Final Report

Summary of Presentations from
Minnesota's Forest Habitats: Managing Across the Forest Continuum

A workshop sponsored by:

Minnesota Chapter of The Wildlife Society
and
American Bird Conservancy

Long Lake Conservation Center, Palisade, MN

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Submitted by:
DJ Case & Associates
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Introduction

Minnesota is blessed with over 17 million acres of forest habitat, represented by a diversity of forest types and age classes. Equally diverse are the wildlife species that rely on Minnesota's forest habitats. Some species may require undisturbed mature forest, some require periodic disturbance creating young forest habitat, while others require a dynamic mix of different forest types and age classes. Almost as diverse are the stakeholders (e.g., various public land management agencies, forest industry, and private landowners) that care about Minnesota's forest habitats. At times, these stakeholders have divergent views on how our forests should be managed. The goal of this forest workshop was to bring together diverse stakeholders and have a safe, constructive dialogue about the integrated management of Minnesota's forest habitats from a landscape perspective, where the full continuum of forest types and age classes, along with the species relying on them and stressors affecting them, were considered.

The American Bird Conservancy (ABC) contracted with DJ Case & Associates (DJ Case) to summarize the workshop sessions and to conduct an interactive discussion session with participants at the end to assess opinions and attitudes about Minnesota forest management. Brief descriptions of the workshop sessions follow.

The State of Minnesota Forest Habitats

Mark Nelson, U.S. Forest Service, Forest Inventory and Assessment Program and Brian Tavernia, US Geological Service, Patuxent Wildlife Research Center

The Forest Inventory and Analysis (FIA) has three product lines: biophysical (tree forest type, volume, etc.), economic (timber product output, etc.), and social (National Woodland Owners Survey). It has a seven-year cycle of measurement of the inventory and is based on hexagonal sample plots. They measure 20% of the plots each year. These are broadly distributed geographically. Results show there has been a decrease in forest land over the last five decades, but that is leveling off. The aspen/birch group and spruce/fir group have the most acres remaining, and are mostly in public ownership. Annual net growth of Minnesota forestlands is declining and mortality is increasing. Harvest removal is decreasing as well (3.5 million cords in 2004 to 2.5 million cords in 2013). There is increasing area in the small diameter stand size class, unlike neighboring states.

There is very little old growth in Minnesota (over 140 years old). But the over-100-year-old class has increased in recent decades. There are mixed ages in most stand size classes. The Northern Forest Futures Project shows anticipated changes in forest composition between 2010 and 2060. Minnesota will have a population increase and forest land loss of 280,000 acres. Public can download reports and data from the USFS Data Mart on the Internet. The database can be queried for any variable. http://apps.fs.fed.us/fiadb-downloads/datamart.html.

Summary

There has been a decrease in Minnesota forest land acreage over the past five years.
Annual net growth of Minnesota forests is declining and mortality is increasing.
Harvest of Minnesota forests is declining.
There is very little old growth forest in Minnesota, but the >100-year-old age class in increasing.
Tremendous information on Minnesota's forests are available to the public on the USFS Data Mart.

The State of Forest Breeding Birds in Minnesota – results from Minnesota's first BBA

Jerry Niemi, University of Minnesota–Duluth, Natural Resources Research Institute

The Minnesota Breeding Bird Atlas (BBA) was started in 2008 to document and map the occurrence and breeding status of all species in the state. It provides a baseline for monitoring future changes. It consists of 2 databases. The first contains data gathered by volunteers to determine evidence of breeding. The second method is a systematic, 10-minute point count for every township in Minnesota. The goal is to understand the abundance of breeding birds and the factors associated with abundance. The BBA has 7,080 bird atlas monitoring locations and a total of 8,376 locations. They confirmed breeding for 250 species in the state and have over 350,000 observations in the database. The monitoring points covered 99.8% of 2,300 townships in Minnesota. Researchers are currently conducting analysis on data and will prepare a website, and possibly a book, to present the results. To illustrate the results of the BBA, the presenter showed some specific data for ovenbirds and GWWs.

The Chippewa and Superior National Forests both have breeding bird-monitoring programs. On both forests, results showed that 95% of the species tested were stable or increasing. Only one species has a decreasing trend on both forests (Connecticut warbler). However, these results may only be applicable to National Forest lands. Other species are maintaining stable populations.

Logging in Minnesota has changed. While fairly stable until the 1980s, it has increased since then. Researchers conducted a study on the effects of this logging. Stakeholders agree that Minnesota should not lose any more forested land. Historically, Minnesota had 31 million acres of forest, but that was reduced to 16-17 million acres currently forested. In 1995, the Forest Resources Act and Council were created, and are still active today. The Council developed models to examine three levels of harvest, to examine sustainability. The results indicated that a total harvest of 4 million cords would be sustainable. Minnesota has not exceeded that level since the models were created. Harvest is still declining. According to the Minnesota Forest Resource Council, young forest and old growth forest are both increasing, and 40-60 year-old trees are decreasing. The major threats to Minnesota forests include:

- Climate change and associated disturbances
- Loss and fragmentation of forests
- Invasive species
- Biomass harvesting and other energy infrastructure
- Changes in the balance between forest cover types, aged classes and patch size
- Management strategies that deviate from the range of natural variation in Minnesota forest ecosystems

Summary

Forest Resources Council agreed that Minnesota should not lose any more forest land.
There are certain bird species that are of concern in Minnesota forests.
Certain species require significant conservation effort.
Harvest levels are below historical levels and declining. Models show that a harvest level of four million cords per year would be sustainable.
Managers need to get current with recent and historical literature.
Need to keep a landscape perspective.
Pay attention to patch size.
Post-breeding and migratory habitat and landscape use by birds along with technology is important.

Current and Future *Stressors on Minnesota's Forest Ecosystems*

Mark White, Forest Ecologist, The Nature Conservancy

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The presentation focused on northern temperate-boreal forest transition zone. Mark White talked about a range of stressors to forests and how those stressors interact. Historically, there was a great loss of long-lived conifers and structural diversity with European settlement. He listed a range of insect pests and the effects of climate change on them. Forest pathogens are very complex—there are many variables. Climate change will likely increase pathogen impacts on forests, although it could reduce risk for white pine blister rust.

With CO_2 enrichment, nitrogen deposition may offset some of the effects of warmer and drier conditions. Chemical defenses in trees may increase with moderate drought stress, but they decrease under high stress. Stressed trees are much more vulnerable to opportunistic pests. Additionally, deer impacts are variable across the landscape. Under high population density, selective feeding on preferred tree species limits tree regeneration resulting in cascading effects across trophic levels. This facilitates invasive plant colonization. Additionally, recovery is slow, with reduced adaptive capacity. Invasive earthworms complicate this issue by causing increased soil bulk density, decreased nitrogen and phosphorous availability, and lower moisture-holding capacity. This can cause regeneration failure.

Invasive plants further complicate resiliency in forests. Invasive species in Minnesota's forests include common buckthorn, garlic mustard, and shade-intolerant species such as Canada thistle, bull thistle, common tansy, etc.

Disturbance regimes are another potential stressor to Minnesota's forests. They include fire (more with drought and disease), land-use fragmentation, and wind. All these stressors have the potential to be impacted by climate change. While modeling forests under climate change can be done, the results have high uncertainty. However, by modeling low and high emissions scenarios with different management treatments, we can gain insight into the range of possible changes in forest composition and how we might use management to help maintain functioning forests.

Summary

Management can increase the adaptive capacity of forests.
Trophic interactions are significant drivers over time.
Higher emissions will reduce adaptive capacity in forest ecosystems.
Multiple factors (fire, wind, insects, disease, deer, earthworms) will interact with climate change and will have large impacts.

Full Season habitat Associations of Forest-Nesting Songbirds

Henry Streby, National Science Foundation Postdoctoral Research Fellow, University of California–Berkeley

There are large potential problems with using counts of singing male birds on the breeding grounds as the *only* measure of necessary habitats needed by a species. Singing habitat is only about 0.2% of all habitats used by songbirds. Therefore, all our management decisions are based on a tiny fraction of available habitat. This study used radio telemetry on bird use of habitat during the full breeding (spring and summer) season. The study compared ovenbird (mature forest nester) and golden-winged warbler (GWW) (young forest nester) habitat needs over this period. They wanted to know how to reconcile the

different habitat needs of these species. Ovenbirds nest almost exclusively in mature forest, but raise young in mid-stage forest, and independent young spend most of their time in young forest. GWWs sing in young forest on the edge of mature forest, but spend a lot of non-singing time in mature forest. Females nest in mature forest almost as much as young forest, but always near the edge. When the young fledge, they spend a lot of time in mid-successional stands. When independent, most (78%) fledglings go to mature forests. Predator avoidance and food availability are the most likely explanations for this switch. The mid-successional forest stage is really important. In Tennessee, they don't have much mid-successional forest, and their fledgling survival is very low because of predation. Tamarack National Wildlife Refuge has the highest productivity of GWWs ever recorded—probably because of good availability of mid-successional habitat.

Summary
Habitat associations developed strictly from song perches are over-simplifications of reality.
Diverse forest bird communities require diverse forest landscapes.
Dense mid-seral-stage stands are important to many songbirds.

Marten and Fisher *use of forest habitat in Minnesota*
John Erb, Wolf and Furbearer Research Scientist, Minnesota Department of Natural Resources
Fishers and martens are forest-dependent species. Both species are declining in general. Not all forests are created equal for their habitat. Physical structure is critical. They need blowdowns, rocky, shallow soils, burrows, and healthy small mammal populations. They primarily need old forest or forest that was old and some of that structure was left. Fishers mostly use tree dens for nesting. Dens were mostly (71%) in live trees, with average dbh of 20.5 inches. Aspen trees were used most commonly. Marten also mostly use tree cavities, but 36% use underground burrows. The average dbh of den trees was 18 inches, mostly aspen and cedar. Underground dens were around root wads in lowland rocky soils.

Both of these species may spend up to ¾ of their time resting in either above-ground structures (witches broom, cavities, branches, nests or elevated logs), ground-level structures (hollow logs, log piles) or below-ground structures (burrows, burrows under trees/snags, burrows under rock outcrops, burrows under stumps or burrows in/under tip-ups). Fishers tend to den longer than martens during January, but both spend the most time in their dens during the month of January.

Summary
Populations of fishers and martens are both declining in Minnesota.
Both species require forest with a lot of physical structure.
In general, old forest is best for habitat.

Beaver management in Forest Landscapes: Opportunities for Co-existencee
Steve Windels, Research Wildlife Biologist, Voyageurs National Park
Research in Voyageurs National Park has provided an excellent dataset. After the park was created and hunting/trapping prohibited, beaver populations greatly increased—to the highest levels ever recorded in the lower 48 states. Up to 13% of the land in the park was impacted by flooding from beaver dams. Consequently, beavers are one of the largest disturbance agents in the park. They prefer deciduous species like aspen, birch, willow, alder, and mountain maple. They impact areas far beyond the pond itself. Beavers are keystone species. They create water storage capacity, affect sedimentation rates, biogeochemical processes, nutrient cycling, methylmercury production, and accelerate succession in

forest and wetland plant communities. They also increase structure in lake and river systems, creating habitat for all kinds of wildlife. The presence of beavers increases the abundance and richness of aquatic plants. Beavers are key food sources for wolves and other predators.

Beavers were extirpated from the park area in the 1900s, but they can disperse over 90 km by water, and they came back very strong. The population in the park peaked about 1985, and is now leveling off. Beavers can cause big problems for humans, primarily through flooding and losses to commercial and ornamental trees. They do also cause conflicts with stream trout fisheries, through habitat degradation and restrictions on passage.

Summary
Because of their dam-building activities, beavers have ecological importance far greater than their size and numbers would otherwise indicate. Managers need to strive to maximize beaver-related ecosystem services versus minimizing beaver-human conflicts.

Moose and deer Habitat use in Northeast Minnesota
Amanda McGraw, PhD student and Ron Moen, University of Minnesota – Duluth, Natural Resources Research Institute
Moose are declining in Minnesota. The population went from 4,000 in the mid-1980s to less than 100 now in northwest Minnesota. A similar decline is now happening in Northeast Minnesota as well. Many moose are dying in late summer, when living should be easy. No one has yet discovered any quick or easy answers why this is the case. Moose spend most of their time either foraging or ruminating. They have huge home ranges. Moose use areas of higher canopy closure when it's over 63 degrees and they tend to chose soil with higher water content. Moose are foraging less in early successional forest than originally hypothesized. They recently collared some deer in moose range to see if there are negative interactions between deer and moose.

Summary
Moose in Minnesota are in serious decline.
Moose are dying in late summer, when mortality would be least expected.
To date, there is no explanation for the decline. More research is underway.

Natural Models for Ecological Forestry
Brian Palik, U.S. Forest Service, Northern Research Station
Aldo Leopold's admonition to "keep all the parts" is at the heart of ecological forestry. After WWII, much of forestry followed the basic agricultural model. Forests were simple and homogeneous. Ecological forestry is much more than this. It is designed to sustain ecological services across the landscape. But timber/fiber production is still an important part of the mix. Nature generates structurally complex forest stands. Management (usually) makes them more simplistic. Complex and heterogeneous structure provides more options for the future. You develop these traits through disturbances, stand development processes, and time. The three-legged stool of ecological forestry includes: legacy management, recovery periods and intermediate treatments. It balances production with ecological services.

The benefits of ecological approaches include: sustaining biodiversity, restoring native ecosystems and adapting ecosystems to future climates. In addition, forests that mirror the complexity of natural

systems tend to be resistant to invasion and catastrophic disturbance, store more carbon, provide habitat for a variety of species and maintain productive capacity.

Summary
After WWII, much of forestry followed the basic agricultural model—simple and homogeneous.
Complex and heterogeneous structure provides more options for the future.
Ecological forestry is designed to sustain ecological services across the landscape, but timber/fiber production is still an important part of the mix.
The benefits of ecological approaches include: sustaining biodiversity, restoring native ecosystems and adapting ecosystems to future climates. In addition, forests that mirror the complexity of natural systems tend to be resistant to invasion and catastrophic disturbance, store more carbon, provide habitat for a variety of species and maintain productive capacity.

Minnesota GAP Project: habitat-wildlife modeling for forest species
Gary Drotts, Minnesota Department of Natural Resources
A Gap Analysis is the science that attempts to answer how we are protecting common plant and animal species. It is a nationwide program promoted by USGS to provide regional assessments to facilitate the application of this information to management activities. The Minnesota GAP (MN-GAP) project acts as a benchmark for cover type, habitat and species. To develop the GAP, the DNR prepared GIS coverages for land cover, land stewardship and management and predicted animal distributions. The layers were then analyzed to compare predicted animal distributions with ownership and management coverage. Finally, the DNR generated summary maps and tables reporting representation of land cover types and wildlife species in each stewardship/management category.

In the future, land stewardship information will need to be continually edited, updated and standardized. Land cover images and processing should be duplicated at least every twenty years. In addition, a standard method for continual review of the data via expert input should be established. Finally, the information from the GAP project should be made available to the public via a web-based, user-friendly platform (www.gapanalysis.usgs.gov).

Summary
The Minnesota GAP (MN-GAP) project acts as a benchmark for cover type, habitat and species.
To develop the GAP, the DNR prepared GIS coverages for land cover, land stewardship and management and predicted animal distributions.
The DNR generated summary maps and tables reporting representation of land cover types and wildlife species in each stewardship/management category.
Land cover images and processing should be duplicated at least every twenty years.
GAP project information is available to the public via a web-based, user-friendly platform (www.gapanalysis.usgs.gov).

