Chapter 1: Purpose and Need

1.1 Introduction

This environmental assessment was prepared to provide the decision-maker (Gunflint and Tofte District Rangers) and the public with information about the potential effects of proposed vegetation management activities and connected road actions in the North Shore Restoration Project. This environmental assessment was prepared by an interdisciplinary team of resource specialists.

Summary of Project

Who: The Gunflint and Tofte Ranger Districts of the Superior National Forest are proposing the North Shore Restoration Project.

Why: The main purpose of the North Shore Restoration Project is restoration of native vegetation communities to move towards desired conditions in the Superior National Forest Land and Resource Management Plan (Forest Plan or FP). The composition and diversity of the North Shore's forest has changed dramatically from historical conditions, and restoring conifer and other species that have diminished would increase forest health, productivity, and resiliency. Other related objectives of this project are described later in this report.

What: Proposed activities include a full suite of reforestation activities (such as site preparation, planting, interplanting, or release), installing deer exclosures (fencing to keep deer from browsing an area) and harvesting (such as thinning, clearcut with reserves, or selection harvest). Harvesting followed by natural or artificial regeneration, would include any needed temporary road construction.

Where: The North Shore Project Area is located in Cook County, Minnesota, along the north shore of Lake Superior. The Vicinity Map (Figure 1) shows the general location of the North Shore Project Area. Townships included in the project area, from east to west, are: Township (T) 63 North (N) Range (R) 4 East (E); T62N, R4E, R3E, R2E; T61N, R2E, R1E, R1West (W), R2W; T60N, R2W, R3W, R4W; T59N R4W, R5W. The North Shore Project Area encompasses approximately 102,400 acres, of which, about 39,900 acres are National Forest System land. Proposed activities would occur only on National Forest System lands.

When: If a decision is made to implement these activities, the proposed actions would be implemented beginning in 2014. Given the large scale of the proposal and cost of restoration activities, implementation would be limited by available funding and resources in any given year. Implementation of the primary treatments would be expected to occur over ten years.

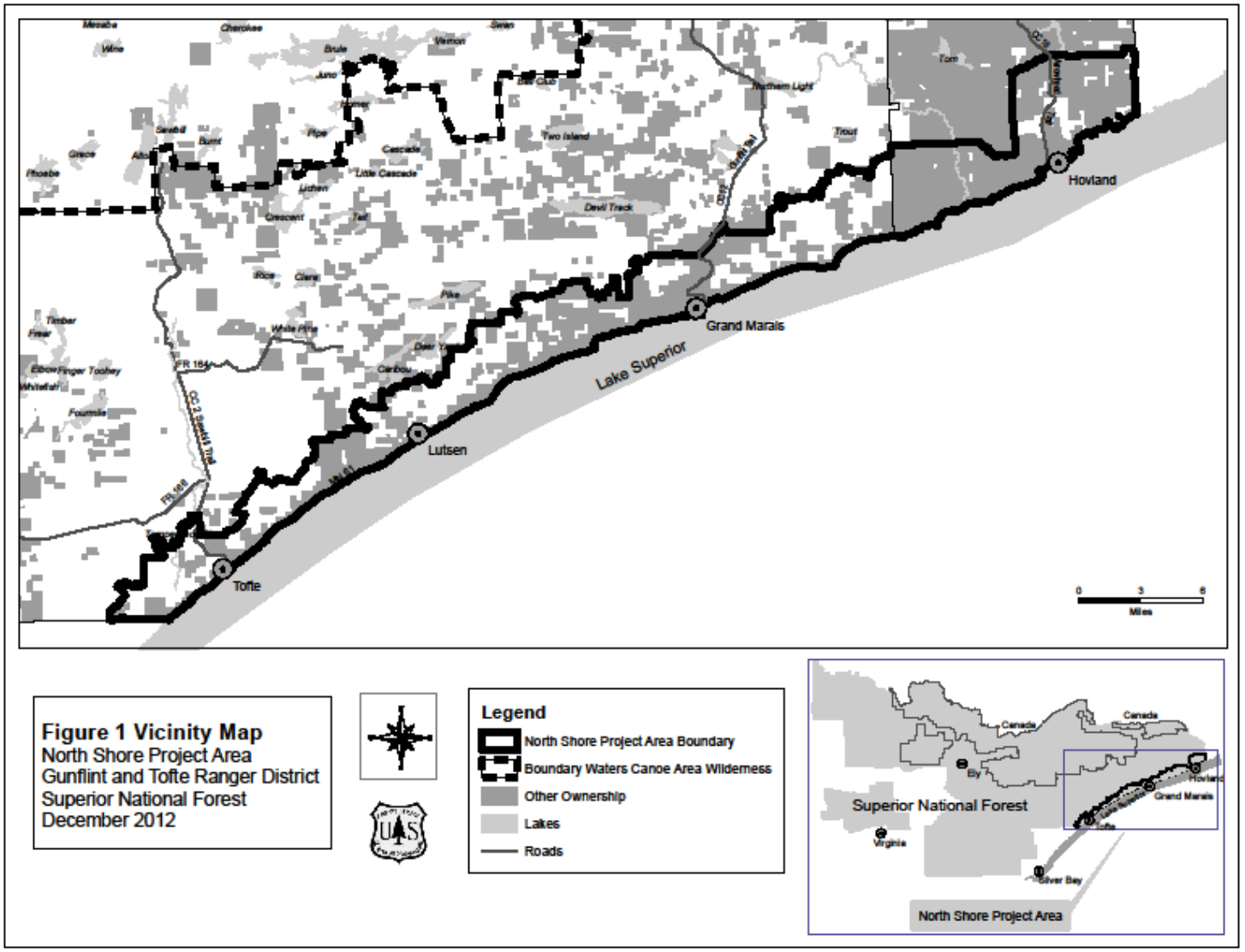


Figure 1 Vicinity Map
North Shore Project Area
Gunflint and Tofte Ranger District
Superior National Forest
December 2012

1.2 Organization of the Environmental Assessment

This environmental assessment (EA) is organized into four chapters with appendices. The major sections of the EA are as follows:

- **Chapter 1: Purpose and Need.** This section provides introductory material that explains the purpose and need for the proposed action, provides background information about the project area, presents direction from the Forest Plan, and describes the issues to be addressed.
- **Chapter 2: Alternatives.** This section describes alternatives analyzed in detail in Chapter 3 and alternatives analyzed briefly. Chapter 2 also includes mitigation measures and monitoring procedures that would be used in implementing the action alternative. A summary comparison of the environmental effects for each alternative is also provided.
- **Chapter 3: Affected Environment and Environmental Effects.** This section describes the affected environment and the direct, indirect, and cumulative effects likely to occur with the implementation of each alternative.
- **Chapter 4: References.** This chapter provides names of the preparers and contributors to this environmental assessment, a distribution list, and literature cited.
- **Appendices.** Appendices include more detailed information on the proposed action and alternatives, as well as supporting information for the analysis.

An important consideration in the preparation of this EA was the reduction of paperwork. The objective is to furnish enough site-specific information to demonstrate a reasoned consideration of the environmental effects of the alternatives and how any adverse effects can be mitigated or avoided. Additional supporting information is in the North Shore Restoration Project Record and is available at the Gunflint Ranger District Office in Grand Marais, Minnesota, or upon request.

This environmental assessment is tiered to the Forest Plan Revision Final Environmental Impact Statement (FEIS). Relevant analysis from the Forest Plan Revision FEIS was incorporated by reference rather than repeating the information.

1.3 Forest Plan Direction for North Shore Project Area

The Forest Plan divides the Superior National Forest outside the Boundary Waters Canoe Area Wilderness (BWCAW) into ten management areas. Chapter 3 of the Forest Plan (FP) includes the desired conditions, objectives, standards, and guidelines for each management area. The North Shore Restoration Project Area overlaps three Forest Plan Management Areas: Recreation Use in a Scenic Landscape (FP, pp. 3-13 to 3-15), Eligible Wild, Scenic and Recreational River (FP, pp. 3-17 to 3-20) and Unique Biological Area (FP, pp. 3-27, 3-28). The interdisciplinary team used management area direction to guide development of the purpose and need and the proposed action. The following is a brief summary of the desired vegetation for each management area.

- In the Recreation Use in a Scenic Landscape Management Area, which covers most of the project area, ecosystems are managed to provide a predominantly

natural-appearing landscape that may be slightly modified by forest management activities. This management area emphasizes a large tree and old forest character and viewsheds are managed for scenic beauty and big-tree character. Vegetation management activities also enhance wildlife habitat.

- The area one quarter mile on either side of the Temperance and Brule Rivers are in the Eligible Wild, Scenic and Recreational River Management Area. The segments of the rivers in the North Shore Project Area are classified as Scenic. With a Scenic classification, vegetation management practices are to enhance the recreation experience and maintain the near natural environment of the corridor.

- In the Unique Biological Areas Management Area, management emphasis is on conserving or enhancing areas of unique biological interest. The North Shore Project Area includes a Fall River Patterned Fen Unique Biological Area (T61N R1E).

