (Gullion 1970). In addition to aspen saplings, alder, hazel, and dogwood provide suitable drumming cover in Minnesota and Wisconsin (Gullion 1970, Kubisiak et al. 1980).

Nesting Habitat

A typical ruffed grouse nest is an unlined bowl of leaves on the forest floor near the base of a tree, stump, log, or rock (Gullion 1984b). Gullion (1984b) found that nest sites usually have an unrestricted view of the surrounding forest for 50 to 60 feet, presumably to prevent approach by a mammalian predator. Rusch et al. (2000) found that nesting sites had relatively open understories with dense overstory cover. Hens typically nest in pole-sized hardwood stands, with aspen being of particular importance in Minnesota and Michigan (Maxson 1977b, Gullion 1977, Larson et al. 2003).

Brood Rearing Habitat

Grouse broods and hens favor aspen habitats (Kubisiak et al. 1980), but tall shrubs, especially alder, are also important components of brood habitat (Kubisiak et al. 1980). High vertical stem densities are important as they provide cover from predators. In Wisconsin, aspen at least five years old with an alder understory, six to 25 years old without alder, and greater than 26 years old with moderate to dense understories of tall shrubs, are considered good brood habitat. In the absence of aspen, mixed hardwoods of birch, maple, ash, elm and tamarack were used in east central Minnesota (Maxson 1989). Natural forest openings less than 100 feet wide are also used by ruffed grouse broods (Kubisiak et al. 1980). Kimmel and Samuel (1984) found small forest openings with a variety of understory plant species and patchy shrub layer provided a cool, moist microclimate for grouse chicks and insects, which is an essential food for young grouse chicks.

Fall Habitat

When young grouse disperse during the fall, a period known as the fall “shuffle”, they use a wide variety of forested habitats (Barber et al. 1989). These authors found that adult males defend breeding territories at this time by drumming to exclude young males, who are thus forced to use poorer habitat. During early fall grouse appear to seek out habitats that support good supplies of soft mast.

Winter Habitat

Ruffed grouse have adapted to survive winter in a variety of habitats across their range. In general, however, wintering grouse in northern climates are associated with aspen (Gullion 1970, Rusch and Keith 1971). Since grouse prefer to feed on buds in the upper canopy of mature male aspen trees in the winter (Svoboda and Gullion 1972, Huempfner and Tester 1988), aspen saplings, alder, and upland brush sites within 100 feet of mature aspen provide cover that is considered good winter habitat (Barber et al. 1989, Rush et al. 2000, Svoboda and Gullion 1972). Ruffed grouse snow roost when conditions allow (Bump et al. 1947). Snow roosting conditions are optimal when snow depths are greater than 10 inches and the snow consistency is light and powdery (Gullion 1984b). If unable to roost under snow, grouse will use dense hardwood saplings, young oaks that retain leaves and conifers as cover during the winter (Rusch et al. 2000). In Wisconsin, the occurrence of understory conifers (< 13 feet tall) at winter flush sites of radio-collared grouse was positively correlated with survival, while the occurrence of overstory conifers (> 13 feet tall) at these sites was positively correlated with mortality (Vispo 1995). Conifers are considered essential winter habitat in regions where snow depths typically preclude snow roosts (Thompson and Fritzell 1988, Bump et al. 1947).

Population Distribution

Ruffed grouse are widely distributed across the forested portions of Minnesota. It is found in 20 of Minnesota's 26 ecological subsections.

Drumming Count Indices

In an effort to ascertain ruffed grouse population trends over time, the MN DNR established semi-permanent roadside "drumming" count routes throughout the forested areas of the state in 1949. These eight to 33-mile routes consist of 10 approximately equally spaced listening stops and are annually surveyed in April or May by DNR staff, personnel from cooperating agencies, and volunteers. Beginning at sunrise, observers drive the routes and record the number of drumming grouse heard during a four-minute period at each stop. Counts from the routes (i.e., drums per stop) are summarized within geographic regions. In 2006 we shifted from using five survey zones based largely on county boundaries to using four survey regions based on ecological boundaries (using the Ecological Classification System) and the similarity of drum counts among routes within the new regions (Figure 12). Statewide results clearly illustrate the 10-year cyclical nature of Minnesota's grouse population (Figure 1, page 25).