Young Forest Bird Habitat Initiatives in Minnesota
Tom Cooper, Eastern Webless Migratory Game Bird Coordinator, U.S. Fish and Wildlife Service and Kevin Sheppard, American Bird Conservancy
Tom Cooper spoke about the population trends of forest nesting birds. It is important to note that almost half of the bird species that rely on young forest are declining over time. The driver to the

population loss is likely connected to states that are showing pretty steep declines in young forest habitat. While Minnesota's young forest habitat is slightly gaining and the woodcock population is stable, both of the national woodcock management regions are showing long-term population declines.

The American Woodcock Conservation Plan was developed a few years ago, and it guides managers in how to optimize for woodcock conservation. The take away message for Minnesota is to balance the age classes of our forests. Kevin Sheppard talked about ABC's GWW work in Minnesota. He gave a few examples of private landowners he had worked with and asked the group for advice on what they would do in the same situations.

Summary
Nearly half of the bird species that rely on young forest are declining over time.
Declines likely linked to loss of young forest habitat.
In Minnesota, young forest habitat is increasing slightly and the woodcock population is stable, but both of the national woodcock management regions are showing long-term population declines.
In Minnesota, the key is to balance the age classes of our forests.

Beyond the Big Trees: Restoring the Function of Old Growth Forests
Becky Marty and Harvey Tjader, Minnesota Department of Natural Resources, Division of Forestry
Old growth forests are forests that have developed over a long period of time with minimal stand replacing disturbances. These forests are typically dominated by sugar maples, white spruce or white cedar and largely have a shaded canopy. While species diversity reduces as a forest ages, this diversity rebounds as the forest reaches an old growth stage at about 200 years and older. The habitat value of old growth forests stems from snags, large trees, fallen logs, lichens, vertical structure, and horizontal structure. Because of the habitat it provides, many mammals, such as fishers, are dependent upon old growth forests. In addition, there are more bird species in old growth forest, especially old, wet stands. About 4% of Minnesota's forest is currently in old growth. This figure was 51% in 1850. The values of old growth (scientific and educational, habitat, benchmarks and recreation) were discussed. There are many species that are obligates for old growth forest.

Summary
In general, wildlife species diversity reduces as a forest ages, but this diversity rebounds as the forest reaches old growth stage (about 200 years and older).
The habitat value of old growth forests stems from snags, large trees, fallen logs, lichens, and structure.
Many wildlife species are dependent upon old growth forests.
Only about 4% of Minnesota's forest is currently in old growth.

Finding common ground: Integrating forest wildlife habitat management at a landscape scale
Workshop Summary and Group discussion led by Bryan Lueth, Minnesota Department of Natural Resources; Phil Seng, DJ Case & Associates; and Andrew Rothman, American Bird Conservancy

To obtain a better understanding of the values and attitudes of the audience toward forest management, DJ Case worked with Andrew Rothman, Tom Cooper, and the workshop committee to generate a list of survey questions. DJ Case used a real-time audience polling software tool called *TurningPoint* to administer the survey. TurningPoint integrates with PowerPoint and gives instant feedback on how the audience responds to the questions posed. Each participant received a

TurningPoint keypad that allowed him or her to answer the questions presented by the moderator. The moderator described the use of the keypads and administered the survey to the audience, beginning with a few demographic questions. The results of the TurningPoint survey are as follows.

The age of participants was nearly equally distributed, with the exception of there being fewer participants over 61 years old than in other categories (Figure 1). Most of the participants were field staff (Figure 4) working for state agencies (Figure 2), with a plurality of participants having less than five years of direct experience working in Minnesota forest management (Figure 3).

When asked "How important are each of the following to your personal definition of a healthy forest," majorities of participants said that "forests able to support populations and diversity of non-game species," "forests with a diversity of age classes," and "forests able to provide ecosystem services" were either very or extremely important (Figures 5-9). Interestingly, most participants did not think that timber production was an important component of a healthy forest (Figure 8).

Participants were asked to rate various conditions or problems as to how challenging they are for reaching the goal of sufficient, healthy, native, diverse, productive forests in Minnesota (Figures 10-14). Although there was not much agreement on which of the conditions or problems were *most* challenging, the problem of "unbalanced forest conditions" was the item most frequently rated as "very" or "extremely challenging" (Figure 14). In contrast, few participants found the "lack of funding," "lack of staff," "lack of coordination/communication among stakeholders" or "lack of compatibility of management objectives" as major challenges.

Participants had largely mixed views regarding the impediments to working across ownerships to better manage Minnesota's forests (Figures 15-17). The number of participants who viewed "historical grievances" and "a lack of information sharing" as major impediments was nearly equal to the number who viewed those items as only minor impediments. However, a majority of participants did view "having differing resource goals" as a major impediment.

In addition to being asked about impediments to working across ownerships, participants also were asked about impediments to working at a landscape scale. In general, most thought there were greater impediments to working on forests at a landscape scale (Figures 18-21) than across ownerships. Over half of the participants identified the major impediment (rated as a 1 or 2) to working on forests at a landscape scale as "having overly complex resource goals." There was less of a consensus around the remaining issues, but slight- or near-majorities of participants also gave a 1 or 2 rating to "lack of information-sharing mechanism," "logistical impediments," and "lack of trust between agencies and the public."

When asked to rate four different threats (invasive species, population growth, socio-economic factors, and climate change) to sustainable forests in Minnesota (Figures 22-26), a majority of participants said all four were major threats. More participants said climate change was a major threat than any other option. While socio-economic factors were viewed as a major threat by the majority of participants, this option also had the largest number of participants who viewed it only as a minor threat (Figure 24).

A plurality of participants thought there was a need for a greater number of old growth trees in Minnesota. Only slightly fewer thought that the mix of young and old growth was about right (Figure 27). Few saw a need for more young forest.

When asked to rate the "Importance of focusing forest management towards species common in Minnesota but not in their historic range" (the golden-winged warbler is the primary example), a large majority felt this was "somewhat" or "very important" (Figure 28).

When asked to rate "the degree to which their personal knowledge or perceptions of Minnesota forest management were changed by the workshop," the majority felt their knowledge and perceptions were changed slightly or moderately. A few claimed their knowledge and perceptions were not changed at all (Figure 29).

No Cross-Tabulations

By asking demographic questions, we were able to conduct chi-square analysis to see if there were differences among the various demographic groups (age, position, etc.) in how they answered the survey questions. For the vast majority of questions, there were no statistically significant differences among groups. For the handful of questions that did show differences, the extremely small sample size in the variables of interest (e.g., only one person self-identified as a county agency representative) made the findings meaningless; therefore, we have not reported them here.

Conclusions

- Most workshop participants had similar views of what a "healthy forest" looks like. It usually includes "forests able to support populations and diversity of non-game species," "forests with a diversity of age classes," and "forests able to provide ecosystem services." "Timber production" was not included in most participants' definition of a healthy forest.
- Participants had a wide variety of opinions about the conditions or problems that were most challenging for reaching the goal of sufficient, healthy, native, diverse, productive forests in Minnesota. The problem of "unbalanced forest conditions" was the item most frequently rated as "very" or "extremely challenging."
- Several workshop speakers recommended that various agencies and ownerships of natural lands should work together to manage for forests that are more resilient to negative impacts such as climate change (and many others). However, most participants had concerns about potentially significant impediments to managing forests across ownerships. Most participants viewed the fact that different ownerships had different resource goals as the biggest impediment.
- Working together at a landscape scale is an admirable admonition that is often heard in forest management circles; however, participants of this workshop felt that inter-agency difficulties and overly complex resource goals are significant impediments to managing Minnesota's forests at a landscape level.
- Workshop presentations showed that there are many potential challenges facing Minnesota's forests. The biggest challenge, in the view of participants, is climate change, but participants have significant concerns about a host of other potential threats.
- Most participants of the workshop believe that additional old growth forest is needed in Minnesota, or that the mix of old growth and young forest is about right. Only a handful believed that more young forest was necessary.
- The golden-winged warbler is a species that is doing very well in Minnesota, but is rare and/or declining throughout much of its historical range. Nearly all workshop participants felt that continuing to focus management efforts on species such as this is important, in spite of the fact that such management is not necessarily warranted to keep Minnesota populations healthy.

- The majority of workshop participants indicated their knowledge or perceptions of Minnesota forest management were changed based on their participation. Holding workshops such as this to share information and management strategies is very important for the future of healthy forests in Minnesota.
- It was noted that it is important not lose sight of the ongoing daily input and struggles managers must go through to meet agency and resource group goals. The agencies and the timber industry are the real drivers of forest management and forest change in Minnesota. Current demands make overall and long-term wildlife management difficult. It will continue to be important but challenging to incorporate new tools and processes for the long-term greater good.

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Figure 1: Participants' Ages