Landscape Ecosystems

Landscape Ecosystems (LE) are ecological areas characterized by their dominant vegetation communities and patterns that are a product of local climate, glacial topography, dominant soils, and natural processes such as succession, fire, wind, insects, and disease (FP, p. 2-55). The Forest Plan uses landscape ecosystems to outline management objectives for forest vegetation composition, age class, tree species diversity, and management indicator habitats (MIH). Management indicator habitats represent the habitats used by a wide variety of native plants and animals, including management indicator species and sensitive species. Managing for MIH objectives is a key component of providing for the full diversity of desired wildlife habitats. Management in each landscape ecosystem would maintain or restore the forest to conditions more representative of native plant communities and landscape scale patterns.

The predominant landscape ecosystem in the North Shore Restoration Project Area is the Mesic Birch-Aspen-Spruce-Fir as shown in Table 1.1. The North Shore Project Area represents about nine percent of the total Forest-wide Mesic Birch-Aspen-Spruce-Fir Landscape Ecosystem. The Cedar Landscape Ecosystem includes both lowland and upland cedar.

Table 1.1. North Shore Project Area Summarized by Landscape Ecosystems

Landscape Ecosystem	Acres[1]	% of Area
Mesic Birch-Aspen-Spruce-Fir	29,231	71
Cedar	4,365	11
Sugar Maple	2,957	7
Lowland Conifer A, B, C	1,698	4
Lowland Hardwood	1,508	4
Mesic Red and White Pine	110	<1
TOTAL:	39,864	100

[1]Data Source: North Shore Silviculture Mid-level Report. These acres include only National Forest System land; total may be slightly off due to rounding.

Chapter 3 section 3.3 contains more information on landscape ecosystems including age class and composition tables for the Mesic Birch-Aspen-Spruce-Fir Landscape Ecosystem.

Landtype Association

The majority of the North Shore Project Area is in the North Shore Till Plain Landtype Association (LTA), and small parts of each of the Sawtooth-Eagle Heights, Honeymoon Mountain, and Tettegouche LTAs. The North Shore Till Plain LTA provides further refinement of the forest communities and ecological characteristics of this particular area of the Mesic Birch-Aspen landscape ecosystem. For example, fire is a major disturbance factor in the Mesic Birch-Aspen landscape ecosystem, but across the landscape ecosystem, the fire regime varies. Away from Lake Superior there is a 70-150 year stand replacement fire regime but on the North Shore (North Shore Till Plain LTA) there is a 250-1000 year stand replacement fire regime. A snapshot of what the forest in the North Shore Till Plain LTA looked like based on bearing tree data (late 1800's-1920) is displayed in Table 1.2. Historically, there was a high amount of conifer, such as spruce, fir and cedar. White pine occurred throughout the area but it was not a dominant forest type.

Table 1.2. Historical Percentage of Tree Species in the North Shore Till Plain Landtype Association

Tree Species	Percentage
Fir	30
White birch	22
Spruce	19
Cedar	17
Aspen	4
White pine	3
Yellow birch	2
Tamarack	2
Ash-elm	2
Northern Hardwood	1

Data Source: Characteristics of the Superior National Forest Land Type Associations

1.4 Purpose of and Need for Action

The North Shore Restoration Project is proposed to address needs related to restoration of native vegetation communities as well as to improve wildlife habitat, improve watershed health, provide sustainable timber products, and reduce hazardous fuels. The needs were identified by comparing the existing condition on the ground with desired conditions described in the Forest Plan. This was done through a "mid-level" assessment by Forest Service resource specialists (interdisciplinary team) and through participation in the North Shore Forest Collaborative.

Through the North Shore Mid-level Assessment the existing condition of all resources (vegetation, wildlife, watershed, transportation, heritage resources, etc.) were considered and possible opportunities were recommended to move the project area toward desired conditions. Using this assessment, the District Ranger selected forest restoration as the primary purpose and need for this project with additional needs of wildlife habitat improvement, watershed restoration, timber products and hazardous fuel reduction.

Through participation in the North Shore Forest Collaborative, Forest Service personnel collaborated with tribal, federal, state and county agencies, non-profit organizations, and private land owners working to restore the North Shore's forests. For example, collaborative members shared data on Native Plant Community classifications and biodiversity rankings in the area, expertise on success of different treatment methods and knowledge of the history of the area. This expertise and information was useful in the development of the North Shore Restoration Project.

Listed below in italic are the Desired Conditions from the Forest Plan relevant to the North Shore Restoration Project. The desired conditions are followed by a description of the existing condition and needs for action.

1.4.1 Restore Native Vegetation Communities

D-VG-1 Native vegetation communities are diverse, productive, healthy and resilient.
D-VG-6 Vegetation conditions that have been degraded or greatly diminished in quality or extent on the landscape by past land use are restored to conditions more representative of native vegetation communities.

Prior to European settlement, the North Shore's forests were a mixture of white pine, white cedar, white spruce, balsam fir, paper birch, aspen, sugar maple, yellow birch, black spruce, tamarack, and other species. Since the last part of the nineteenth century, human activities have created significant changes to this landscape. Logging in the late 1800s and early 1900s removed most of the white pine and white cedar. Severe fire swept through the slash that was left behind, and the forest that grew back is heavily dominated by paper birch and quaking aspen (Sugarloaf, 2005). The northward expansion of deer range after European settlement resulted in changes to forest plant composition in the canopy and the ground layer. The forest has been changed from a diverse mix of conifer and deciduous tree species to the predominance of deciduous trees that we see today.

Although much of the North Shore's forest is at a growth stage where natural succession to conifer would occur, the successional trajectory has been changed. The current stands of birch and aspen have reached their typical age limits, and, spurred by drought and other events, these species have been in accelerated decline for more than five years. However regeneration of white pine, white cedar and other conifer species has been limited because of multiple factors, including: fewer older pine and cedar trees to provide seed, an increase in bluejoint grass which chokes off young conifer seedlings, and heavy deer browse of select conifer seedlings. Current population levels of deer along the North Shore, especially in the winter, make it very difficult to successfully regenerate cedar,

white pine, and yellow birch. As a result, some areas have little forest canopy and an understory of beaked hazel, other shrub species, or bluejoint grass.

The desired condition is a resilient ecosystem, sustainable and able to adapt to climate change. The assumption is that a forest closer to natural conditions is likely to be sustainable in an ecological sense, ensuring the long term persistence of all components of the ecosystem and the functioning relationship among the components (MFRC 2003). There is a need to increase white pine, white cedar, white spruce, tamarack, and yellow birch and increase structural diversity of native vegetation communities along the North Shore.

Figure 1. 2 Comparison of Existing and Desired Conditions

Existing Condition: Decadent birch forest with no conifer regeneration.

Desired Condition: Diverse forest of conifer and deciduous trees.

1.4.2 Improve Wildlife Habitat

D-WL-1 Aquatic and terrestrial wildlife habitats are diverse, healthy, productive, and resilient.
D-WL-2 Aquatic and terrestrial wildlife habitats on NFS land contribute to ecosystem sustainability and biological diversity of northern Minnesota and, for wide-ranging species, larger landscape scales. Habitats contribute to supporting populations of wildlife that address peoples' current and future need for, and interest in, the many aesthetic, commercial, subsistence, recreational, cultural, wildlife watching, hunting, fishing, trapping, and scientific uses and values of wildlife.

There is a need to move the forest composition and structure toward the historical conditions under which species evolved to improve wildlife resting, foraging, and hunting habitat for both resident and migrant species. The lack of conifer and other components in the North Shore ecosystem means all the components needed for diverse wildlife habitat are not present. For example, white pines are an important species for bald eagle nest sites and large raptor perches and provide large, long lasting cavities for the many cavity nesting and denning species of northern

Minnesota. White pine forest comprised three percent of the historic forest cover prior to European settlement, but currently comprises less than one percent of the forest cover.

Coarse woody debris is another missing component of the ecosystem in the North Shore Project Area, especially in plantations. Large downed, dead trees provide food, cover, and growing sites for forest fungi, soil microorganisms, small mammals, and invertebrates, which in turn provide food for mammalian carnivores and forest raptors. White cedar and yellow birch regeneration are enhanced by downed logs acting as nutrient rich, moist nurse logs for seedling growth. There is a need to restore this component of the ecosystem to improve wildlife habitat.

The Superior National Forest is listed as a Globally Important Bird Area (ABC 2012) and a major bird migration corridor exists along the north shore of Lake Superior. A lack of diversity in the forest, including the understory, provides less than optimal habitat. In a western experimental area browsed by deer for more than 50 years, songbird abundance was 55%-70% lower than on deer free study areas with a close fit between songbird abundance and understory vegetation cover (Allombert 2005). Restoration of the diversity of regenerating species in the understory, such as cedar and yellow birch, is needed to provide high quality song bird habitat.

1.4.3 Improve Watershed Health

D-WS-1 Watersheds and their components… are protected or enhanced to provide for unique plant and animal communities, special habitat features, habitat linkages, wildlife corridors, aquatic ecosystems and riparian ecosystems.

Natural regeneration of long-lived species such as white pine, white cedar, and white spruce in riparian areas has been hindered by the same conditions described above - lack of seed trees, heavy browse by deer, and competition from some grass and brush species. Yet these long-lived trees are critical to riparian area functioning and aquatic habitat conditions. For example, conifer trees in riparian areas provide shade for aquatic species and ecosystems and thermal cover for wildlife. In addition, species such as red and white pine contribute coarse woody debris to streams and lakes over the long term. Restoring these long-lived species would improve the function of riparian areas, thereby increasing watershed health.