An effort was made to quantify the magnitude and significance of any long-term trends in regional drumming indices after accounting for the dramatic, shorter-term trends caused by the 10-year population cycle (Appendix B). Drum count data indicate that the long-term trend is stable in most of the former survey zones. Although trends in the northwest and central hardwoods zones may appear to be slightly negative, they are mostly an artifact of which years were included in the analysis. The first years were near the high end of a cycle (1951 – 1952), whereas the last years were during the low end of a cycle (2001 – 2003). A similar trend analysis was conducted on the 1949 to 2002 harvest data (Appendix C). Although some harvest data exist back to 1920, data gaps prevent analysis prior to 1949. There was no statistically significant trend in the annual statewide harvest.

The southeast is the only zone with a long-term survey trend that is not stable. In the southeastern zone there was a general increase in index values from the early-1960s to the early-1970s, followed by a long-term decline until the early 1990s, and then a stable trend at low index values. These population changes are consistent with changes in land use and land cover during the same periods. As the number of farms and farmed acres in the region—including southwestern Wisconsin—declined, pastures and fields converted to early successional forests that supported an increasing number of ruffed grouse (S. Walter, Univ. of Wisconsin-Richland Center, personal communication). When these forests, which are not dominated by aspen, later matured they did not have a dense understory, and the quality of ruffed grouse habitat declined. Currently, non-native brush provides some of the best cover for grouse in this region, and grouse populations appear to be limited by nesting habitat and possibly brood-rearing habitat, which results in low survival of females during spring (S. Walter, Univ. of Wisconsin-Richland Center, unpublished data).

The decline of ruffed grouse populations in southeastern Minnesota also appeared to coincide with increases in the density of wild turkeys. Some stakeholders have expressed concern that turkeys may have caused the grouse decline and may be responsible for preventing an increase in grouse populations. However, there is little evidence of direct interactions between turkeys and grouse, and there likely was not a substantial decline in turkey densities during the 1960s and 1070s that would explain the increase in grouse populations at that time. It is much more likely, therefore, that correlations between the densities or trends of grouse and turkey populations in an area are related to land cover and habitat.