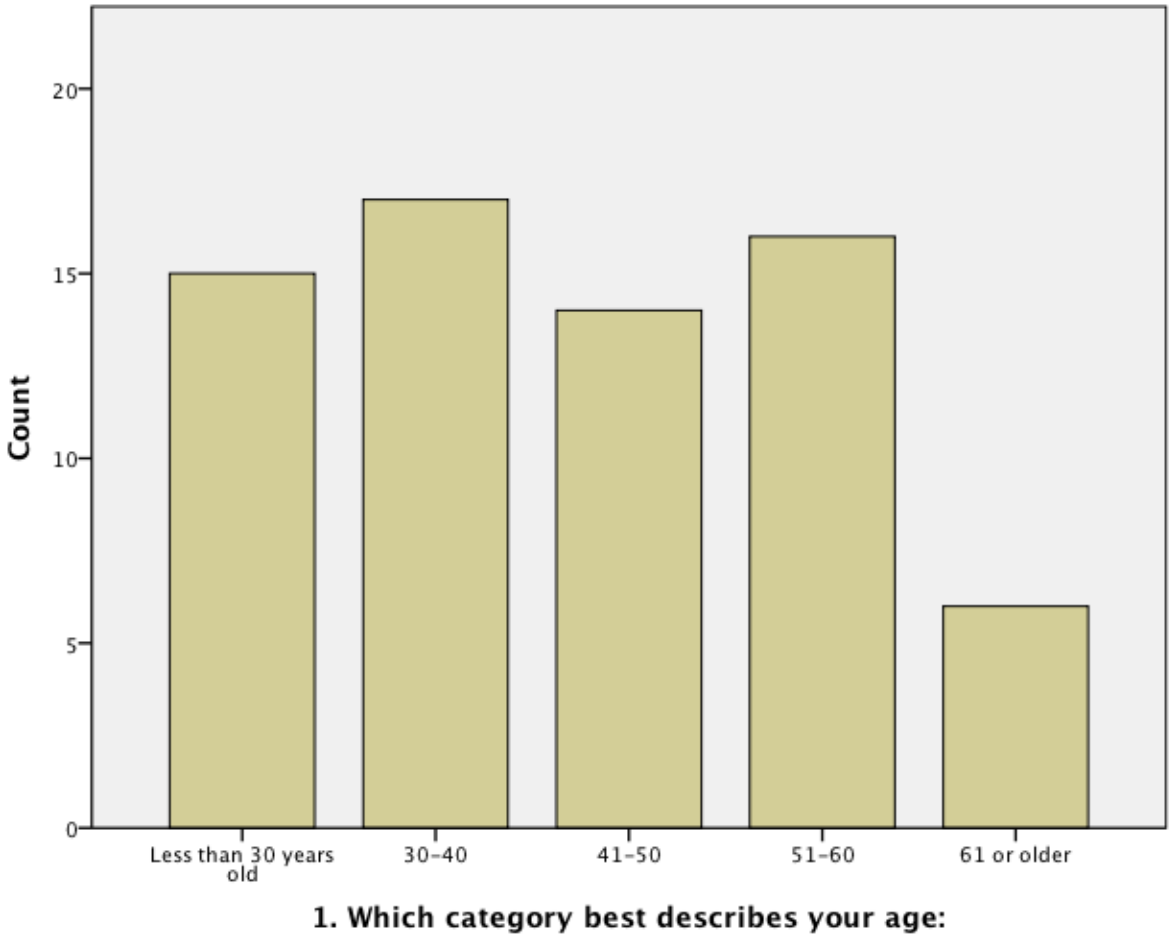

Figure 2: Participants' Affiliation

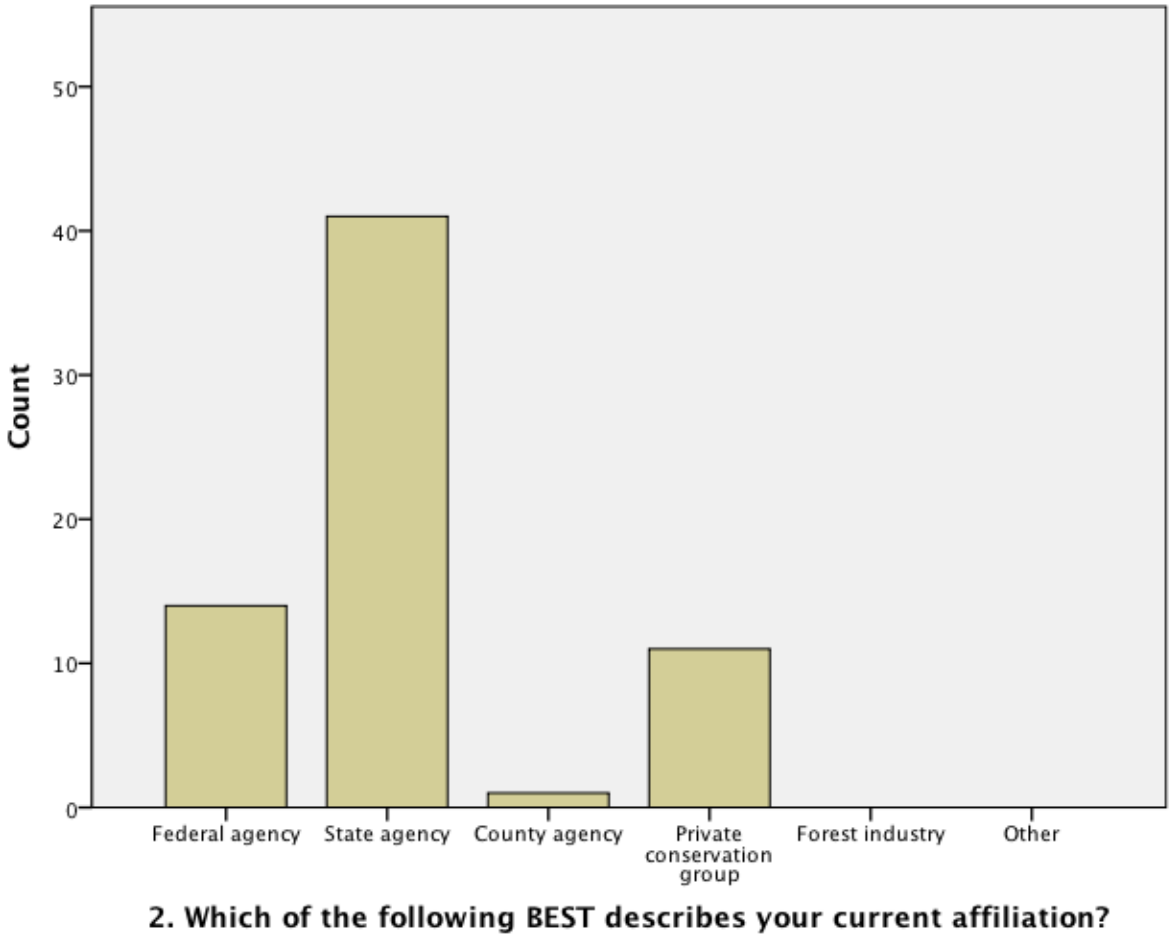

Figure 3: Participants' Years of Experience

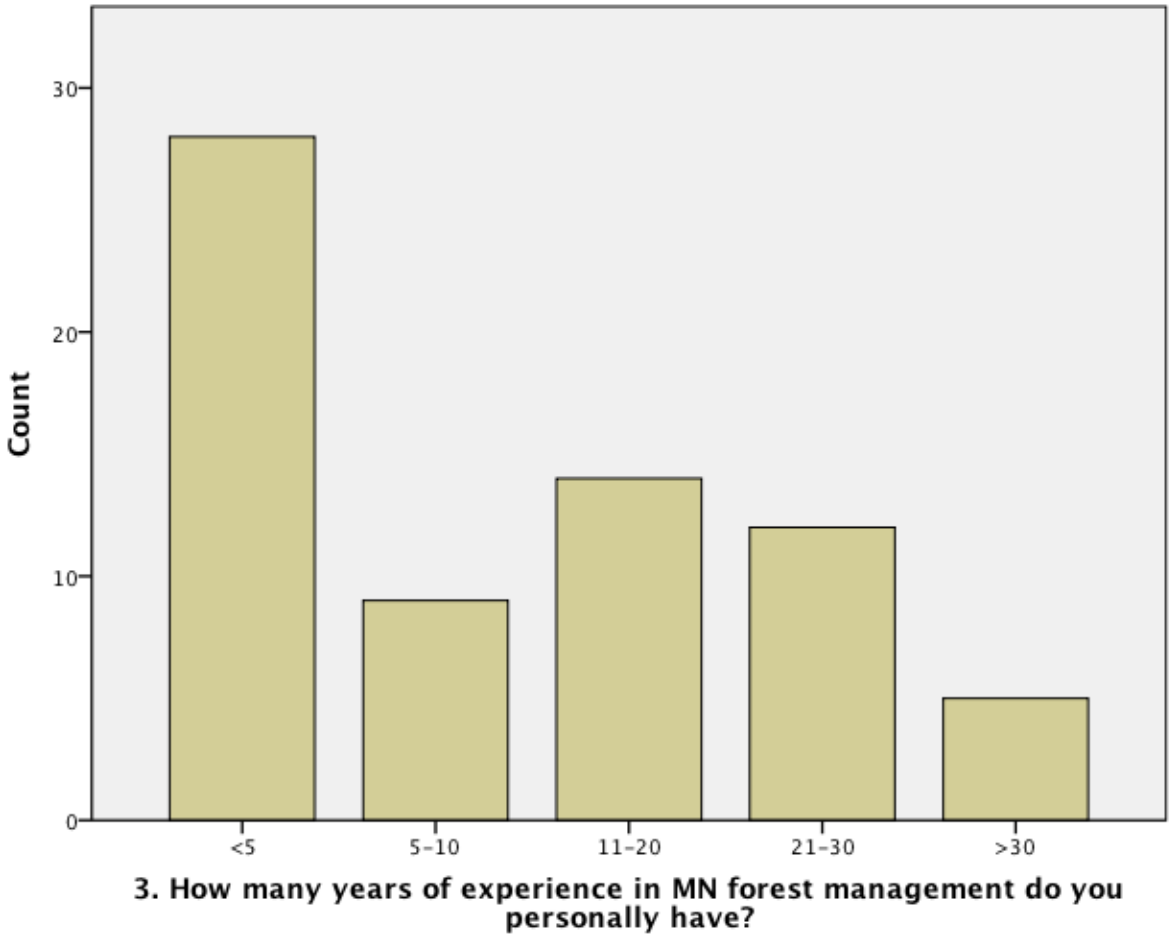

Figure 4: Participants' Positions

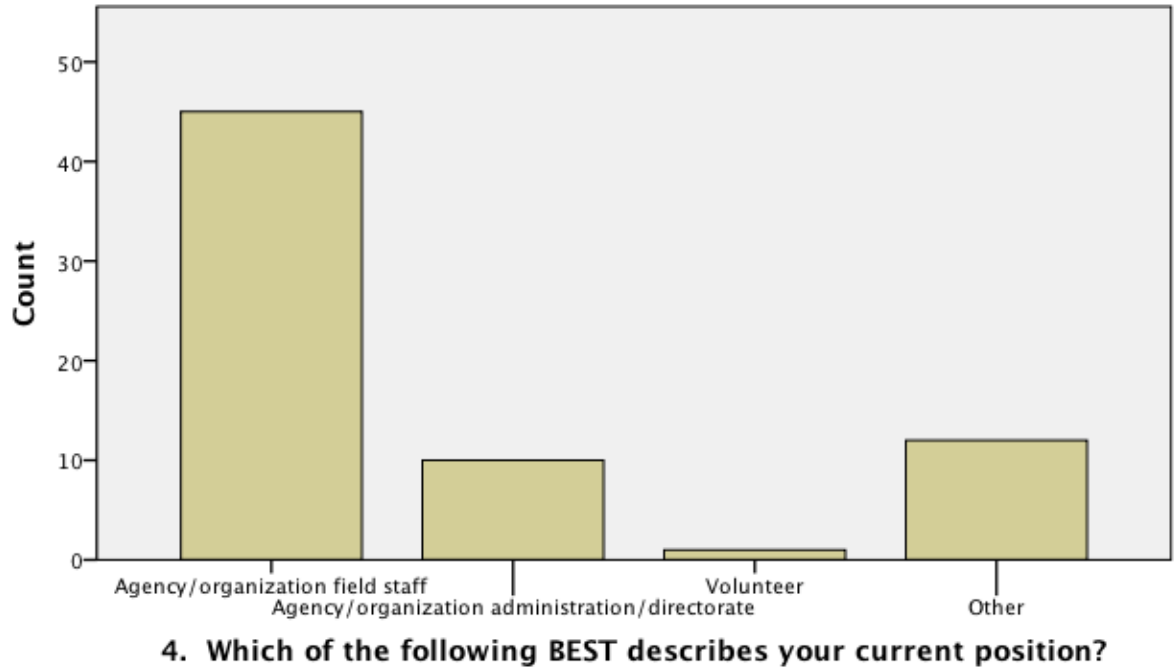

Figure 5: Importance of *Wildlife* for personal definition of a "Healthy Forest"

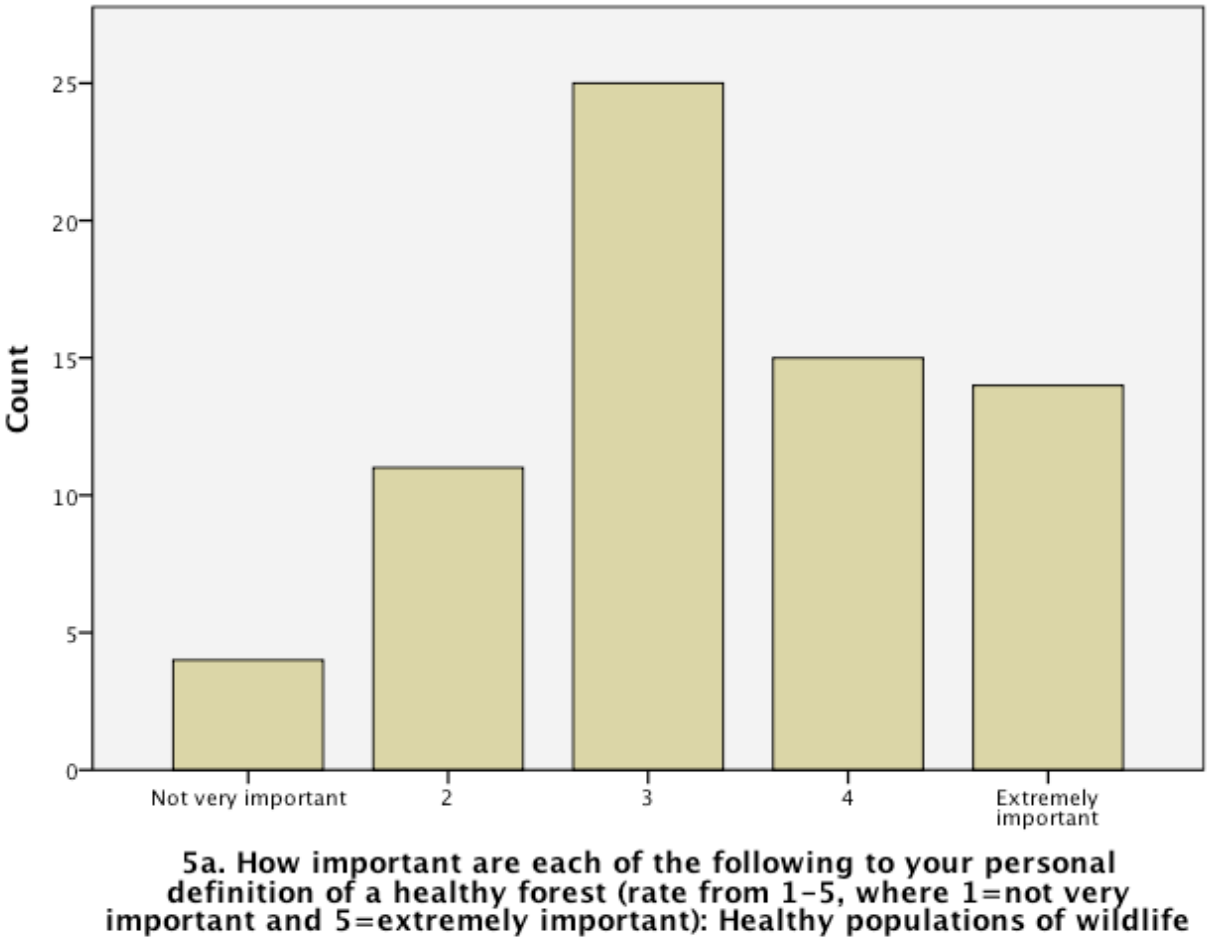

Figure 6: Importance of *Healthy Populations and* Good *Diversity of Non-Game Species* for personal definition of a "Healthy Forest"

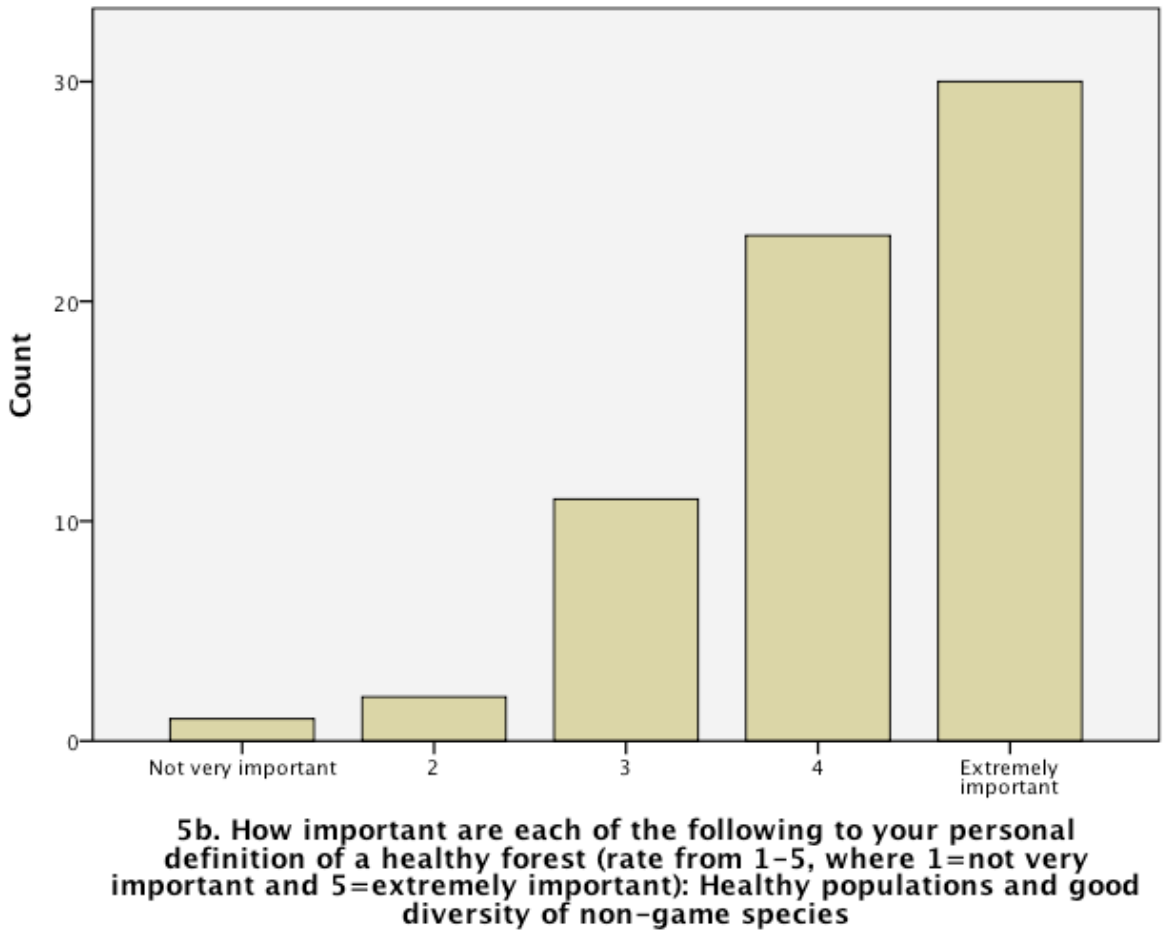

Figure 7: Importance of a *Diversity of Forest Age Classes* for personal definition of a "Healthy Forest"

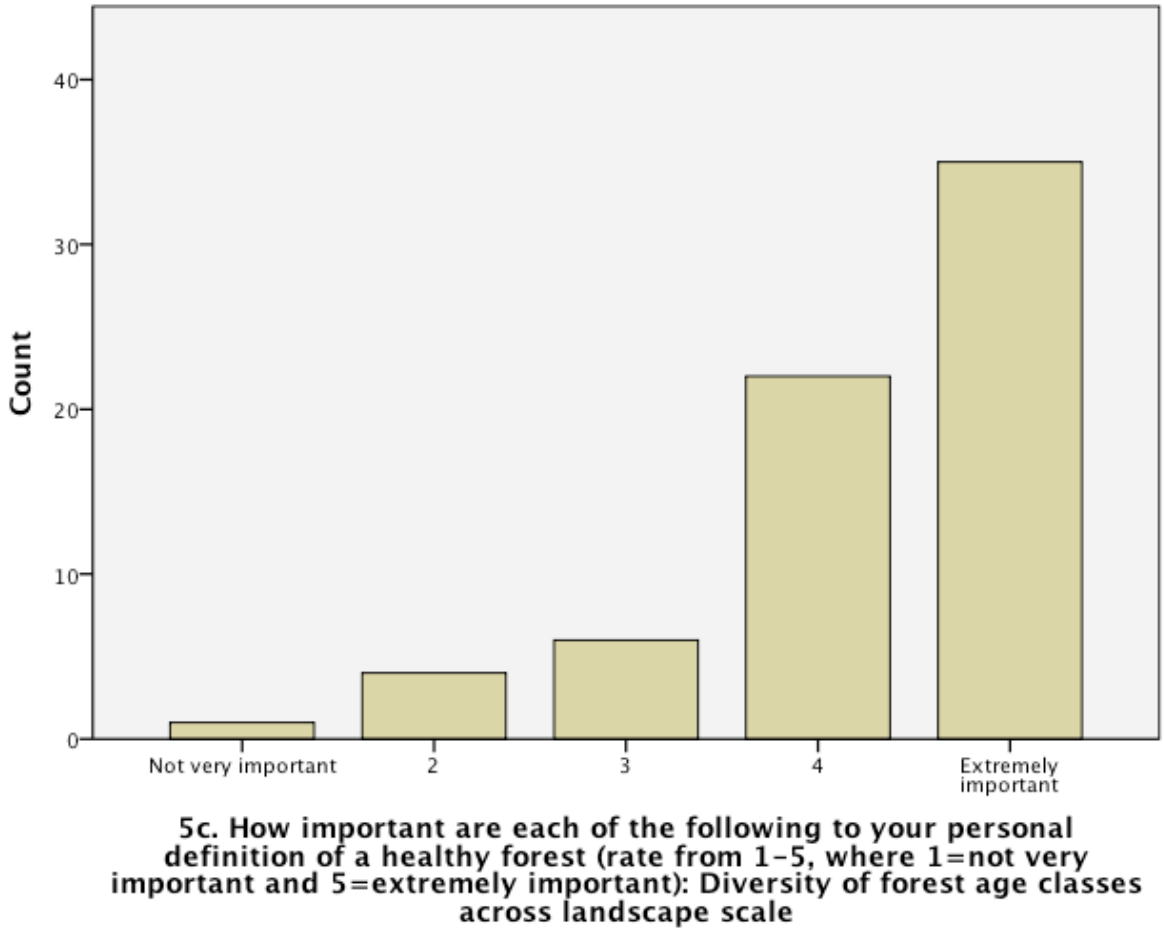

Figure 8: Importance of *Producing Timber* for personal definition of a "Healthy Forest"