1.4.4 Provide Sustainable Timber Products

D-TM-1 The amount of commercial timber sales available for purchase is at a level that is sustainable over time. Mills operating in northern Minnesota can depend on a consistent level of timber harvest on the National Forest.

Vegetation management has the opportunity to provide wood products for businesses and mills in northern Minnesota. Some of this project's objectives could be accomplished through the sale of marketable wood products. Timber harvesting on the suitable forestland within the project area would meet the needs of sustaining a healthy forest and providing an economic opportunity to local communities.

Managing white spruce and red pine plantations (that are 20-60 years old) can provide timber products and/or restore lost ecosystem components to the areas. At the time these plantations were established, the practice was to heavily scarify the site and plant with one (or occasionally two) species. As a result there is little structural or species diversity in some plantations. As the trees have grown, they have become more tightly spaced with little growing room for the planted trees or light for any other forbs, shrubs or other trees species. There is a need to develop diverse spruce and pine habitat conditions for a more natural mix of type and structure in these communities as well as provide timber products. The additional growing space would increase timber stand vigor, decreasing the stand's susceptibility to insect and disease outbreaks.

1.4.5 Reduce hazardous fuels

D-ID-1Resource conditions minimize undesirable fire, insect, and disease outbreaks. When such events occur, healthy ecosystems are resilient and able to recover.

In the North Shore Project Area older deciduous stands that are in decline have much dead and down fuel and sometimes, an increase in balsam fir, a highly flammable ladder fuel. While natural fire starts (such as lightning strikes) are less frequent, human-caused fires occur regularly in the North Shore Project Area. The increase in fuel load at the landscape level is tempered by Lake Superior's influence on the shore's climate, moderating the potential for large fires. However, there are many towns as well as private and commercial development, along the shore that would be at risk from a wildfire. Additionally, changes in the climate that increase temperatures and/or decrease moisture may alter fire regimes. Therefore minimizing hazardous fuels would move towards conditions that minimize undesirable fire and would make the ecosystem more resilient. Treatments designed to meet other project objectives can be designed to minimize fuel loads, and in areas near improvements, to reduce fuel loads.

1.5 Proposed Action

The proposed actions are those actions the interdisciplinary team felt would best accomplish the purpose and need. When developing the proposed action the interdisciplinary team worked with tribal personnel, state personnel and North Shore Collaborative members. The purpose of these discussions was to share expertise and gather the latest research, information and ideas on how to effectively reach the objectives listed above.

A scoping report that described the Proposed Action was distributed to the public in December 2013 and the public was invited to submit comments. As explained during scoping, the interdisciplinary team continued to refine the proposal in collaboration with interested parties during the development of issues and alternatives. The interdisciplinary team modified the Proposed Action based on a review of comments received and further evaluation of the existing condition. The primary modifications are:

1. Units were deleted from the Proposed Action when a combination of factors such as steep terrain, difficult road access or field reconnaissance showed the proposed treatment is not feasible or needed.
2. Units were added to the Proposed Action when factors such as increased emphasis on riparian planting or a need to provide adequate growing space (through thinning) was identified in additional stands.
3. Treatment method or mitigation measures of a unit were changed to respond to public comments or more accurately reflect site conditions.

The interdisciplinary team also considered possible effects from climate change while making modifications to the proposed action (see Appendix F for details).

The intent of the Proposed Action remained intact with the modifications. A detailed listing of the changes made to the Proposed Action is in the North Shore Restoration Project Record. The North Shore Restoration Project Environmental Assessment analyzes the Modified Proposed Action (Alternative 2) as described below.

1.5.1 Proposed Action Summary

Overall, an estimated 12,000 acres across the North Shore Project Area have been proposed for some type of treatment to accomplish the purpose and need. However, not all of these proposed areas may receive treatment with this project.
The Proposed Action includes the following amount of regeneration:

- White pine: Increase white pine in units up to 6,300.
- White spruce: Increase white spruce in units up to 5,900 acres.
- Black spruce: Increase black spruce as a component in units up to 200 acres.
- White cedar: Increase cedar in units up to 400 acres.
- Tamarack: Increase tamarack as a component in units up to 200 acres.
- Yellow birch: Increase yellow birch as a component in units up to 800 acres.
- Paper birch: Regenerate birch up to 1,000 acres.

The treatment needed to accomplish the regeneration varies by site and site conditions. The proposed action includes the following primary treatments:

Mechanical Site Preparation: There are approximately 1,200 acres proposed for mechanical site preparation and subsequent planting or seeding. The areas identified for this treatment are typically poorly stocked birch and aspen stands over 70 years old with little or no regeneration except for pockets of balsam fir. Many have grass or brush dominating the understory. The regeneration species for a specific unit would be based on Native Plant Communities. For example, in a fire dependent system such as Northern Mesic Mixed Forest class FDn43, regeneration would be a mix of white spruce, white pine, and birch. Some stands would be regenerated predominantly to birch. Even in cases where planting will occur after site preparation, a diversity of regeneration species is expected.

After preparing the site, regeneration of the stand would occur through planting seedlings or natural seeding. To ensure success of conifer seedlings, in many instances, protective

measures would be installed to protect the seedlings from deer browsing (for example, exclosures). Release from herbaceous or deciduous tree competition would likely also be needed to establish the conifer component.

Underplanting: There are approximately 5,000 acres proposed for underplanting. Areas identified for underplanting are older birch and aspen stands with a moderate amount of overstory. Most stands have little regeneration and all are lacking a more diverse mixture of native vegetation species. Areas underneath the canopy would be planted to different mixtures of white pine, white and black spruce, cedar, yellow and paper birch and tamarack. The planting spots would be in small openings or pockets where some light is reaching the forest floor or where certain species do well in limited light conditions. Twigs, needles and leaves would be cleared by hand crews just prior to planting trees.

Installing Deer Exclosures: There are approximately 600 acres where deer exclosure installation is proposed. This acreage refers to the acres in a proposed stand and not the total acreage of exclosures. A particular stand may have multiple small exclosures around individual trees or may have one large exclosure, up to 20 acres in an area.

Deer exclosures, or tall fences, would protect conifer (and other seedlings) from deer browsing until they reach a height where they are no longer damaged by deer. Numerous single tree exclosures, located in suitable white pine and cedar habitat, are proposed where needed to increase cedar and white pine tree regeneration within stands. Larger, 10-20 acre deer exclosures are proposed in areas needing white cedar, yellow birch, and white pine regeneration, increased diversity of understory plants, and cover to provide missing habitat for resident and migratory birds.

Thinning: There are approximately 3,200 acres proposed for thinning. White spruce stands proposed for this type of treatment are typically between the ages of 20 and 79 years old and pine stands proposed for this type of treatment are typically between the ages of 30 and 79 years old, depending on site productivity and growing conditions. These stands currently have a high density of trees and some of these stands, when compared to Native Plant Communities, are occupied by off-site species or are missing structural components.

Thinning overcrowded spruce and pine stands provides growing space for remaining trees, improves habitat for wildlife, and reduces the susceptibility of the stand to future insect and disease attacks. In some stands, thinning would create openings that could be planted or would naturally regenerate to a more diverse species mix. For example, an area that currently has off-site red pine would receive treatments that over time would reduce red pine and favor the establishment of what is appropriate for the Native Plant Community of the site.

A variety of thinning prescriptions, including traditional thinning, variable density thinning, or pre-commercial thinning, would be used depending on site conditions. All of the thinning prescriptions include the removal of a portion of the existing trees (usually

less than 30 %) that is impeding growth and vigor of the existing desirable vegetation. A description of the different thinning prescriptions is in Attachment C.

Even-aged Harvest: There are approximately 1,300 acres proposed for even-aged harvests. The areas identified for this treatment include sites where restoration is needed but there is too much overstory to mechanically prepare the site for the planned restoration activities. In these cases, mechanical site preparation, planting, exclosures or other reforestation activities would occur subsequent to the harvest. Some of the harvest sites are well stocked birch and aspen stands over 80 years old where birch or aspen regeneration is desired.

Selection Harvest: There are approximately 200 acres proposed for selection harvests. About half of the areas proposed are lowland black ash stands or upland mixed hardwood stands with a larger component of black ash. While these stands are currently mature and functioning, there is concern that emerald ash borer, now found in Minnesota, could move into these stands and kill the ash trees. Selective harvesting of these stands, followed by interplanting would reduce the component of ash susceptible to the borer and replace it with other species that would maintain forest cover during an emerald ash attack. It would also be an opportunity to increase the species diversity in those areas with species such as yellow birch, cedar, black spruce and tamarack.

The other half of the stands proposed for selection harvest are mainly plantations where down logs and branches, or large, coarse woody debris, is desired. Cutting five to ten individual, scattered trees per acre in selected stands would improve cover, food, habitat structure, and growing sites for many different plants and animals.

Temporary roads: Temporary roads would need to be constructed to access some of the proposed harvest treatment units. Approximately 14.7 miles of temporary road construction is proposed. All temporary roads would be decommissioned and effectively closed to motorized traffic as soon as access use is complete.

Decommission roads: Three unauthorized roads totaling about one mile are proposed for decommissioning.