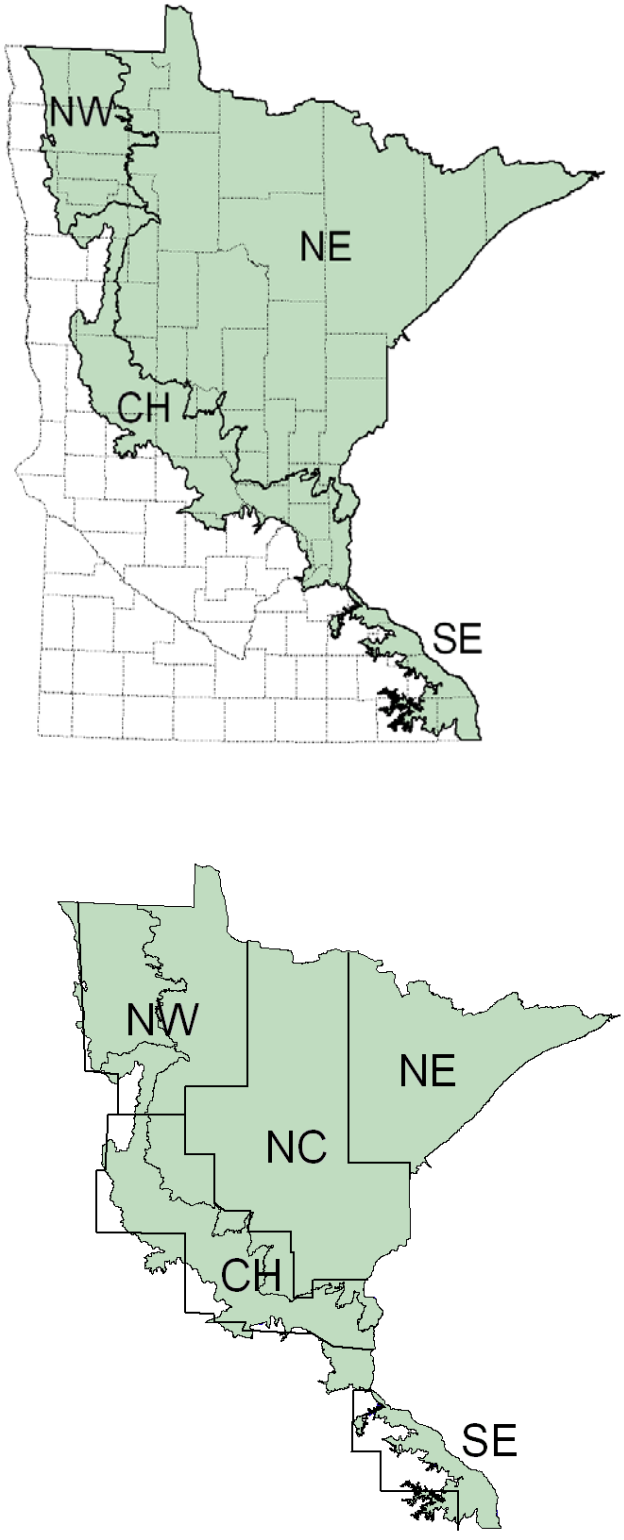


Figure 12. Ruffed grouse survey regions (shaded, curved boundaries) based on the Ecological Classification System. Top panel: regions are labeled and overlaid on counties (dashed lines). Bottom panel: former survey zones (straight boundaries) are labeled and overlaid on regions. NW (Northwest), NE (Northeast), CH (Central Hardwoods), SE (Southeast)