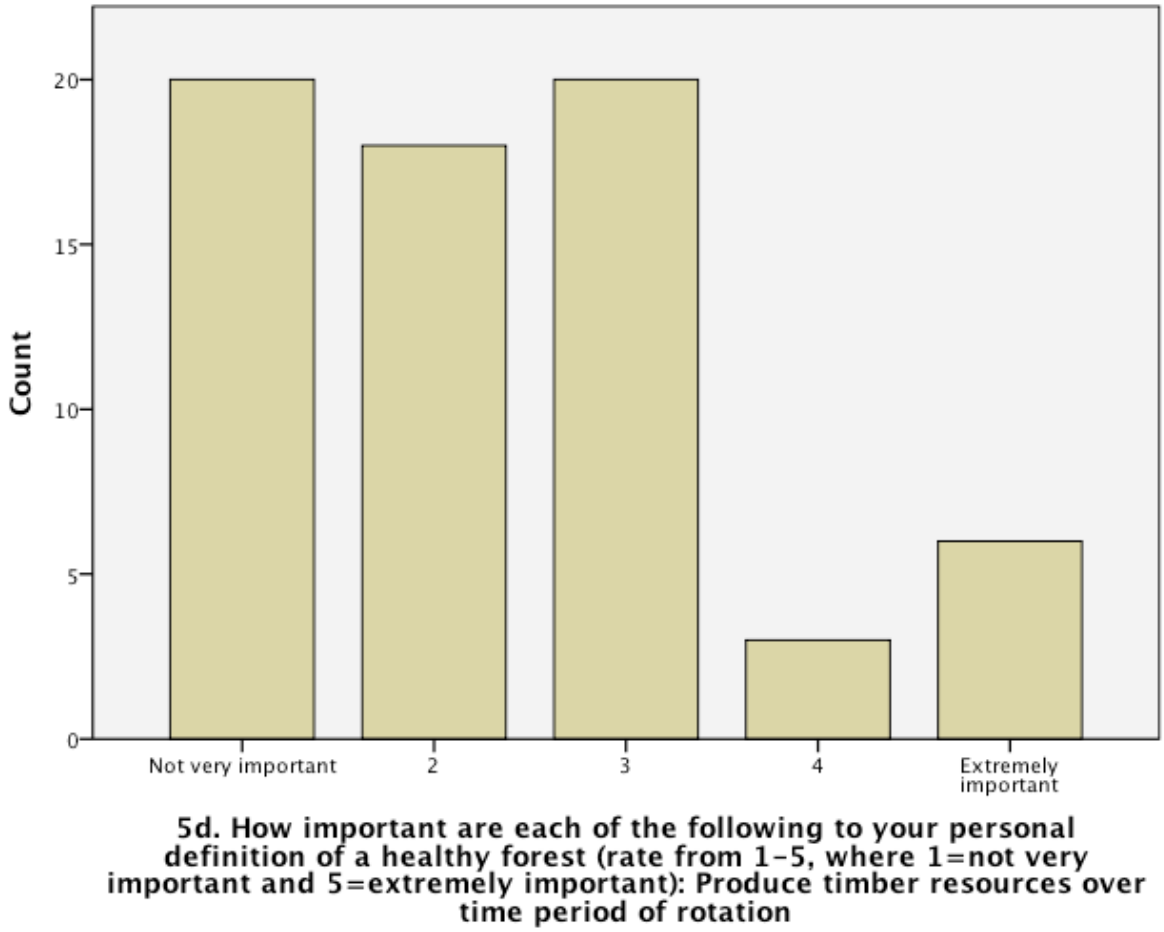

Figure 9: Importance of *Providing Ecosystem Services* for personal definition of a "Healthy Forest"

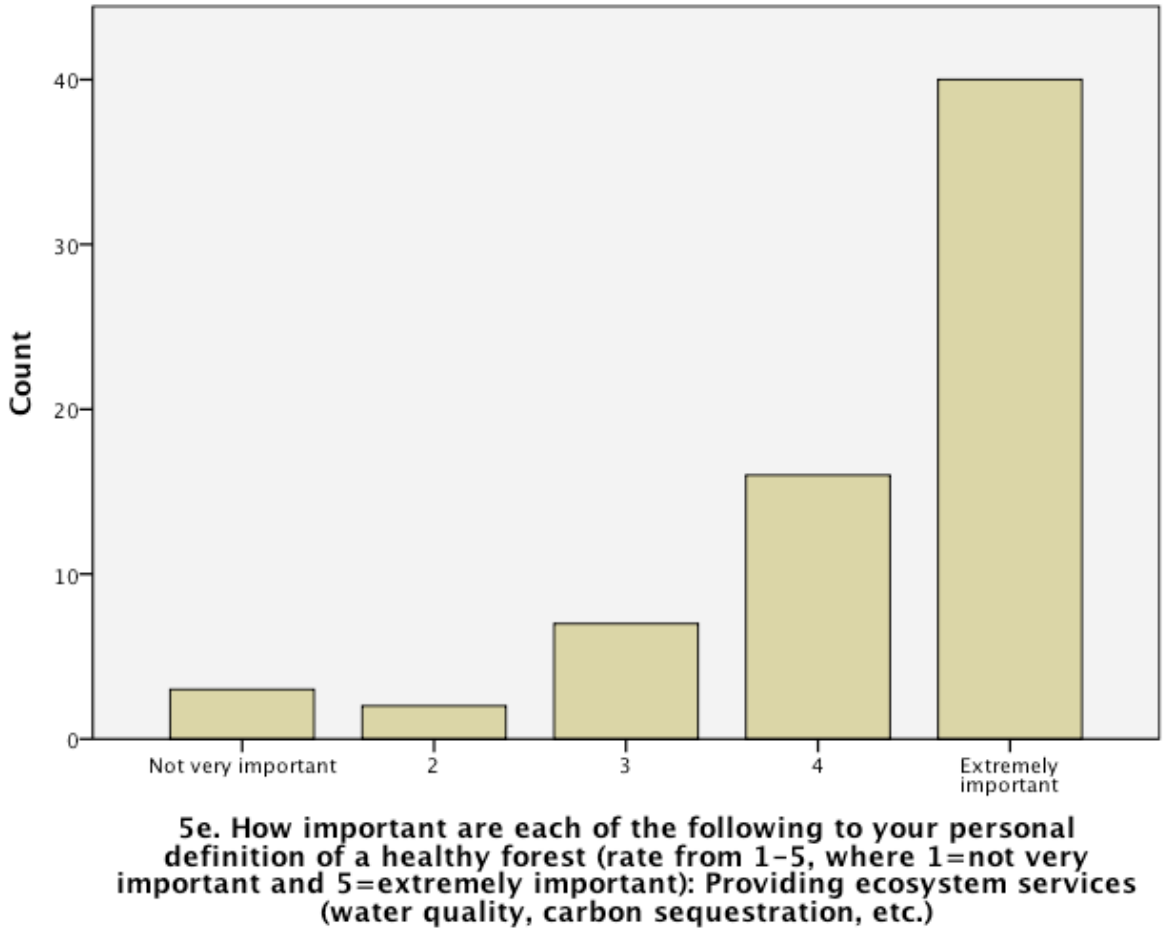

Figure 10: Challenge of the *Lack of Funding* to have Sufficient, Healthy, Native, Diverse, Productive Forests in Minnesota

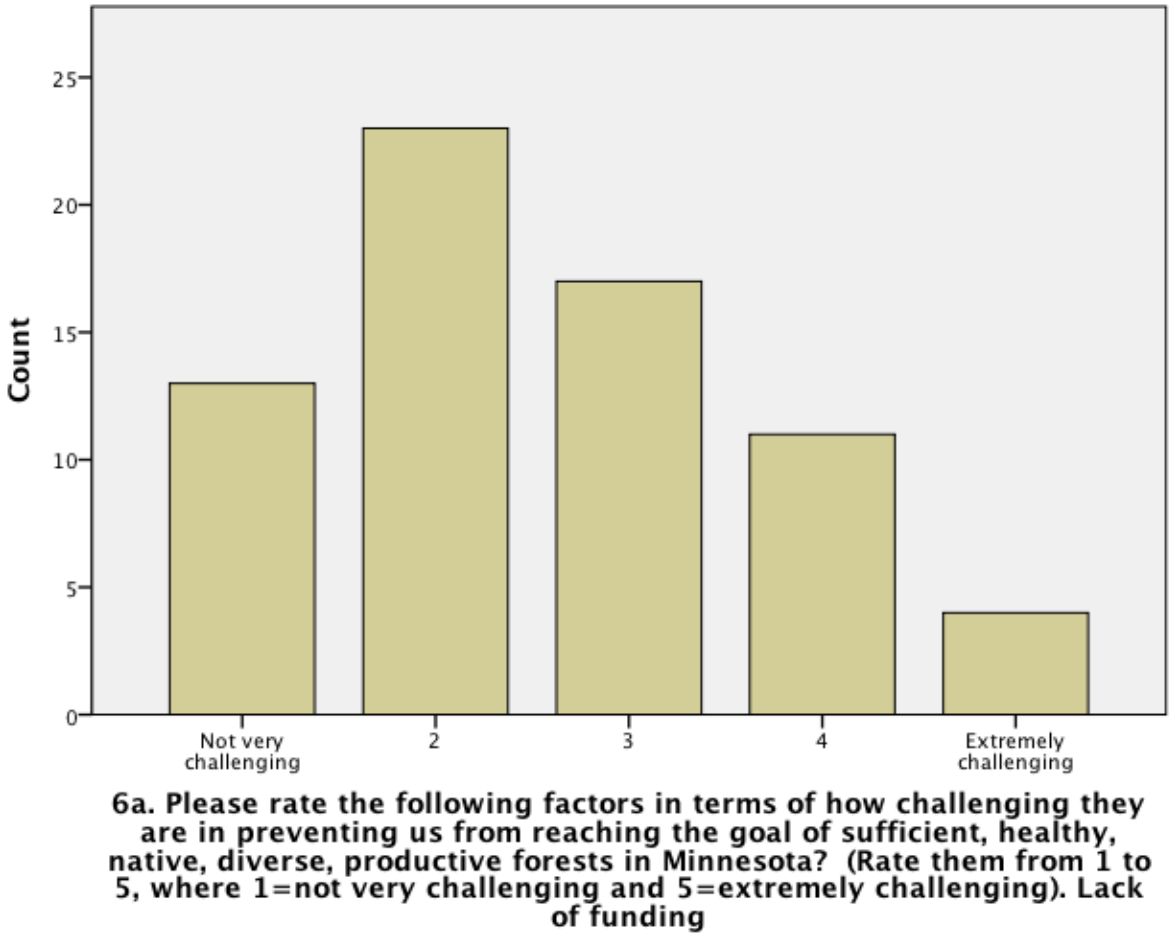

Figure 11: Challenge of the *Lack of Staff (Capacity)* to have Sufficient, Healthy, Native, Diverse, Productive Forests in Minnesota

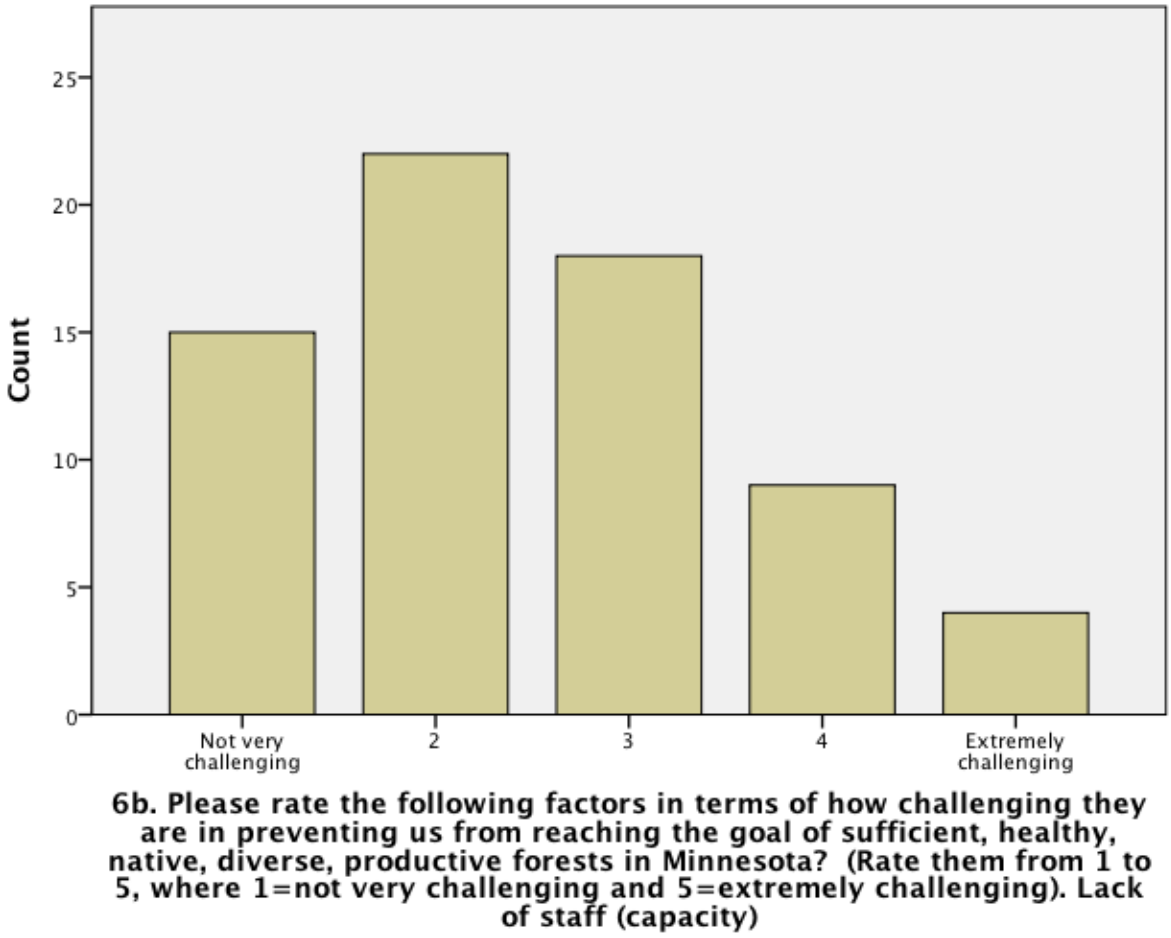

Figure 12: Challenge of the *Lack of Coordination/Communication Among Stakeholders* to have Sufficient, Healthy, Native, Diverse, Productive Forests in Minnesota