1.5.2 Adaptive Management

Adaptive management is a concept for dealing with uncertainty in environmental management. Projects are designed with built-in continuous assessment (monitoring – “If X happens”) and processes for improvement (“Then the next action will be taken”). It allows managers the latitude to treat successive portions of the project based on local conditions, and to assess and monitor these activities while staying within the range of anticipated impacts described in the environmental assessment. The environmental assessment will disclose both the effects of the proposed action, and the effects of adjustments taken through adaptive management.

In this case, some of the uncertainty lies in the existing condition at the time of implementation of activities. The proposed actions are based on stand conditions as we

know them today and some treatments may need to be modified as stand conditions change. The proposed treatments are based on forest plot data that was gathered in 2009 and 2010 (or earlier) supplemented with site visits in 2012. As mentioned earlier in this document, many of the stands are in a rapid state of decline, with some stands regenerating to a diverse mix and other stands not regenerating. Also, this project is likely to be implemented over a longer time frame (5-10 years), given the size of the proposal which would result in more changes to stand conditions.

Some of the uncertainty also lies with increasing species diversity to the ecosystem at the stand level and landscape level. In this case, adaptive management would allow the Forest Service to conduct reforestation activities in an area, monitor the outcome, prescribe additional reforestation activities, monitor the outcome, and eventually allow the forest to grow when desired conditions are reached. Additional treatments would be prescribed based on predictable treatment outcomes (conditions that trigger the next action).

Monitoring would occur prior to, and throughout, implementation of the activities. Trigger points, evaluated through monitoring, would be used to determine if activities are achieving desired outcomes or whether a different action is needed.

For this project, trigger points are based on the following observable stand conditions:

- Overstory species composition;
- Basal area of overstory (cross-sectional area of all stems in a stand measured at breast height, and expressed per acre; a measure of forest density);
- Ground cover composition;
- Composition of regenerating tree species;
- Native plant community type.

A detailed description of the Adaptive Management proposal can be found in Section 2.3 of this Environmental Assessment.

1.6 Decision to be Made

The Gunflint and Tofte District Rangers will decide whether or not to implement any of the proposed management activities. Based on the purpose and need identified for the North Shore Restoration Project, the scope of the project is limited to decisions concerning vegetation and related transportation system activities. If the District Rangers decide to conduct management activities, she/he will then decide on the following:

- The amount and type of vegetation treatment activities, including reforestation
- Relevant mitigation measures and monitoring actions

The District Rangers will also decide if the proposed management activities would have a significant impact that would trigger the need to prepare an environmental impact statement.

1.7 Public Involvement and Issues with the Proposed Action

Public, community and agency involvement has been an integral component of the North Shore Restoration Project and has occurred throughout the development of the purpose and need, proposed action, issues and alternatives.

North Shore Forest Collaborative

A large part of the public, community and agency involvement has occurred through Forest Service participation in the North Shore Forest Collaborative. The North Shore Forest Collaborative, started in 2011, is comprised of tribal, federal, state and county agencies, non-profit organizations, and private land owners working to restore the North Shore's forests. The mission of the Collaborative is to revitalize and maintain a healthy and functioning ecosystem along the North Shore of Lake Superior with emphasis on restoring and maintaining native trees and associated forest communities.

The East End Working Group of the collaborative is looking across all ownerships, in an area roughly equivalent to the North Shore Project Area, to identify restoration needs and implement projects to accomplish those needs. Through participation in the East End Working Group, Forest Service personnel gained expertise useful to the North Shore Restoration Project. For example, collaborative members shared data on Native Plant Community classifications and biodiversity rankings in the area, expertise on success of different treatment methods and knowledge of the history of the area.

Scoping

The interdisciplinary team utilized several methods to inform the public about the scoping comment period for the North Shore Restoration Project. In December 2013, a scoping package requesting comments was mailed to over 1,300 individuals, groups, and agencies who either own land within the project area or who have expressed an interest in these types of projects. The scoping package was also available online at www.usda.fs.gov/goto/superior/projects. The North Shore Restoration Project was listed in the Superior Quarterly (a Schedule of Proposed Actions for the Superior National Forest) starting in January 1, 2011. A local news release was issued; information about the project was also aired on local radio and Minnesota Public Radio.

During the scoping period, the District Ranger and interdisciplinary team hosted an open house (January 11, 2013). The open house provided an opportunity for members of the public to learn more about the project and discuss the proposal with the District Rangers and other staff members who developed the proposal. About thirty people attended and provided comments. Comments were varied. Many private landowners wanted more information about how they could restore their property. Members of the North Shore Forest Collaborative were on hand to help answer questions. Trail partners discussed proposed treatments around skiing, hiking and snowmobile trails in the area and private landowners expressed support or concerns for treatment around their property.

Since the end of the scoping period, there have been ongoing discussions with private landowners, trail partners and Collaborative members. The purpose of these

conversations has been to understand concerns and, if possible, resolve concerns through mitigation or better explanation of actions.

All interested parties on the North Shore mailing list were sent a letter (or email notification) in May 2013 that provided an update on the project, as well as information on a North Shore Forest Collaborative private land owner meeting in June.

To date, over 125 written and verbal responses were received from individuals, groups, and agencies. This includes comments received during the scoping period, open house or subsequent to the open house. The responses ranged from simply wishing to remain on the project mailing list to detailed pages of comments about different aspects of the project.

Analysis of Comments

The purpose of scoping is to identify significant environmental issues deserving of further study and to de-emphasize the insignificant issues in the environmental effects analysis (40 CFR 1500.4g). Issues are defined as points of disagreement, debate, or dispute about potential effects of a proposed activity and are based on some anticipated outcome.

All comments received were considered by the interdisciplinary team and District Ranger. The interdisciplinary team placed the comments into one of four categories and determined the best way to address the comment in the environmental analysis. Categories of comments include: 1) Issue Analyzed in the Environmental Assessment, 2) Alternative, Mitigation Measures, Changes to the Proposed Action, 3) Non-issue Comment or Question or, 4) General Comment. Appendix A, North Shore Restoration Project Scoping Summary, lists all comments received and how they were categorized.

Through the analysis of public comments, the interdisciplinary team identified issues that need to be analyzed in the Environmental Assessment. Issues identified include impacts to soil resources, water quality and trail scenery and effects of non-native invasive species and fragmentation. The interdisciplinary team did not identify any issues where the extent of geographic distribution of effects, duration of effects or intensity of interest warranted development of another alternative considered in detail. To the extent possible, the interdisciplinary team resolved issues through modification of the proposed action.

Administrative Objections

The North Shore Restoration Project is an activity implementing a land management plan and is not authorized under the Healthy Forest Restoration Act; therefore the North Shore Restoration Project decision is subject to objections following Forest Service regulations at 36 CFR 218, Subparts A and B. Only individuals or organizations who submit timely and specific written comments as defined at 36 CFR 218.2 regarding the proposed project during a public comment period established by the Responsible Official are eligible to file an objection to the North Shore Restoration Project. The opportunity to object will be provided when a draft decision on the project is published, after public comment on this Environmental Assessment is considered.

Chapter 2: Comparison of Alternatives

2.1 Introduction

This chapter is the heart of the environmental assessment. It describes how an adequate range of alternatives was developed for the North Shore Project. It describes each of the alternatives analyzed in detail and also briefly describes the alternatives eliminated from further study and the reasons why they were eliminated. This chapter presents the environmental effects of the proposed action and alternatives in a comparative form. The comparison of alternatives is by resource and how each alternative would accomplish the purpose and need, providing a clear basis for choice among alternatives. The environmental effects presented here are a summary of the analysis from Chapter 3.

2.2 How a Range of Alternatives was Developed

The implementation guidelines (40 CFR 1500) developed by the Council on Environmental Quality (CEQ) require that an environmental analysis must "...rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated (Sec. 1502.14 (a))." This direction does not mean every conceivable alternative must be considered or analyzed in detail, but the selection and discussion of alternatives must permit a reasoned choice and foster informed public participation and decision-making. The range of alternatives is defined by the purpose and need for action since all alternatives must in some way meet the purpose and need. A range of alternatives includes all reasonable alternatives analyzed in detail as well as those analyzed briefly. (CEQ 1981, Forty Most Asked Questions, Question 1a).

The interdisciplinary team considered all scoping comments to determine if there were any unresolved issues about effects. No issues were raised for the North Shore Restoration Project from scoping that would necessitate the development of an alternative to analyze in detail. However, scoping comments did suggest other alternatives and these alternatives were analyzed briefly. Rationale for why there were not analyzed further is discussed in Section 2.4.

In accordance with CEQ regulations, a No Action Alternative (Alternative 1) is included in this analysis. This alternative is intended to serve as a control showing the environmental and social effects of taking no action, as well as to provide the deciding official the option of taking no action at this time.

The North Shore Environmental Assessment analyzes the effects of two alternatives briefly and then focuses detailed analyses on two alternatives. The amount of analysis of each alternative is appropriate because there is adequate disclosure of the trade-offs between resources, the effects of the alternatives, and how each meets the purpose and need. These four alternatives are an adequate range of alternatives.