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Appendices

Appendix A.
Ruffed grouse habitat by Ecological Classification System Subsection

Appendix B.
Summary of public input

Appendix A

Ruffed grouse habitat by Ecological Classification System Subsection

RUFFED GROUSE HABITAT BY ECS SUBSECTION

MN-GAP Land Cover Types

ECS No.	ECS Name	Total Acres	Acres of Ruffed Grouse Habitat	% of ECS Subsection as Habitat	Upland Shrub	Lowland Deciduous Shrub (90 meter buffer)	Balsam Fir mix	Aspen/White Birch	White/Red Oak	Bur/White Oak	Red Oak	N. Pin Oak	Upland Deciduous mix	Upland Coniferous-Deciduous mix	Jack Pine-Deciduous mix	Red/White Pine-Deciduous mix	Spruce/Fir-Deciduous mix	Red Cedar-Deciduous mix
212Lb	North Shore Highlands	1,481,924	992,219	67%	72,213	121,979	62,153	723,301	0	222	6,799	0	1,260	705	0	3,586	0	0
212Ld	Toimi Uplands	339,292	211,994	62%	26,202	46,375	8,094	129,142	0	0	871	0	0	1,310	0	0	0	0
212Lc	Nashwauk Uplands	810,046	491,539	61%	148,262	55,104	36,808	244,210	0	102	149	0	1,142	278	0	3,269	2,216	0
212Ja	Glacial Lake Superior Plain	109,676	66,240	60%	982	4,909	6,161	50,228	0	767	672	0	2,068	452	0	0	0	0
212La	Border Lakes	2,771,523	1,484,121	54%	137,522	71,817	68,228	1,099,687	0	0	0	0	0	0	0	58,822	48,045	0
212Le	Laurentian Uplands	567,293	295,259	52%	26,650	35,751	18,278	198,941	0	0	20	0	0	1,324	0	14,240	55	0
212Nb	St. Louis Moraines	1,648,148	857,692	52%	73,450	94,990	18,506	606,642	4,967	2,231	39,906	0	16,088	844	34	28	7	0
212Jd	St. Croix Moraine	2,946	1,414	48%	4	49	0	671	0	234	324	0	133	0	0	0	0	0
212Na	Chippewa Plains	2,202,546	987,682	45%	54,819	118,473	25,283	547,853	0	1,622	14,981	0	210,376	0	7,084	5,838	1,353	0
212Nc	Pine Moraines & Outwash Plains	3,025,815	1,346,153	44%	150,242	73,181	5,900	916,004	0	46,659	149,072	0	4,565	0	220	293	18	0
212Ma	Littlefork-Vermillion Uplands	1,651,056	704,784	43%	49435	78893	16191	535400	0	1808	299	0	20707	0	359	542	1149	0
212Kb	Mille Lacs Uplands	3,388,960	1,209,619	36%	10,670	178,124	14,245	764,904	0	32,962	101,954	4,260	102,173	326	0	0	0	0
212Nd	Tamarack Lowlands	1,513,965	456,405	30%	46,131	106,567	3,077	286,630	4,212	19	1,382	0	17	8,369	0	0	0	0
222Lc	The Blufflands	1,287,983	381,983	30%	14,448	1,187	0	42	91,663	7,322	252,509	0	8,625	0	0	1,000	0	5,186
212Mb	Agassiz Lowlands	3,653,734	793,224	22%	22,979	243,620	4,374	497,110	0	23,624	344	0	966	0	57	131	18	0
222Mc	Anoka Sand Plain	1,200,223	196,290	16%	9,241	31,566	4	25,621	0	23,721	50,095	55,989	53	0	0	0	0	0
222Ma	Hardwood Hills	3,496,946	509,359	15%	70,866	40,080	1,588	139,533	0	93,127	151,471	228	11,778	0	243	232	214	0
223Na	Aspen Parklands	2,906,191	433,152	12%	39,948	92,434	16	228,349	0	72,165	20	0	0	167	49	0	6	0
222Md	St. Paul-Baldwin Plains	463,761	42,837	9%	13,367	935	1	1,326	0	8,956	15,558	2,012	682	0	0	0	0	0
222Lf	Rochester Plateau	1,359,459	55,254	4%	1,100	826	0	112	5,519	15,646	28,591	0	3,201	0	0	139	0	121
		31,250,225	11,517,222	37%	968,530	1,396,860	288,908	6,995,707	106,360	331,186	815,018	62,489	383,834	13,776	8,045	88,119	53,082	5,308
					8.4%	12.1%	2.5%	60.7%	0.9%	2.9%	7.1%	0.5%	3.3%	0.1%	0.1%	0.8%	0.5%	0.0%

Ruffed Grouse habitat numbers

State of Minnesota (total acres)	54,007,917	
Defined Ruffed Grouse range (acres)	31,250,225	(57.8% of Minnesota)
Ruffed Grouse habitat within range	11,517,222	(36.8% of defined range)

Habitat

Aspen / White Birch	6,995,707	60.7%
Lowland Deciduous Shrub	1,396,860	12.1%
Oak	1,315,053	11.4%
Upland Shrub	968,530	8.4%
Upland Deciduous mix	383,834	3.3%
Balsam Fir mix	288,908	2.5%
Coniferous-Deciduous mix	168,330	1.5%

Appendix B

Summary of Public Input

In 2006, an early draft of portions of this plan was made available on the MN DNR website and interested parties were invited to comment online or by mail. Comments were received from 70 individuals. Modifications to the plan consist mostly of clarification of specific subjects (such as a history and justification for current bag limits) and did not affect the long-range direction of ruffed grouse management.

Multiple comments were received on two specific topics as factors that reduce the abundance of ruffed grouse: 1) length of the hunting season and the size of the bag limit, and 2) predations. We have addressed these two topics (below).

Season Length and Bag Limits

Current regulations are for a daily limit of five grouse (10 in possession) and a season running from mid-September through December. These regulations have been in effect since 1977.