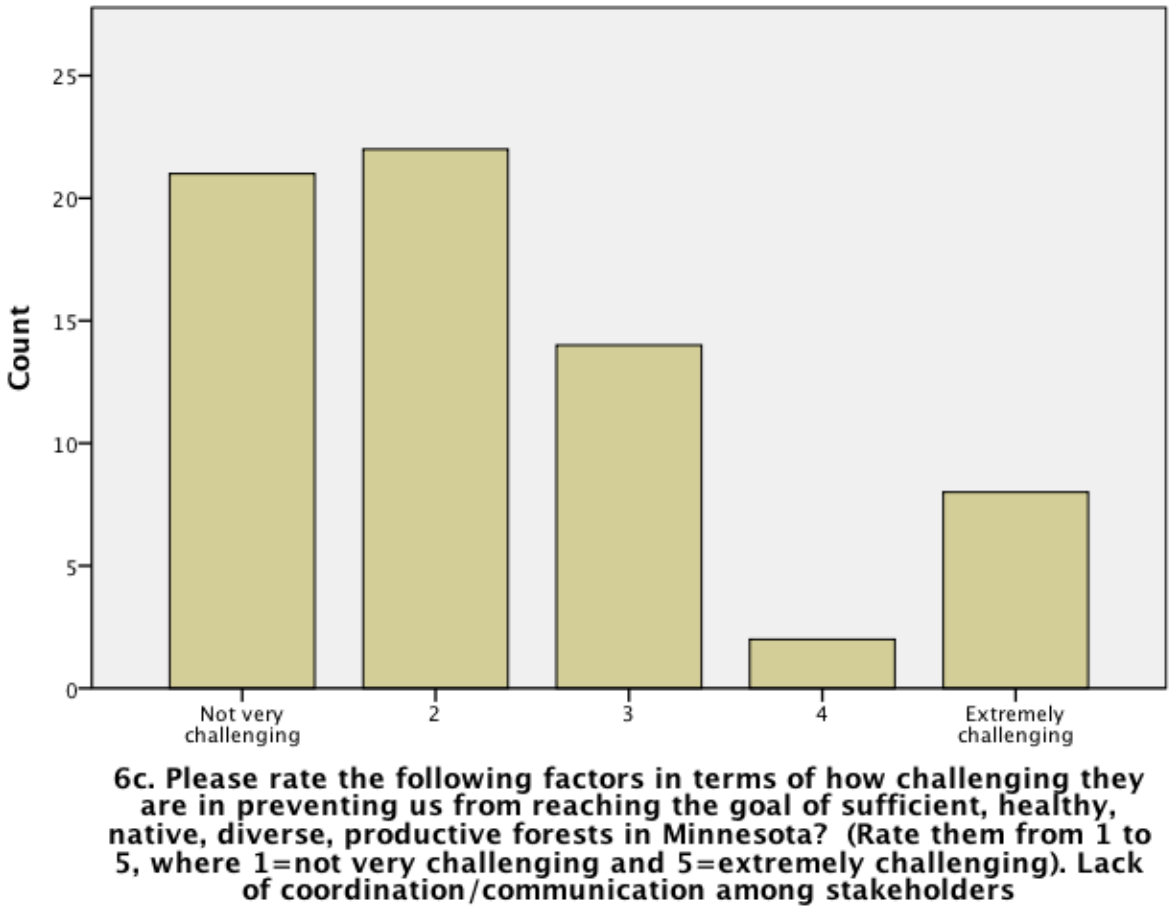

Figure 13: Challenge of the *Lack of Compatibility of Management Objectives* to have Sufficient, Healthy, Native, Diverse, Productive Forests in Minnesota

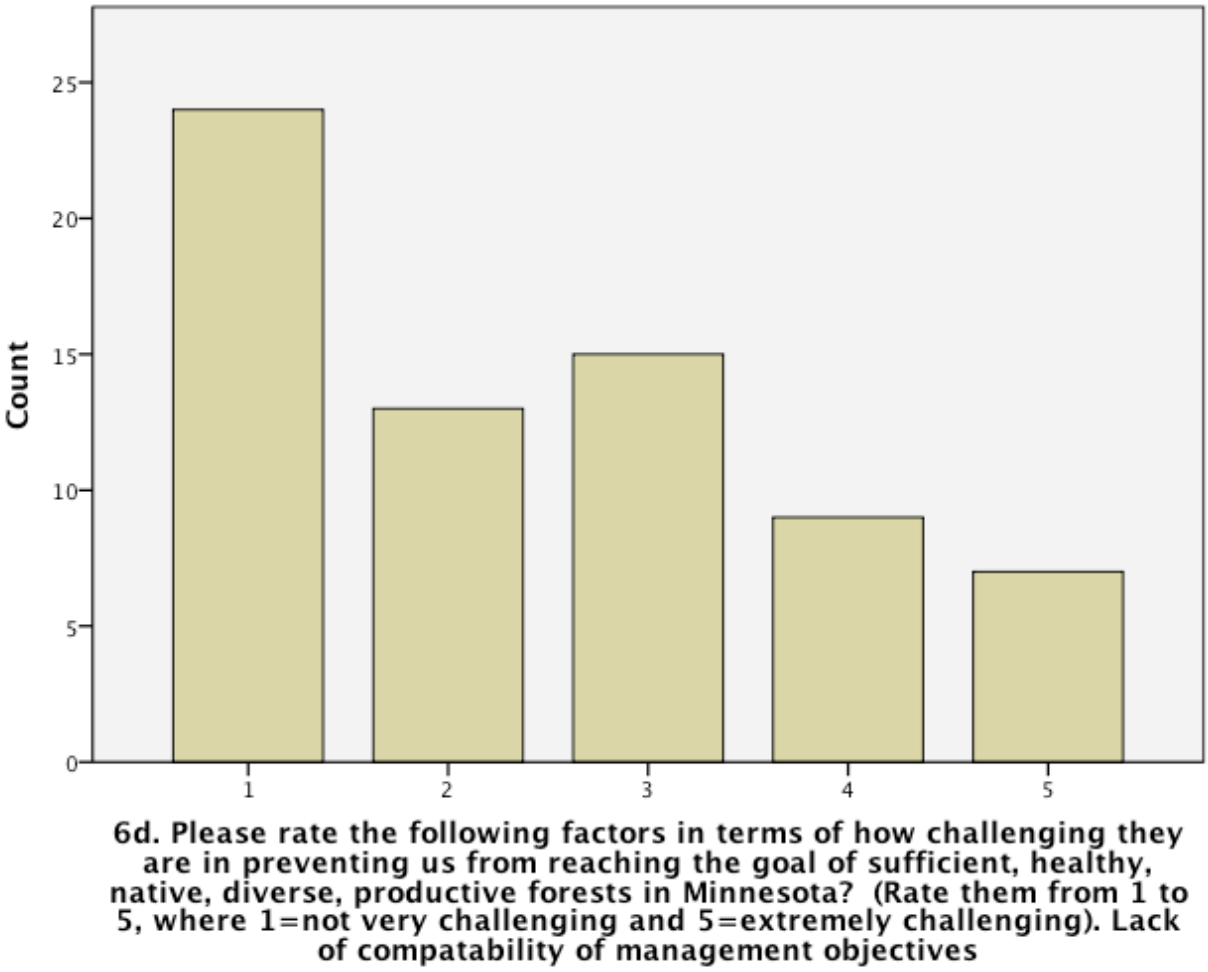

Figure 14: Challenge of *Unbalanced Forest Conditions Making Management Difficult* to have Sufficient, Healthy, Native, Diverse, Productive Forests in Minnesota

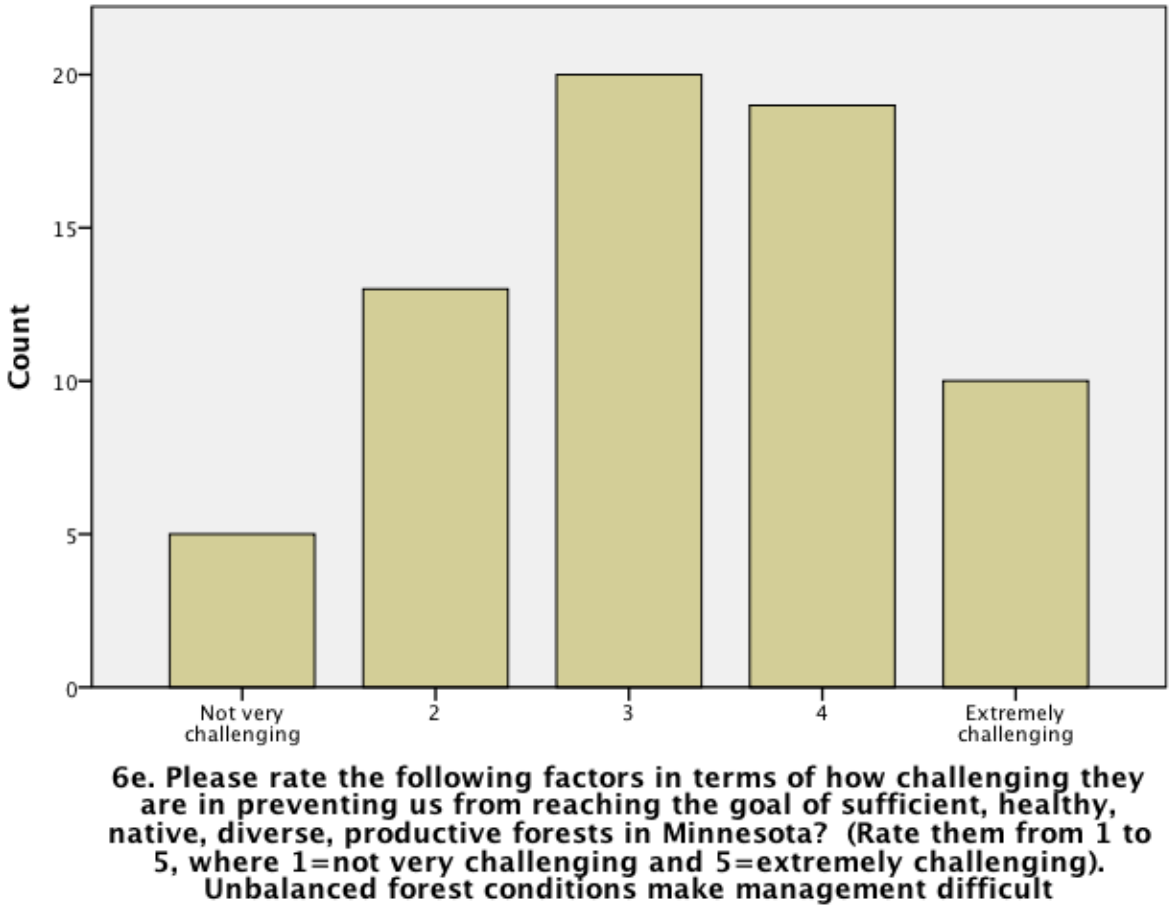

Figure 15: Degree to which *Different Resource Goals* is an impediment to working across ownerships to better manage Minnesota's Forest Resources

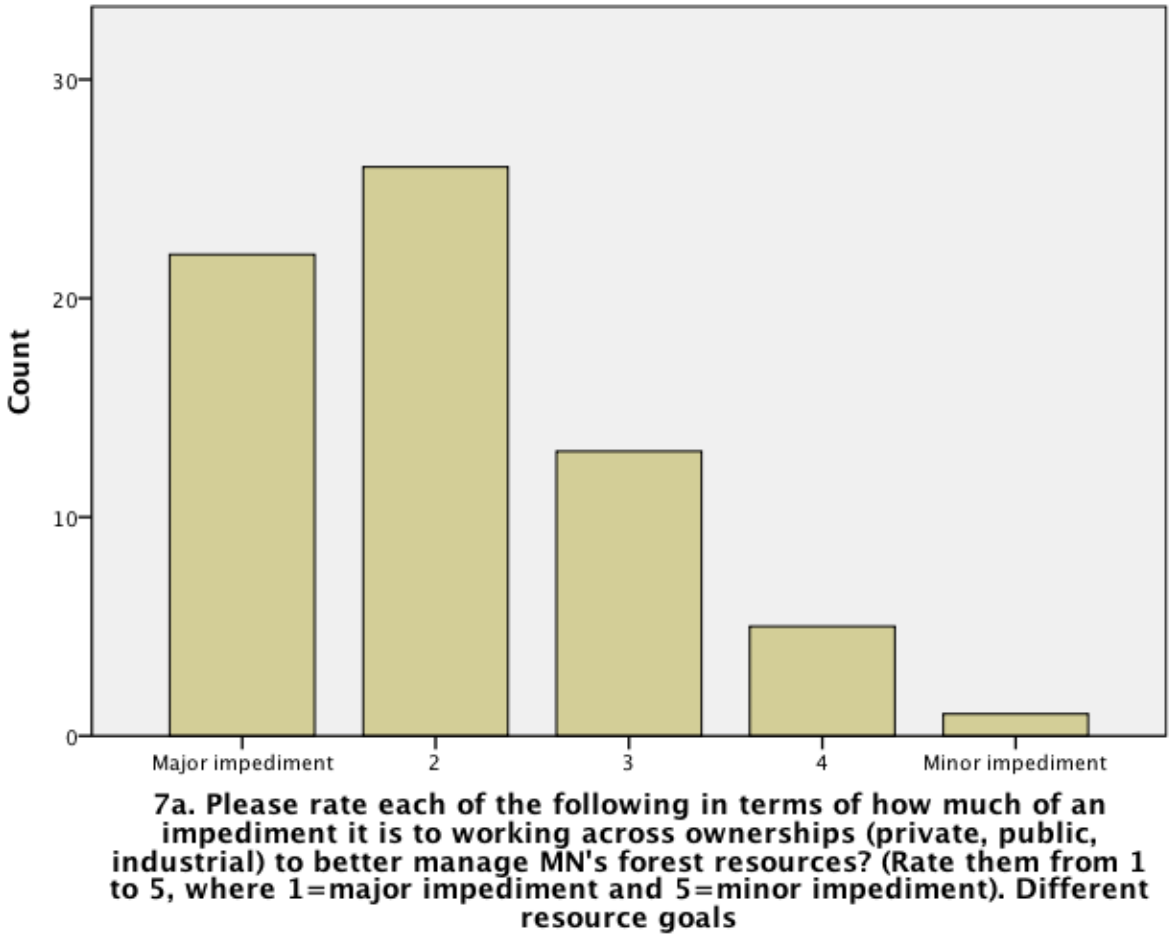

Figure 16: Degree to which *Historical Grievances and Lack of Trust* is an impediment to working across ownerships to better manage Minnesota's Forest Resources