2.3 Alternatives Analyzed in Detail

Alternative 1 - No Action

In this alternative, the proposed action would not take place, and there would be no new vegetation management actions in the project area. There would be no additional site preparation, planting, or harvesting activities. Existing management actions such as road maintenance would continue. Natural succession processes would take place; in the long term, pioneer species such as aspen or birch would succeed to later successional species of spruce-fir (or brush where there is inadequate tree regeneration). Selection of this alternative would not preclude future management actions in the project area.

Alternative 2 – Modified Proposed Action

A summary of the modifications made to the proposed action is described in Chapter 1, section 1.5. The proposed action, included in the December 2013 Scoping Report, was developed by the interdisciplinary team to meet the purpose and need for the North Shore Restoration Project. The team made minor modifications to the proposed action based on additional field reviews, new information and public comments.

Alternative 2-Modified Proposed Action emphasizes use of reforestation activities to restore native vegetation communities. Activities such as mechanical site preparation and planting will occur in stands with inadequate tree stocking, regeneration or species diversity, whereas underplanting will occur in areas with a moderate but declining overstory. Many acres of underplanting will be along area streams and creeks to improve riparian habitat and watershed function.

Although conifer species are emphasized for regeneration, hardwood species are promoted as well. Predictions from climate change models are used to inform the choice of regeneration species. For example, species such as white pine, which climate change models predict to fare well under various scenarios, will be regenerated in a large number of units. Alternative 2 includes limited planting of red oak and bur oak which currently are only present in small areas in the ecosystem but are projected to fare well under predicted changes in the climate. To retain all ecosystem components, species such as white spruce and tamarack will also be regenerated even though they are not predicted to fare well under climate change scenarios. Protection of desired regeneration through large exclosures or single tree exclosures in Alternative 2 is critical to regeneration survival. Retaining and restoring a diverse array of tree species is designed to improve the quality of wildlife habitat in the project area.

Alternative 2 will thin red pine or white spruce plantations providing space for remaining trees to grow in size as well as for additional species to increase in size or area. Variable thinning and/or underplanting will occur in some plantations to improve structural or species diversity, moving the plantations towards the diversity more typical in native vegetation communities.

Harvesting in Alternative 2 is designed to regenerate hardwood species such as birch and aspen. Harvesting birch will create the disturbance needed to regenerate birch and retain

it as an ecosystem component. Interplanting within the birch stands will restore species diversity more typical of native vegetation communities. Selection harvest will add additional species in ash stands in anticipation of mortality from Emerald Ash Borer. In addition to meeting ecological objectives, harvesting and thinning will contribute to the local economy.

Summary of Actions

The summary of acres in Table 2.1 is by primary treatment type and in Table 2.2 the summary is by secondary treatment type. Unit acres listed are based on the acres in our vegetation database for each stand proposed for treatment. Treatment acres are an estimate of what would actually be implemented because of further refinement of unit boundaries and operable areas during implementation.

More detailed information on Alternative 2 can be found in the appendices. Reviewing all of the information will provide a more complete picture of the alternative.

- Figure 2.1, Alternative 2 Proposed Treatment Map displays the locations of the proposed treatments in the project area.
- Appendix B lists the specific treatments and mitigation measures proposed for each unit.
- Appendix C gives a definition for each of the treatment types and mitigation measures.
- Appendix D lists the Operational Standards and Guidelines that apply to all units. Operational Standards and Guidelines, based on the Forest Plan and Minnesota Forest Resource Council Guidelines, are an integral part of the proposal and are designed to minimize adverse effects.

Table 2.1: Summary of Proposed Action by Primary Treatment Type

Primary Treatment Description	Unit Acres	Treatment Acres
Restoring stands through a variety of non-harvest activities		
Underplant	5,063	2,500
Mechanical Site Preparation	1,183	600
Exclosure	562	120
Single Tree Felling	306	306
Single Tree Exclosure	109	109
Release	93	90
Under Burn	63	60
Hand shearing	63	60
Improving stand conditions through intermediate harvest treatments		
Thinning	2,854	2,000
Variable Thinning	336	240
Creating young forest through even-aged harvest treatments		
Clearcut with Reserves	1,210	850
Creating or maintaining two or more age classes through uneven age harvest		
Selection Cut	147	100
Total of all Treatment Types	**11,989**	**7,035**

Table 2.2: Summary of Proposed Secondary Treatment and Reforestation

Treatment Description	Unit Acres
Secondary Treatment	
Exclosure	25
Mechanical Site Preparation	213
Mechanical Site Preparation/Slash Disposal and Pile Burn	112
Shearing	56
Single Tree Exclosure	395
Slash Disposal and Pile and Burn	1,604
Underplanting	192
Regeneration Method	
Natural Regeneration	543
Interplant	1,103
Plant	1,095
Underplant	5,369

Table 2.3 shows the acres of different planting combinations. These include interplanting, underplanting and interplanting after any primary treatment and in some cases are in addition to natural regeneration.

Table 2.3 Acres of Tree Species Planting Combinations

Tree Species	Unit Acres
Cedar	63
Cedar, Yellow Birch, Tamarack and Black Spruce	147
Paper Birch	830
Paper Birch and Yellow Birch	70
Red Oak and Bur Oak[1]	250
White Pine	74
White Pine and Paper Birch	54
White Pine and White Spruce	5,818
White Pine and Yellow Birch	244
Yellow Birch	108
Yellow Birch and Cedar	134
Yellow Birch, Paper Birch and White Pine	25

[1] Specific units have not been identified for planting these species. The planted oak may be in addition to or instead of the other planned regeneration species.

When developing the optimal prescriptions for each unit, the interdisciplinary team balanced the impacts to different resources with trying to meet the objectives of the project. A portion of 44 units proposed for site preparation or fuel reduction (slash disposal) are on low nutrient soils where Forest Plan guidelines call for retaining slash and woody debris (G-WS-8, FP, p. 2-16). Where site preparation or fuel reduction is a high priority, the treatment is proposed and this part of the soil guideline would not be followed. A list of these units is in the North Shore Restoration Project Record. The proposed site preparation is needed to reduce the competition from brush and hardwoods, allowing restoration of conifer. The fuel reduction is needed in areas of urban interface

(structures or cabins) that may be at risk from a wildfire. Chapter 3 describes the effects of removing slash on these sites.

Biomass removal could occur on harvest units with secondary treatments of slash disposal or site preparation and on non-harvest units with primary treatments of understory fuel reduction or site preparation. Biomass removal would not occur on units where soil mitigations call for retaining slash. Biomass removal would include tops and limbs (from harvest operations), brush and non-merchantable stems. It would not include stumps or existing coarse woody debris. Biomass removal would follow Operational Standards and Guidelines (Appendix D).

Road access would be needed to harvest units. As shown in Table 2.4, Alternative 2 would not create any permanent roads and all temporary roads would be decommissioned after implementation of the proposed activities using the actions listed in G-TS-16 and LG-TS-2 (Appendix D: Operational Standards and Guidelines). The three unauthorized roads within the project area proposed for decommissioning are displayed on Figure 2.1.

Table 2.4: Proposed Transportation Management Activities

Transportation Activity	Miles
Construction of temporary roads	14.7
Decommission unauthorized roads	1.0

Adaptive Management and Monitoring

Under Alternative 2, there would be three primary treatment activities where adaptive management could be used during implementation: 1) underplanting, 2) mechanical site preparation, and 3) clearcut with reserves. The adaptive management would occur in two phases. Phase I would occur before stand treatments take place; Phase II would occur after management actions have been implemented within a stand. This would allow us to conduct primary treatments appropriate to the initial site conditions (Phase I), prescribe additional reforestation activities (Phase II), and achieve desired conditions over a larger portion of the project area than would otherwise be the case. Adaptation would take the form of an iterative process that would use monitoring data to inform and adjust implementation of the decision, rather than simply eliminating areas from treatment when conditions at the time of implementation do not match conditions at the time of the decision.

<u>Phase I: Proposed Primary Treatment</u>

Phase I adaptive management addresses changes in stand condition that occur between decision and implementation. The proposed primary treatments are based on forest plot data gathered in 2009 and 2010 (or earlier) and supplemented with site visits in 2012. However many of the stands are in a rapid state of decline; some stands may regenerate to a diverse species mix but others may not regenerate at all. Since this project is likely to be implemented over a time frame of 5-15 years, it is likely there would be changes to stand conditions by the time implementation occurred. Actions would be modified in response to such changes. In Phase I, monitoring and adaptation would address the

question, *Is the primary treatment prescription appropriate for the site given its condition at the time of implementation?*

Observable stand conditions (thresholds, or "trigger points",) would be used to determine if the proposed primary treatment is appropriate given the stand conditions at time of implementation, or whether a different treatment is needed. In Phase I, the indicators shown in Table 2.5 would be monitored relative to their trigger points and adapted prescriptions would be based on this information.

Table 2.5: Phase 1 Adaptive Management Indicators and Triggers

Indicator	**Trigger point**
Basal area[1] of overstory	Basal area is less than 50-60 square feet
Composition of regenerating tree species	Existing diversity, measured in percentages of species present, is inadequate to meet stand objectives
Stocking level of regenerating tree species	Stocking level, measured by stems per acre of species, is inadequate to meet stand objectives

[1] Basal area is the cross-sectional area of all stems in a stand measured at breast height, and expressed per acre; a measure of forest density.