Research (as outlined in the following text) supports the belief that at a landscape or population scale, grouse populations are controlled by habitat conditions, not hunting harvest. Interest in the impacts of hunter harvest and season length led to studies and examination of additive-compensatory mortality hypotheses (Rusch et al. 2000). A study in Michigan during the mid-1990's revealed no appreciable difference in annual survival rates of ruffed grouse between sites that were experimentally closed to hunting and sites that were left open to hunting, where 12 to 35% of known ruffed grouse mortalities were due to hunting (Clark 2000). In four studies in Wisconsin, harvest rates of banded or radio-marked ruffed grouse ranged from 10 to 60% (Balzer 1995). Two studies were conducted on public land in central Wisconsin: Kubisiak (1984) found that bands from 221 of 476 grouse were recovered in the first year, mainly in the first two weeks of the season. Small et al. (1991) estimated a harvest rate of 60% on 171 radio-marked grouse. They concluded that hunting mortality was probably additive, and that numbers would be substantially reduced on areas with high hunting mortality and reduced immigration due to fragmented habitat. Harvest rates averaged 18% over 12 years (range 4.0 – 48.6%) on a southeast Ohio public hunting ground. However, statewide harvest rates for Ohio were low (8%) and likely did not affect ruffed grouse populations (Stoll and Culbertson 1995). Intense hunting pressure concentrated in small areas (e.g. <10,000 ha) can have a negative effect on local populations of ruffed grouse (Kubisiak 1984, Gullion 1989). At larger spatial scales, however, evidence supports the idea that hunting—even during periods of low grouse abundance—does not reduce the abundance of grouse during subsequent years.

Grouse hunting pressure tends to be regulated to some extent by hunters themselves. Hunting pressure and harvests are much lower during years of low grouse abundance as fewer hunters choose to hunt, and each hunter bags fewer grouse. During each of the last two peak years (1989 and 1998) in Minnesota approximately 150,000 hunters harvested an estimated 1,076,000 ruffed grouse. During each of the last two low years (1993 and 2004) approximately 91,000 hunters harvested an estimated 240,000 ruffed grouse (MN DNR 2004). Some hunters may choose to not hunt during low years because they think harvest would hurt the grouse population. Others may choose not to hunt because they would encounter many fewer grouse and the probability of their successfully bagging a grouse would be lower. A scientific basis for restricting hunting during low years in the population cycle does not exist.

Predator Control

Ruffed grouse are a potential prey item for a wide variety of predators. Some predators take more grouse than others, and some focus on adult grouse, while others mostly take eggs or chicks. Grouse predators include coyotes, red fox, gray fox, fishers, pine martens, weasels, mink, bobcats, lynx, great horned owls, barred owls, great gray owls, goshawks, red-tailed hawks, sharp-shinned hawks, and Cooper's hawks. In addition, several animals will eat grouse eggs if given a chance, including porcupines, squirrels, chipmunks, woodchucks, raccoons, skunks, and opossums. Grouse predators are native to northern forests and play an important role in ecosystem function. They are valued and admired by many citizens of Minnesota. Raptors are admired by bird watchers and are protected by the Migratory Bird Treaty Act of 1918. Most furbearers are actively trapped for recreation and income.

Seminal research in New York demonstrated that controlling predators did not increase grouse numbers (Edminister 1939). In this study, all predators were killed in one area, selectively removed from another and untreated in the third area. The test areas where predators were removed wound up actually having fewer grouse than did areas having predators.

The diverse suite of wide-ranging predators that feed on ruffed grouse means that an effective control program is not feasible or desirable. It is better to focus our limited resources on habitat, because providing adequate escape cover for ruffed grouse is the best means of mitigating and preventing negative effects of predation to the population. Many studies have documented that high densities of ruffed grouse can be achieved through habitat management without the additional effort or cost of predator control (Gullion 1989). With effective habitat management we can have healthy populations of grouse and other wildlife, including predators.

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