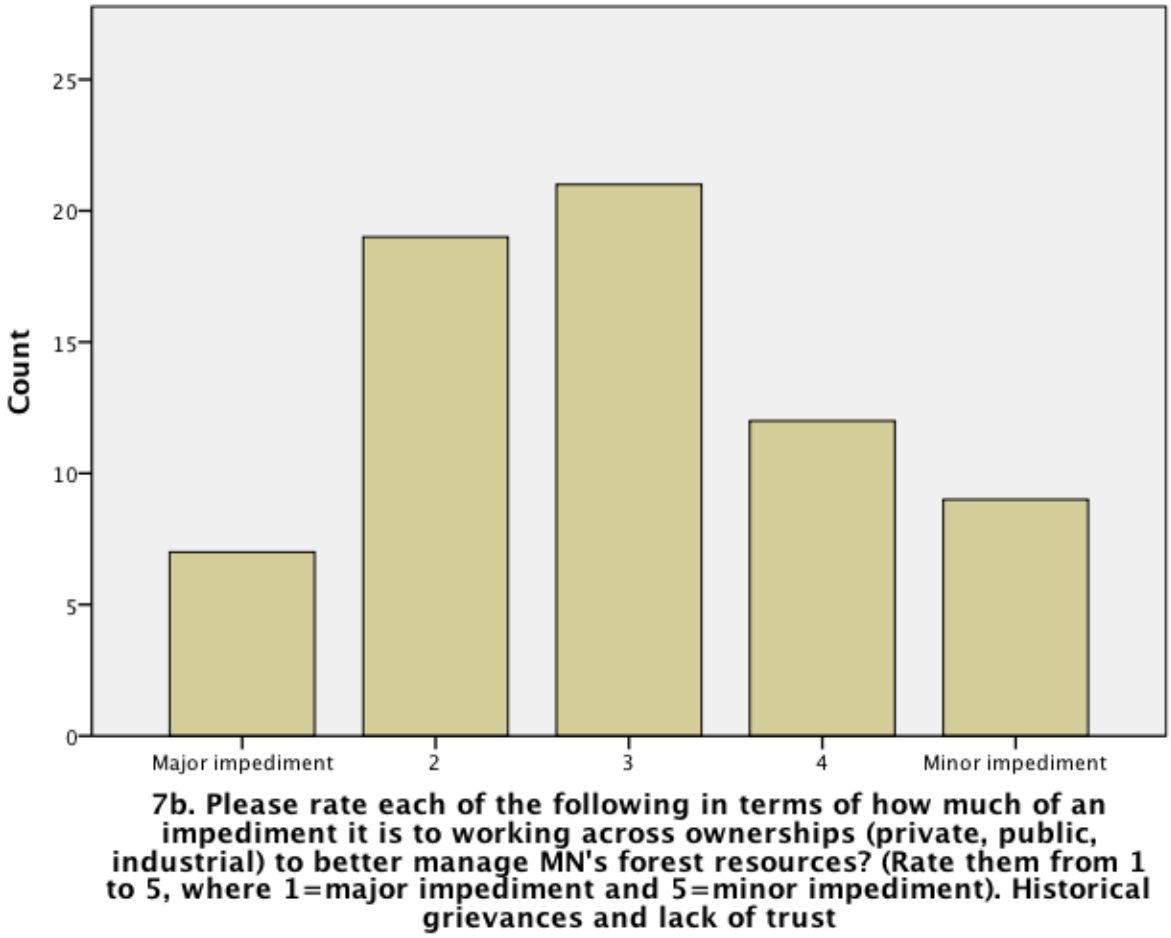

Figure 17: Degree to which *Lack of Information-sharing Mechanisms* is an impediment to working across ownerships to better manage Minnesota's Forest Resources

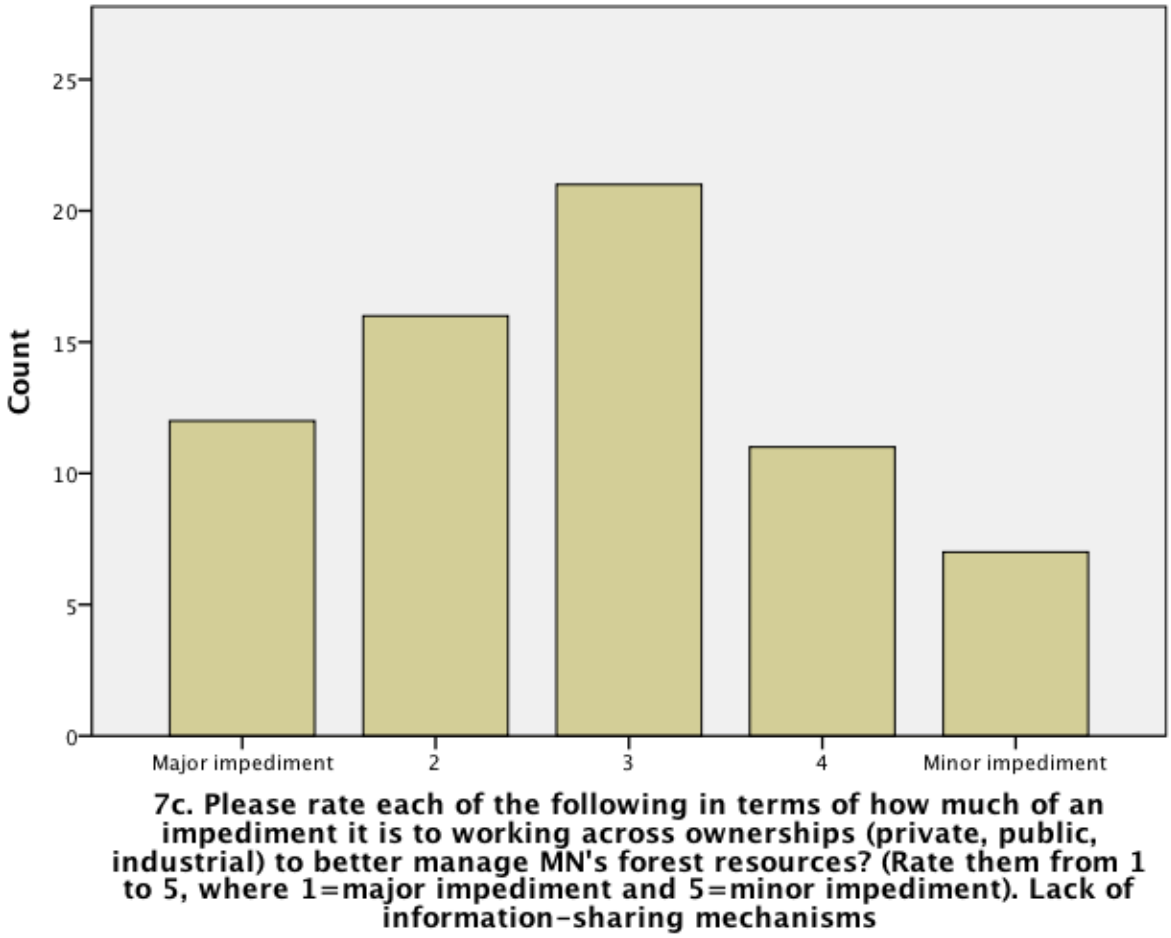

Figure 18: Degree to which *Overly Complex Resource Goals* is an impediment to working on forest management at a landscape scale

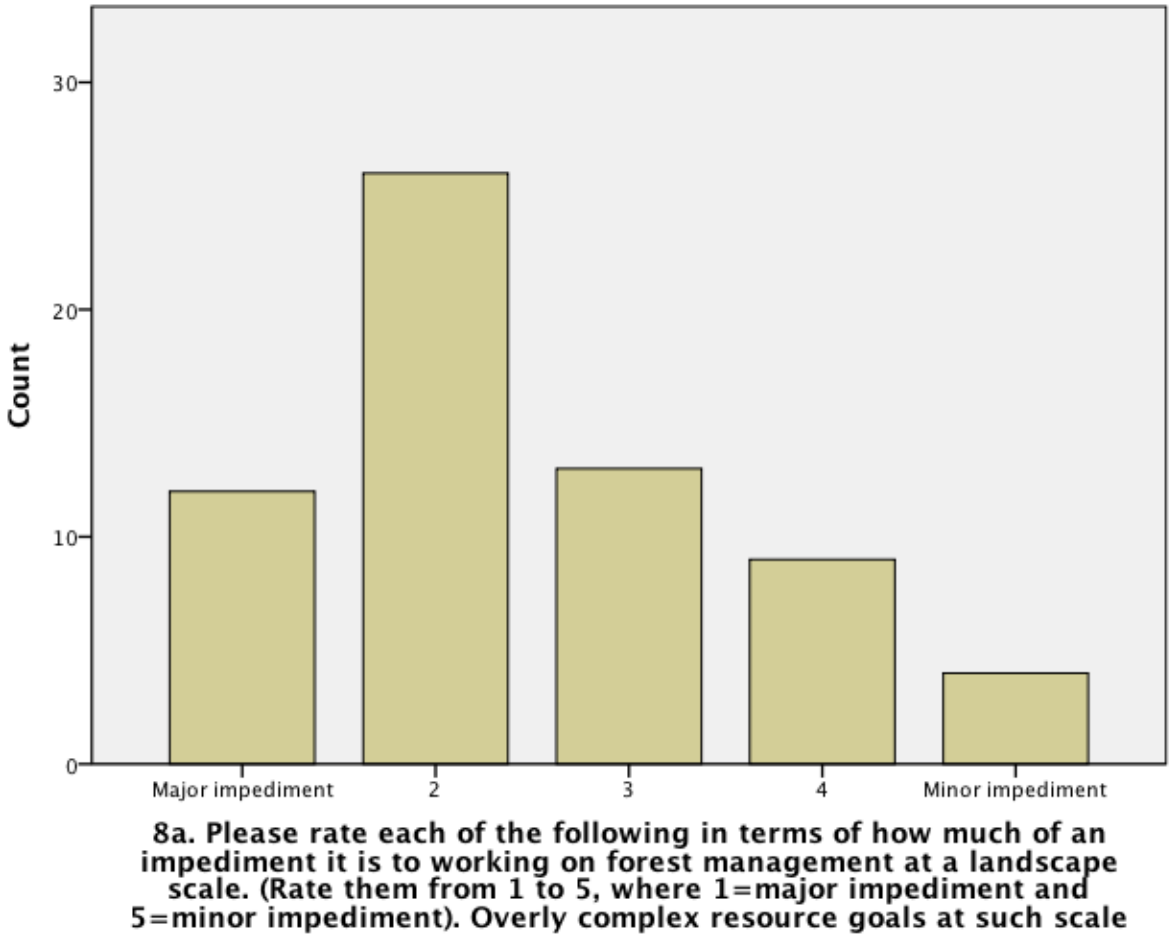

Figure 19: Degree to which *Lack of Information-sharing Mechanism* is an impediment to working on forest management at a landscape scale

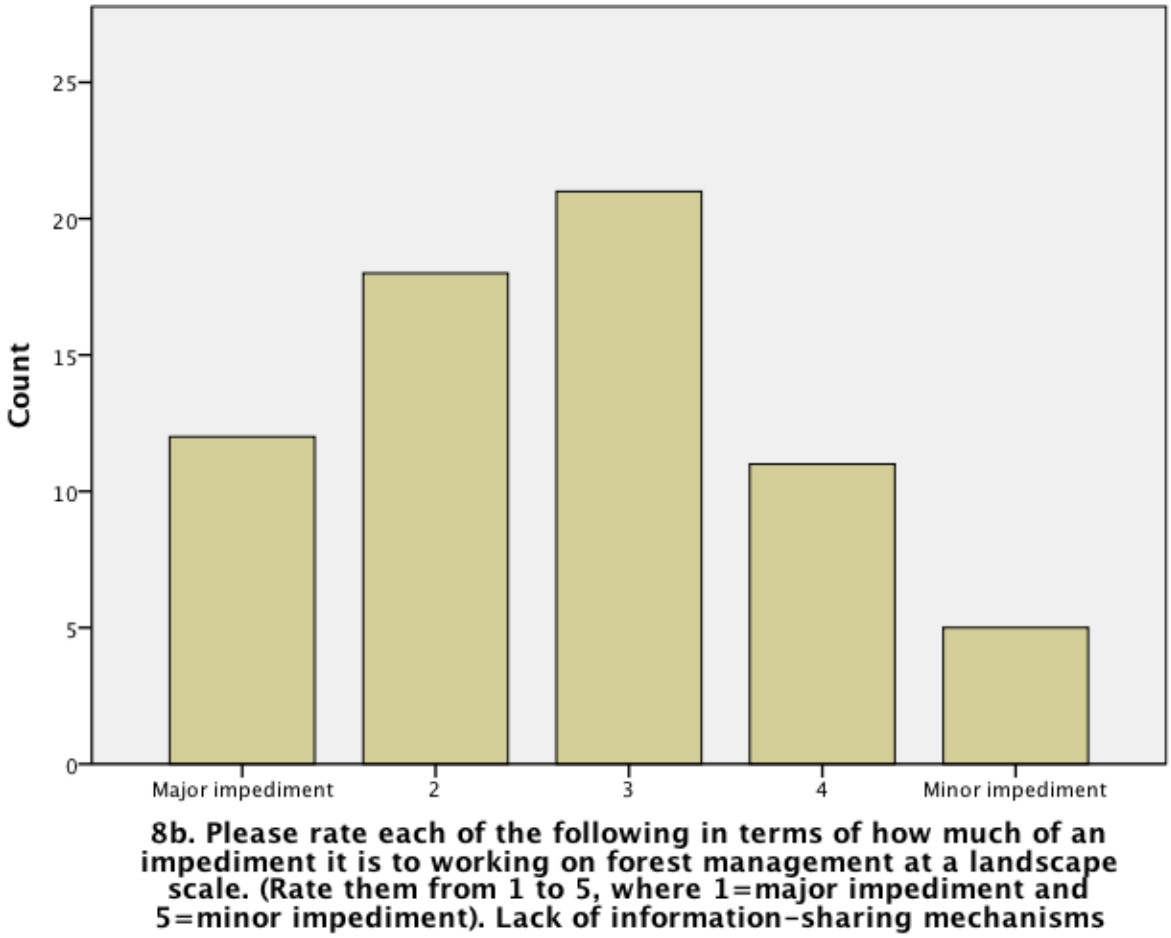

Figure 20: Degree to which *Logistical impediments* are an impediment to working on forest management at a landscape scale