Monitoring data would be collected during initial stand assessment and implementation of the project to track trigger points in this phase. After monitoring the stand conditions, if the proposed primary treatment is deemed inappropriate, the prescription would be adapted. Figures 2-1 through 2-3 illustrate the adaptive management process that would be used to determine changes in management actions in response to changed stand conditions. Figure 2-1 illustrates a unit where timber harvest is the proposed primary treatment and Figures 2-2 and 2-3 illustrate units where reforestation activities are the proposed primary treatments. In many cases primary treatments would be followed by secondary reforestation activities, for example, timber harvest followed by site preparation and underplanting. Adaptive management would be used in an iterative cycle to ensure both primary and secondary treatments are appropriate to the site.

Example of unit with adequate overstory. Underplanting could be used to increase species diversity.

Example of unit with inadequate overstory. Mechanical site preparation and planting would be needed.

Figure 2-1: Phase I Adaptive Management Process for Stands with Timber Harvest as the Primary Treatment. In many cases, harvest would be followed by site preparation.

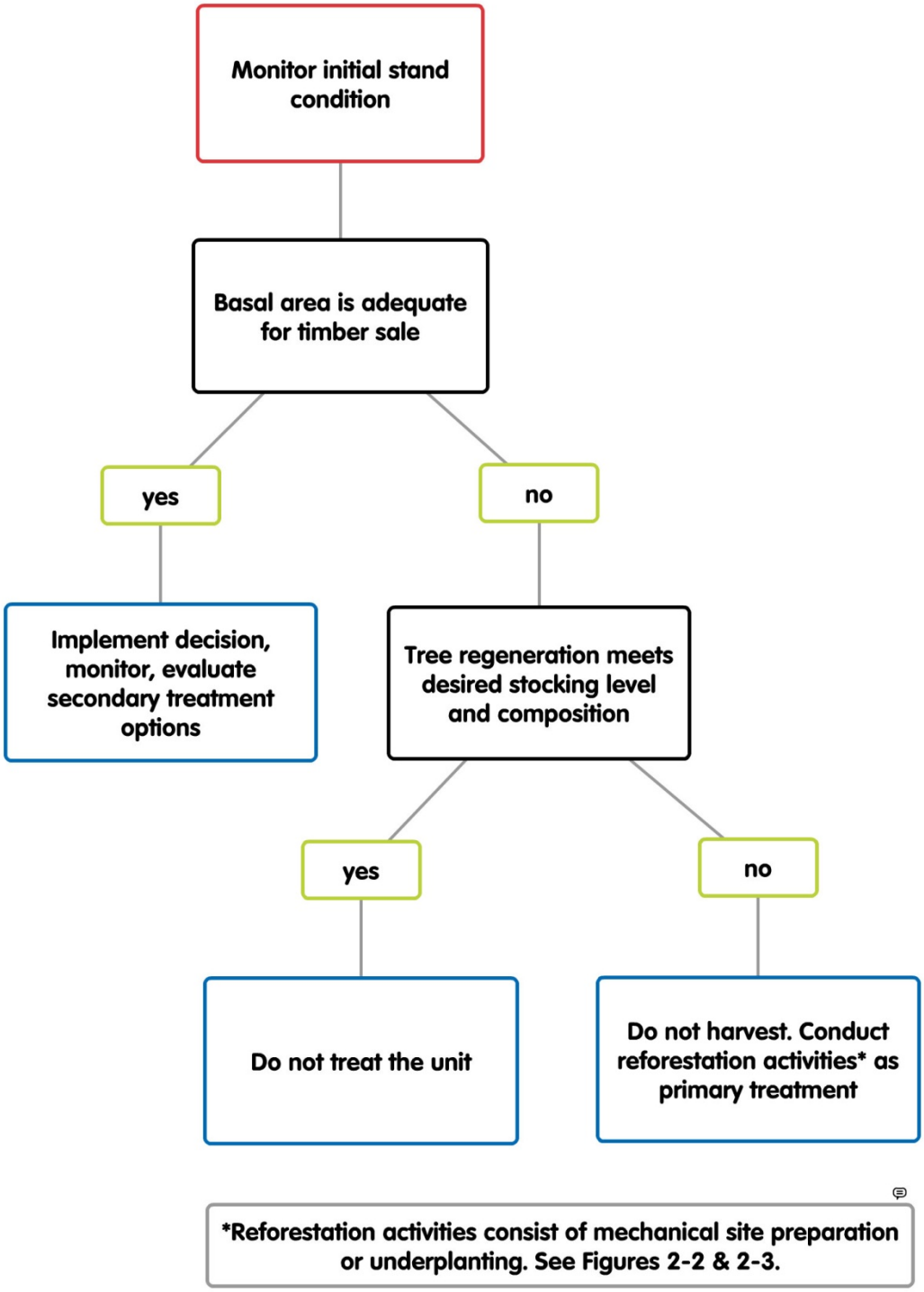


Figure 2-2: Phase I Adaptive Management Process for Stands with Mechanical Site Preparation as the Primary Treatment. Adapted prescriptions may vary depending on stand objectives.

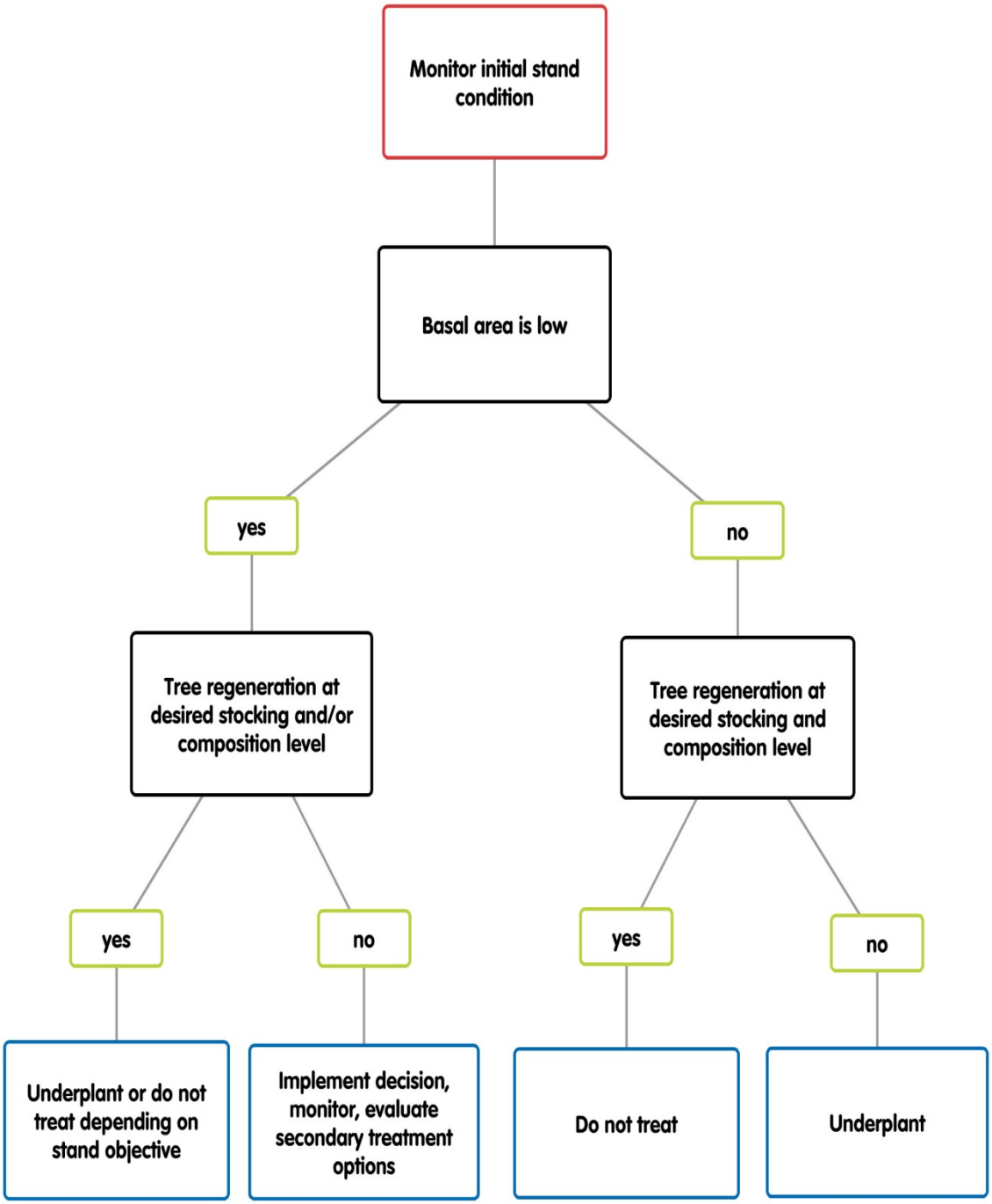
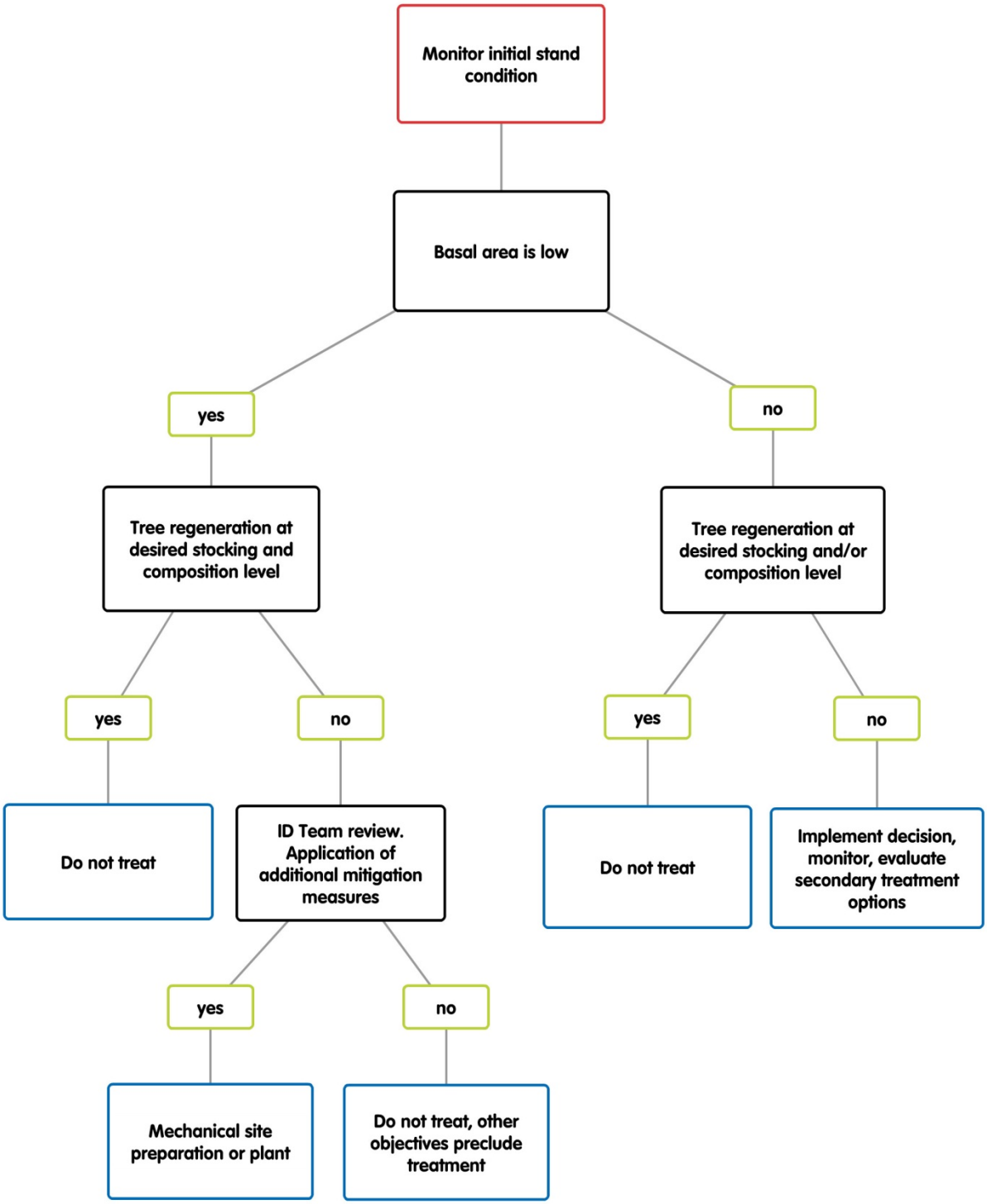


Figure 2-3: Phase I Adaptive Management Process for Stands with Underplanting as the Primary Treatment. Adapted prescriptions may vary depending on stand objectives.



Phase II: Treatment Effectiveness

Phase II would occur after primary and secondary treatments have taken place. In this phase, there is uncertainty regarding how stands would respond to restoration prescriptions, given the changing climate, increased browsing pressure from deer, and increased competition from grass. Adaptive management in Phase II of the project would address the question, *If reforestation efforts on a site did not meet management objectives, why and how can prescriptions be modified to increase success?* In the North Shore Restoration Project, this question applies primarily to the objective of increasing the conifer or paper birch components in project-area stands.

Trigger points would determine if activities are achieving desired outcomes or whether a different action is needed. After monitoring the outcome of primary and secondary treatments on a site, additional treatments in Phase II would be prescribed based on whether or not the trigger points are exceeded for the indicators shown in Table 2.6.

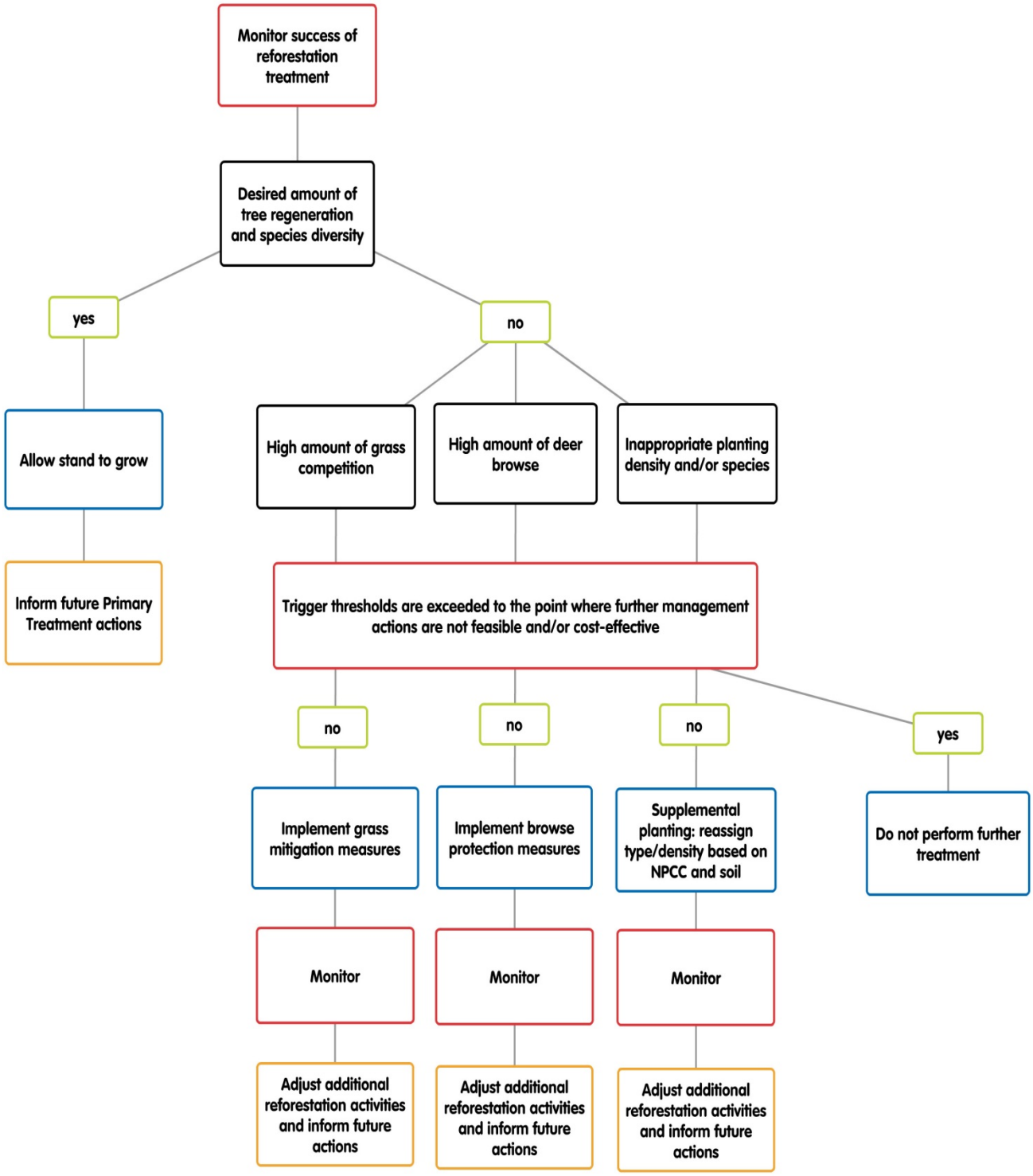
Table 2.6: Phase II Adaptive Management Indicators and Trigger Points.

Indicator	Trigger point
Cover of competitive grass, *Calamagrostis canadensis*	Grass cover, measured using Braun-Blanquet cover-abundance scale rating,exceeds accepted levels to meet stand objectives (Wikum and Shanholtzer 1978)
Deer browsing pressure	Deer browse, measured in proportion of browsed stems, exceeds accepted levels to meet stand objectives (Frerker et al. 2013)
Composition of regenerating tree species	Existing diversity, measured in percentages of species present, is inadequate to meet stand objectives
Stocking level of regenerating tree species	Stocking level, measured by stems per acre of species, is inadequate to meet stand objectives

In Phase II, monitoring would occur throughout implementation of the activities. The information would be used to modify treatments on the site and to inform future primary treatment decisions on sites that have not yet passed through Phase I of the project.