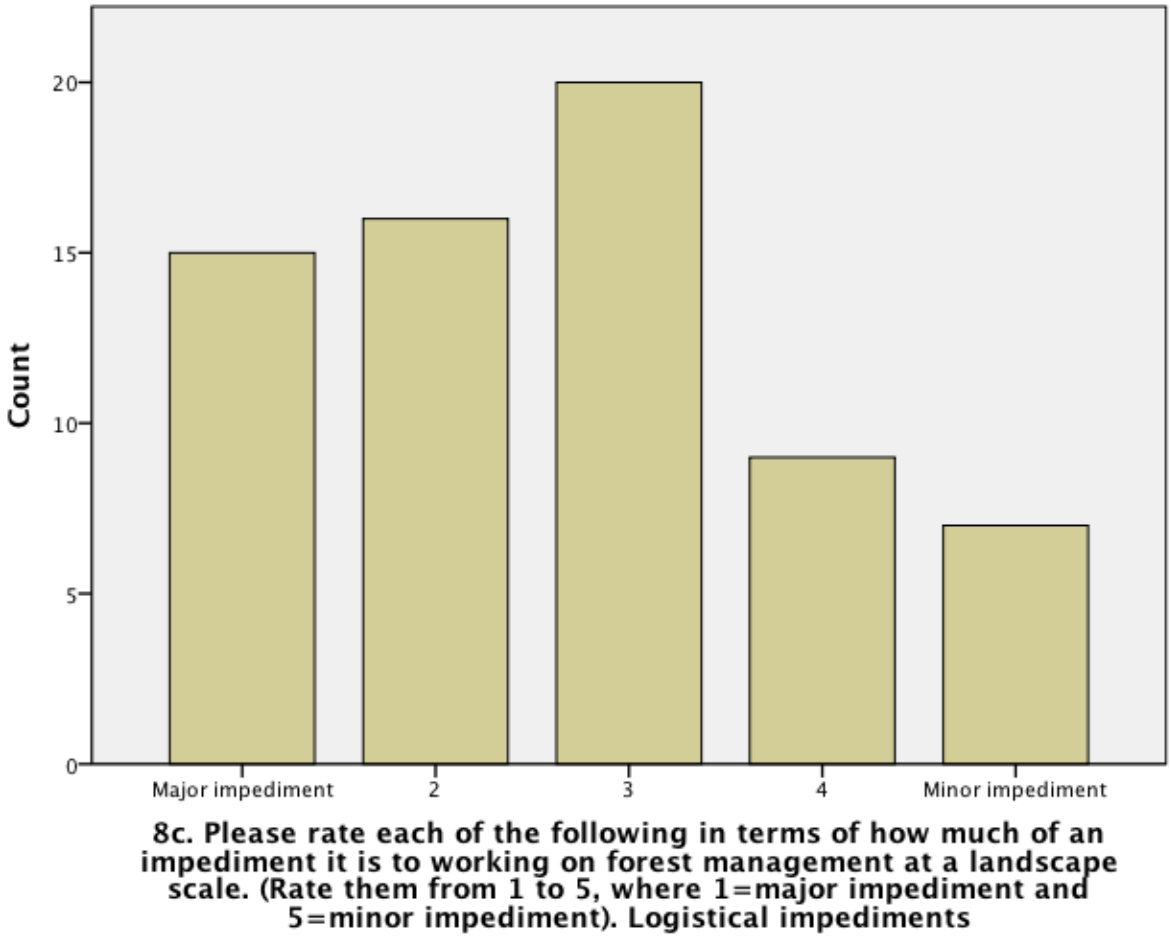

Figure 21: Degree to which *Lack of Trust between Agencies and the Public* is an impediment to working on forest management at a landscape scale

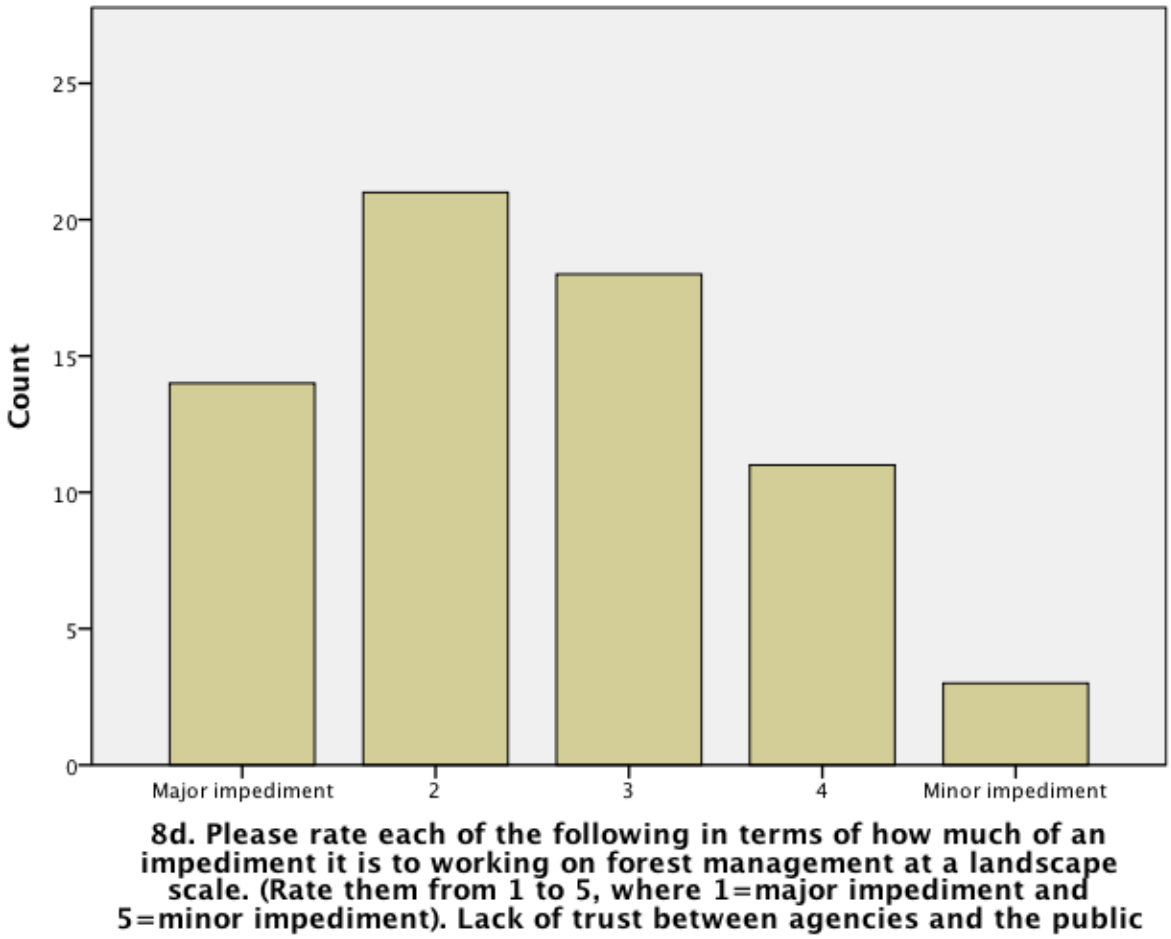

Figure 22: Threats to Sustainable Forest Management- ***Invasive species***

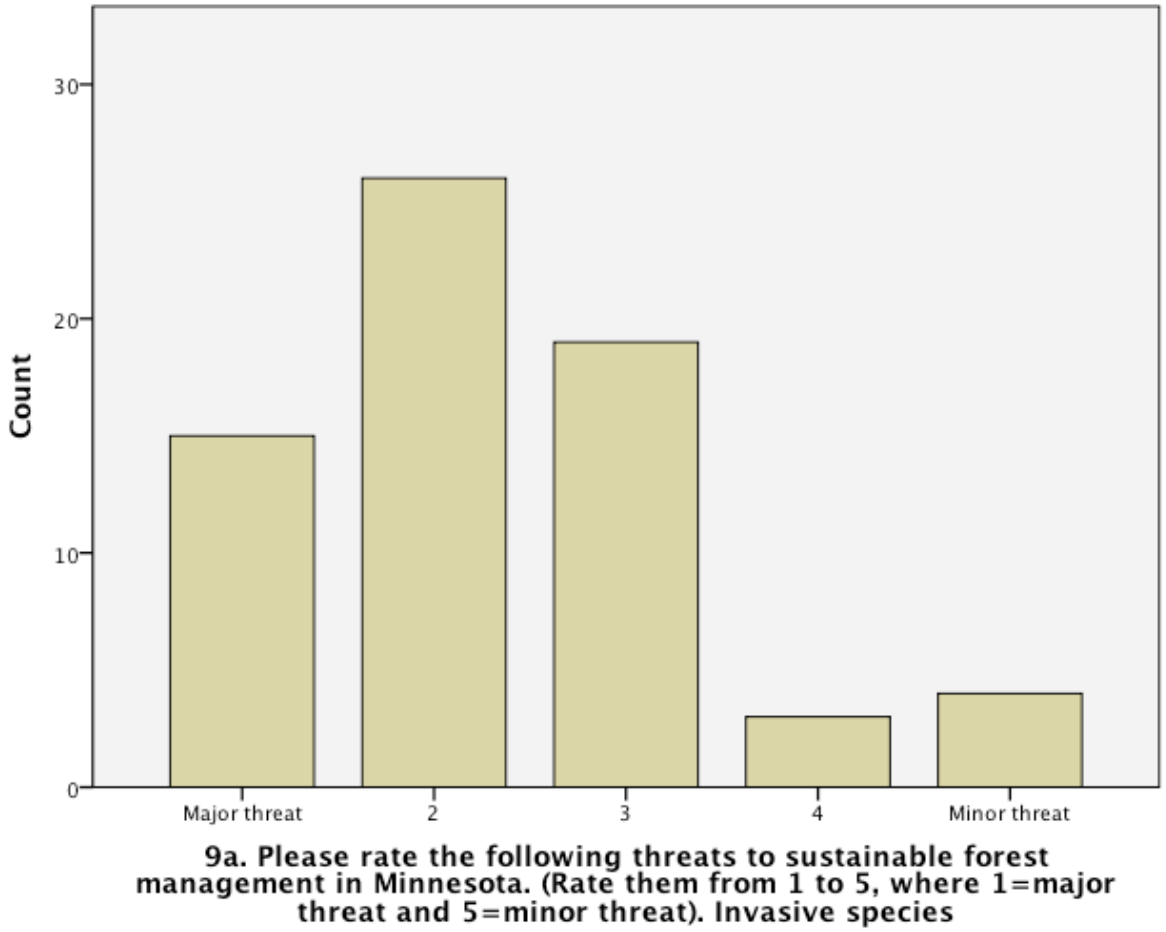

Figure 23: Threats to Sustainable Forest Management- ***Population growth/urban expansion***

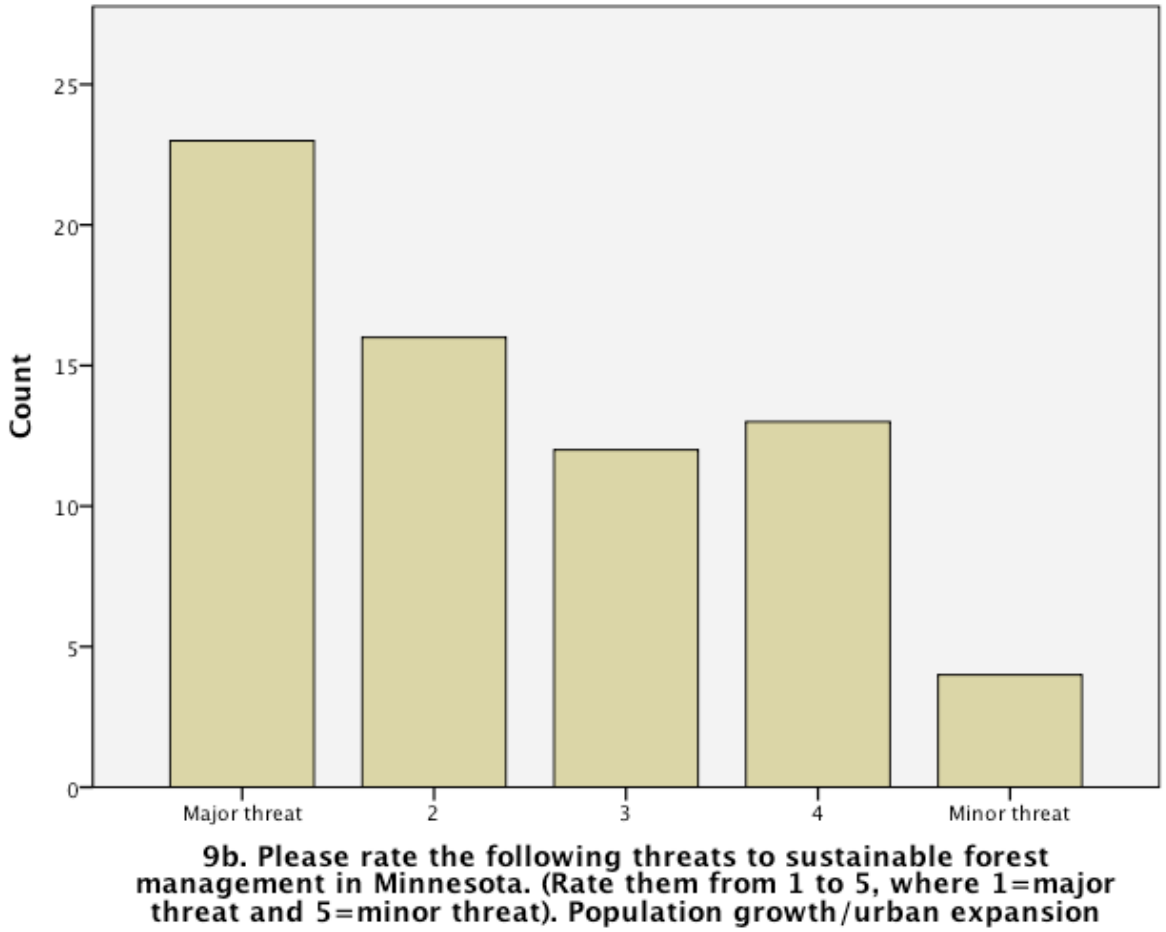

Figure 24: Threats to Sustainable Forest Management- *Socio-Economic Factors*

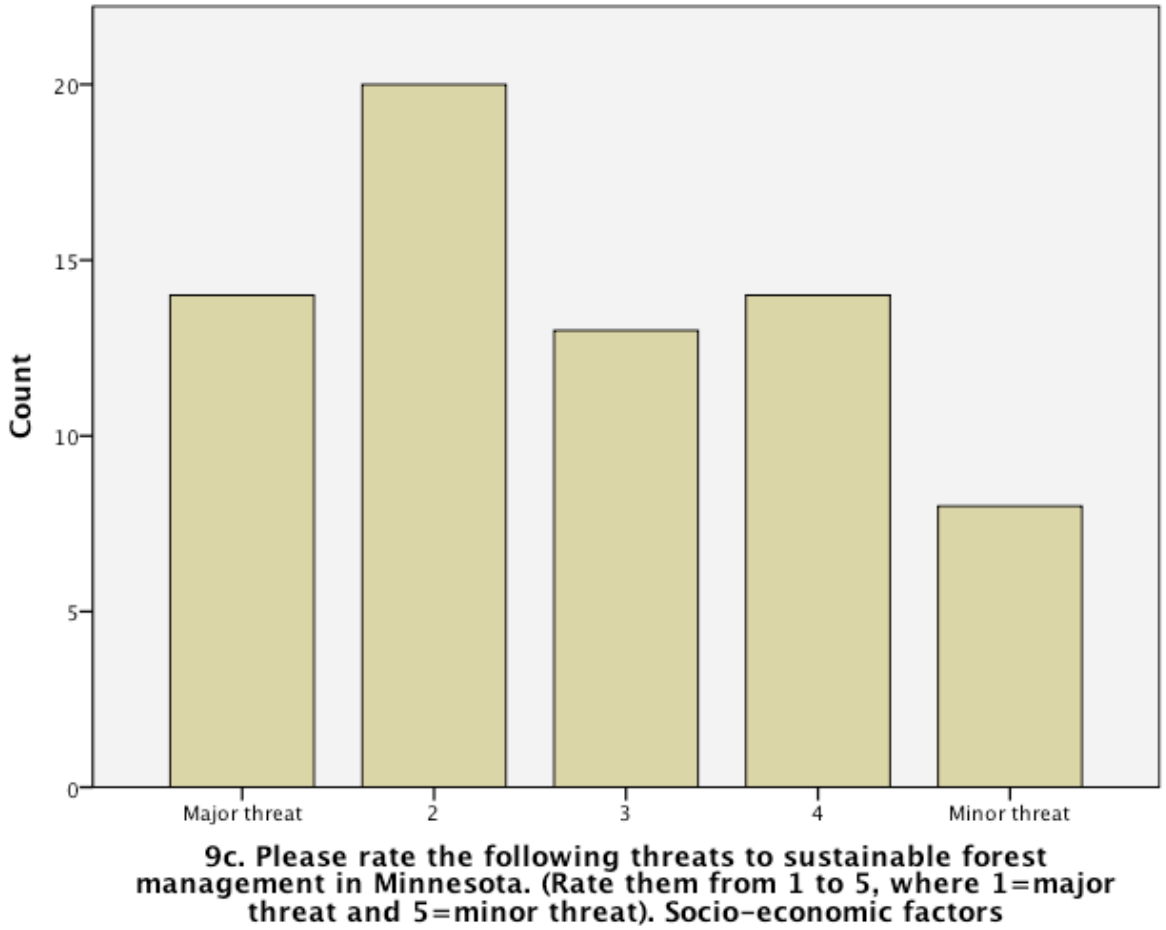

Figure 25: Threats to Sustainable Forest Management- *Climate change*

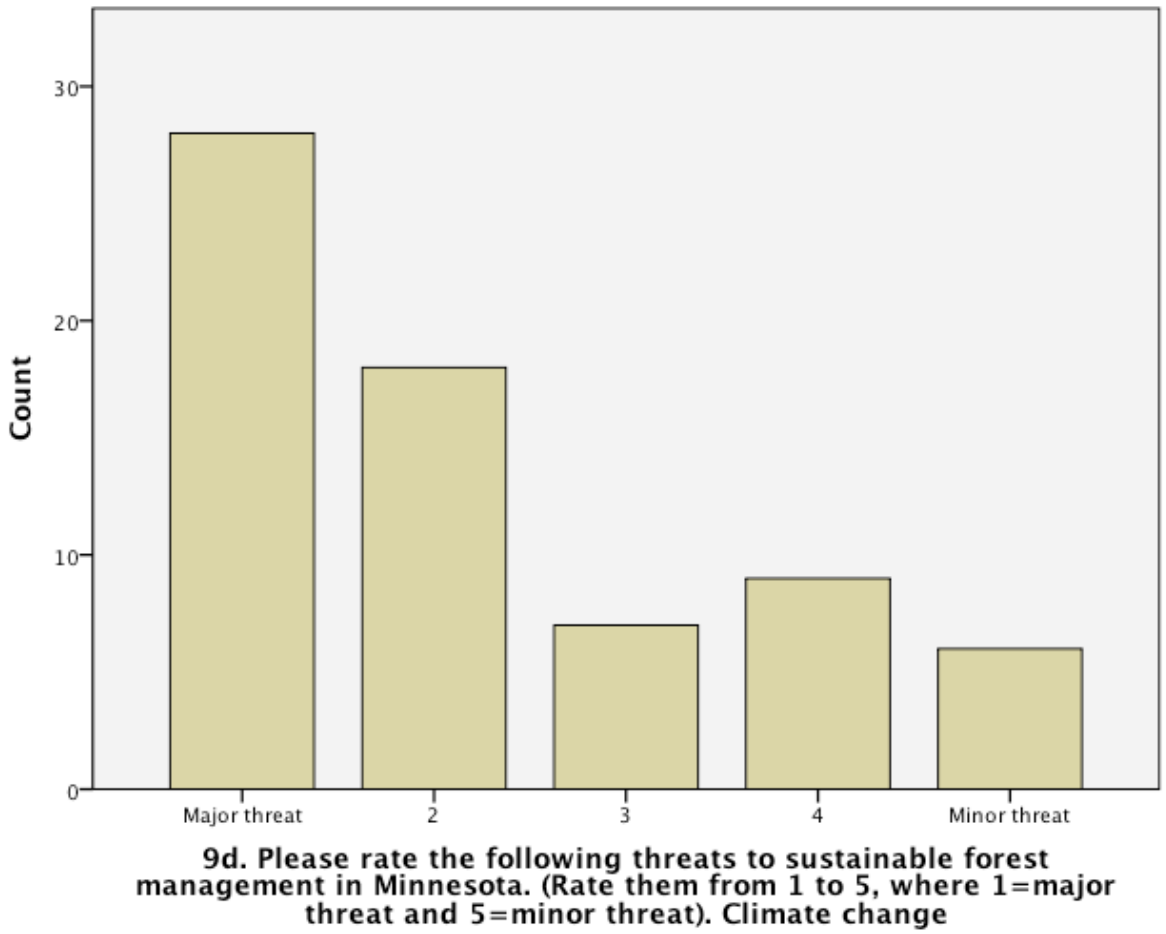

Figure 26: Threats to Sustainable Forest Management- ***Increased Parcelization***

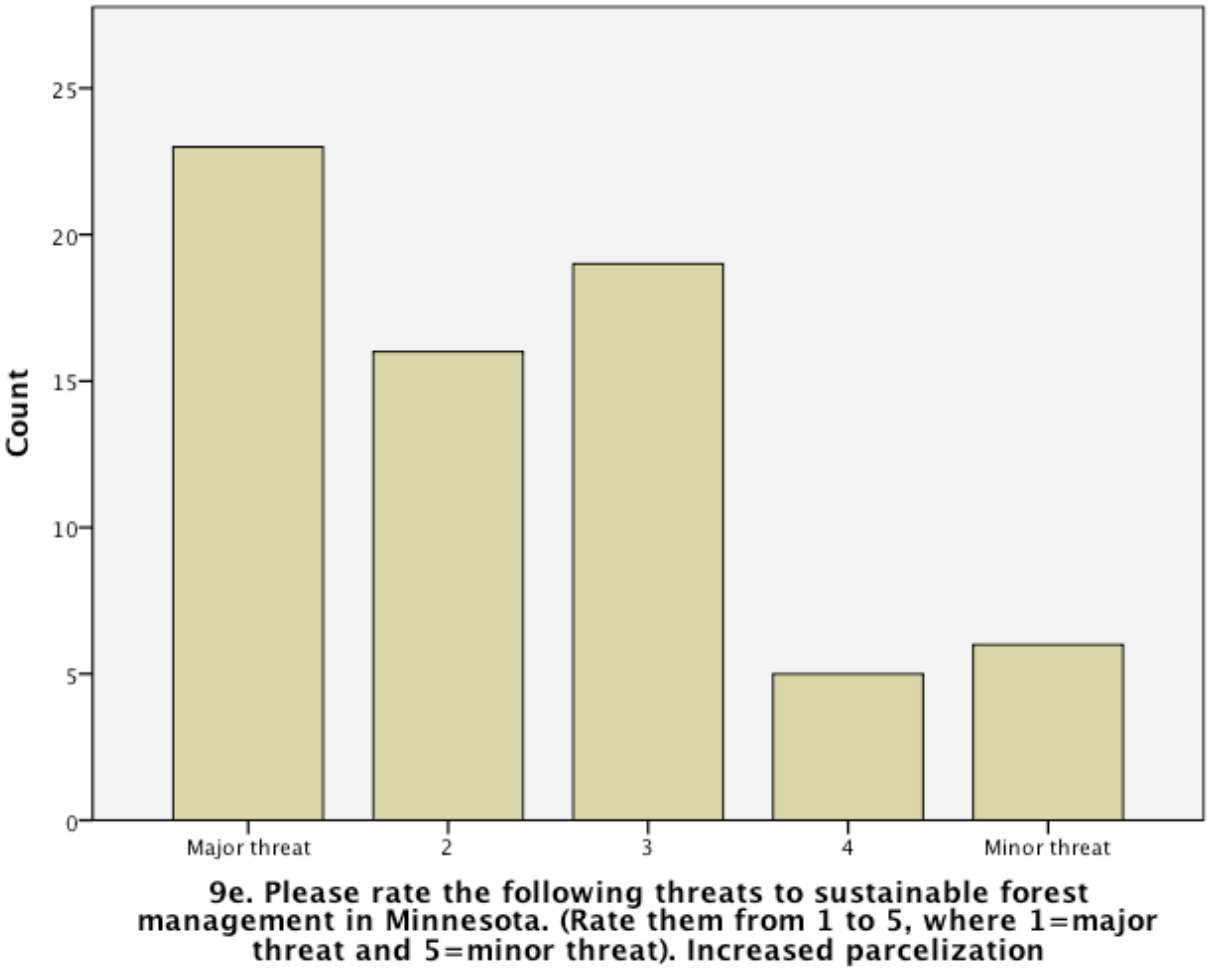

Figure 27: Current Mix of Forest Types in Minnesota

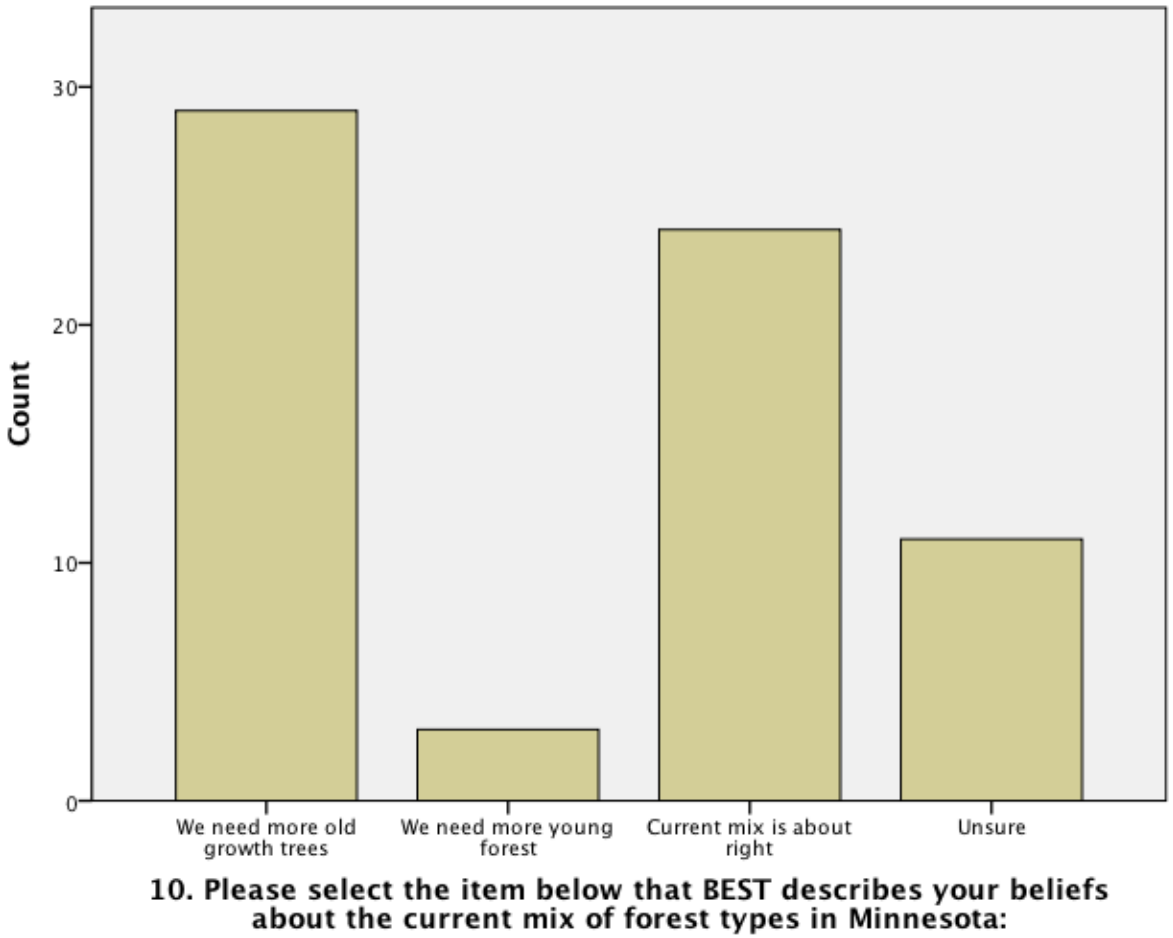

Figure 28: Importance of Focusing Forest Management Towards Species Common in Minnesota but Not in their Historic Range

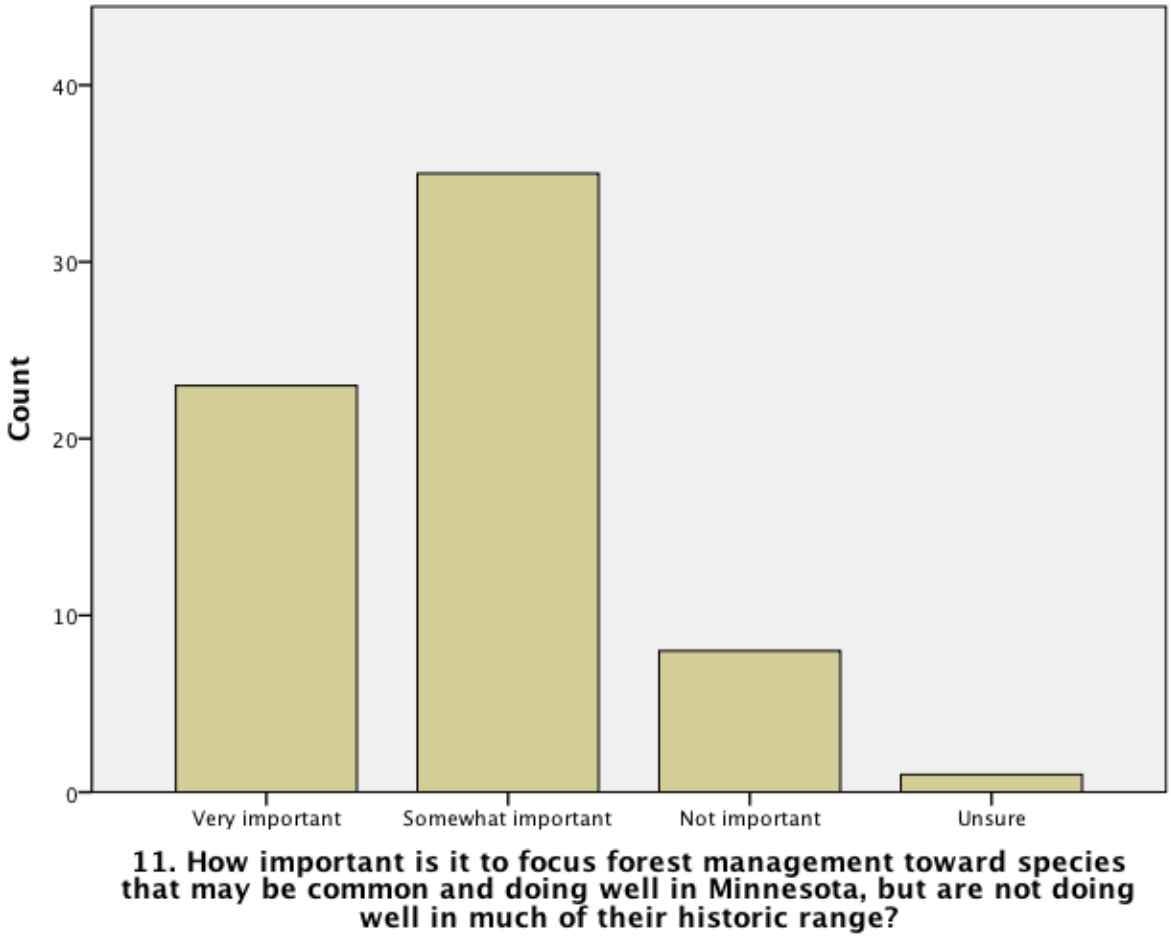

Figure 29: Changes in Knowledge as a Result of the Seminar