Figure 4 illustrates the adaptive management process that would be used to evaluate reforestation success. In the Figure, there are two possible learning outcomes. If the desired regeneration is present as a result of reforestation treatments, this success would inform future primary treatments in the project. If the desired regeneration is not present, factors would be evaluated to determine what is hindering success, adapted actions would be implemented, and results would be monitored to continually inform and adjust management prescriptions. Monitoring data would determine 1) if primary treatments are the appropriate actions for meeting forest management objectives, 2) how to best mitigate problems encountered from competing grass and overabundant deer populations, and 3) how to refine species planting mixes and densities based on the native community class and other observable site factors. Because the project would be implemented over a span of many years, using adaptive management would help modify and refine actions so that future treatments in the North Shore project, and in other projects on the Superior National Forest, would be well-informed, efficient and have high rates of success.

Figure 2-4: Phase II adaptive management process used to evaluate the success of reforestation efforts.



A description of the monitoring activities that would occur under Alternative 2 is displayed in Table 2.7.

Table 2.7: Description of Monitoring Activities.

Phase I Adaptive Management: Initial Stand Condition	
Objective	Determine if the primary treatment prescription is appropriate for the site given its condition at the time of implementation.
Methods	Stands would be surveyed and assessed for triggers points listed in Table 2.5.
Frequency	Once prior to implementation of primary treatment and again prior to implementation of a secondary treatment if prescribed.
Responsibility	Timber Management Assistant, District Silviculturist, District Wildlife Biologist
Phase II Adaptive Management: Forest Composition/Regeneration	
Objective	Ensure that minimum stocking standards (S-TM-4, Forest Plan p 2-20) are met and desired reforestation objectives have been met. If objectives have not been met, determine how prescriptions can be modified to meet objectives.
Methods	Natural and artificial regeneration areas (following harvest and/or mechanical site preparation) would be surveyed for the number of acceptable trees per acre using Regional Guidelines; additionally, areas would be monitored for trigger points listed in Table 2.6. A percentage of areas with underplanting would be monitored for the trigger points listed in Table 2.6. Stands planted to white pine would be checked for pruning and release need.
Frequency	Stocking surveys would be conducted after the 1st and 3rd growing season following reforestation treatment; Release and pruning needs would be evaluated at the time of stocking surveys, every other year for 10 years, and after 10 years every 5 years until the branches are 9 ft. off the ground
Responsibility	District Silviculturist
Harvest and Site Preparation Areas	
Objective	Ensure that the mitigation measures and provisions in contracts are implemented, with emphasis on soil compaction
Methods	Visual inspection of treatment stands
Frequency	Treatment areas would be visited on a regular basis during the length of the contract
Responsibility	Timber Management Assistant, District Silviculturist
Non-Native Invasive Plants	
Objective	Avoid or minimize an increase in the extent of non-native plant infestation in the project area.
Methods	Monitor a sample of harvest units and newly constructed roads after harvest, site preparation, or construction to determine if invasive plants have colonized areas where management activities have occurred
Frequency	Between year one and year three, following the sale
Responsibility	Forest Plant Ecologist
Temporary Roads	
Objective	Ensure that temporary roads are constructed properly and decommissioned after completion of treatment activities

Table 2.7: Description of Monitoring Activities.

Methods	Inspect temporary road locations as they are being built, during treatments, between treatments, and after they are closed to determine if additional protection/rehabilitation efforts are needed
Frequency	Inspect all temporary road locations that are more than ¼ mile in length.
Responsibility	Timber Management Assistant, Zone Engineer

2.4 Alternatives Analyzed Briefly

Two alternatives, including the Proposed Action from the Scoping Report, are analyzed briefly. The analysis, although not detailed, provides valuable information for consideration in making a decision on actions to take in the North Shore Project Area.

Alternative 3 – Proposed Action from Scoping Report

In December 2013, a Scoping Report was distributed to the public informing them of the North Shore Restoration Project. The Scoping Report included a "Proposed Action" which outlined the management activities the interdisciplinary team had determined would best accomplish the Purpose and Need for Action as described in the report. The following information about the proposed action is from the Scoping Report.

Overall, an estimated 12,000 acres across the North Shore Project Area have been proposed for some type of treatment to accomplish the purpose and need. However, not all of these proposed areas may receive treatment with this project.
The Proposed Action includes the following amount of regeneration:

- White pine: Increase white pine as a component in stands on up to 5,000 acres and as the dominant species on up to 100 acres).
- White spruce: Increase white spruce as a component in stands on up to 4,500 acres and as the dominant type on up to 600 acres.
- Black spruce: Increase black spruce as a component in stands up to 300 acres.
- White cedar: Increase cedar as a component in stands on up to 500 acres and cedar regeneration in cedar stands on up to 300 acres.
- Tamarack: Increase tamarack as a component in stands up to 300 acres.
- Yellow birch: Increase yellow birch as a component in stands up to 1,000 acres.
- Paper birch: Regenerate birch on up to 1,000 acres (some as a component, some as dominant type, some already are birch stands).

The treatment needed to accomplish the regeneration varies by site and site conditions. The proposed action includes the following primary treatments:

- **Mechanical Site Preparation:** There are approximately 1,500 acres proposed for mechanical site preparation and subsequent planting or seeding.
- **Underplanting:** There are approximately 3,800 acres proposed for underplanting.
- **Installing Deer Exclosures:** There are approximately 700 acres where deer exclosure installation is proposed.
- **Thinning:** There are approximately 4,000 acres proposed for thinning.

- **Even-aged Harvest:** There are approximately 1,500 acres proposed for even-aged harvests.
- **Selection Harvest:** There are approximately 650 acres proposed for selection harvests.

The Scoping Report stated "During public scoping and development of issues and alternatives, the interdisciplinary team, through collaboration with interested parties, will continue to refine the proposal. Depending on the content of public comments and further analysis by the interdisciplinary team, the team may recommend additional stands be proposed for treatment or proposed stands be dropped from treatment." (North Shore Restoration Project Scoping Report p.7)

The Interdisciplinary team incorporated updated data and information on specific stands. Stand boundaries were updated from field reconnaissance resulting in a more accurate accounting of stand acres and, in some cases, forest types. Units where treatments were deemed not feasible were eliminated from the proposed action. The team also incorporated some mitigation measures of modifications proposed by the public.

This original Proposed Action was not carried forward for detailed analysis primarily because the interdisciplinary team conducted further field reconnaissance and analysis and made modifications that would better meet project objectives (the purpose and need).

Alternative 4 – No Logging, No Roads, No Fuel Reduction Treatments

Alternative 4 was developed to respond to the comment:
"To restore native vegetation communities plant the areas with native species and if existing trees must be felled in the process leave the felled trees where they lay to serve their purpose in the ecosystem. Please implement all planned actions except logging and road construction… Please analyze an alternative in detail that implements Dr. Cohen's fire risk reduction methods. Fuels reduction is ineffective." (D. Artley Scoping Comment, Project Record)

The commenter does not explain Dr. Cohen's fire risk reduction methods in his comments on the North Shore Restoration Project but in his comments on the Windy Project states: "A Cohen alternative would propose to spend earmarked fire funding to:

- educate the public with by providing each homeowner in the WUI written material that summarizes Dr. Cohen's findings.
- educate the public using USFS organized public meetings to answer questions about the types of fine fuels that Dr. Cohen recommends should be removed.
- and most importantly offer USFS labor to help elderly and disabled people living in the WUI (with their written permission) to remove the fine fuels near their home as Dr. Cohen suggests." (D. Artley Windy Comment, Project Record)

It should be noted Dr. Cohen did not provide any comments to confirm that this alternative as Mr. Artley defines it would be an alternative he (Dr. Cohen) promotes.

The interdisciplinary team developed an alternative based on these comments. The alternative would include:

Mechanical Site Preparation and subsequent planting**:** approximately 1,500 acres.
Underplanting: approximately 3,800 acres.
Installing Deer Exclosures: approximately 700 acres.
Thinning by felling trees and leaving them in place**:** approximately 4,000 acres.
Harvest by felling trees and leaving them in place**:** approximately 2,150 acres.

Analysis of Alternative

The three items listed under a "Dr. Cohen alternative" would occur under Alternative 1 (No Action), Alternative 2 (Modified Proposed Action) and Alternative 4. The Superior National Forest and its partners in Cook, Lake, and St. Louis County has been applying for and receiving grants through State and Private Forestry since 2006. These funds have been used to educate private property owners within Wildland Urban Interface (WUI) areas, about what they can do to mitigate wildfire risk on their land including:

1) Defensible space principles within the home ignition zone as recommended by the FIREWISE Communities Program and
2) Landscape scale fuel reduction techniques to reduce surface and ladder fuel loads, as has been proven effective in local fire adapted ecosystems.

The funds provide a means by which property owners can hire contractors to implement defensible space and landscape scale fuel reduction activities on their private lands.

Under all alternatives, the Superior National Forest and its Cook County Wildfire Protection Plan partners would continue to be engaged in educating and assisting communities on how to maintain fuel reduction treatments over time and become responsible land stewards within the Wildland Urban Interface.

Under Alternative 4 fuel reduction would not occur on 218 acres; In addition, activity fuels would not be treated on any mechanical treatment units. Instead, fuel loads would increase substantially in the approximately 4,000 acres of thinning as a result of large amounts of flammable conifers (white spruce and red pine) left on site. If a fire were to occur in any of these areas, subsequent negative impacts to private property, forest products, wildlife habitat and/or recreation resources could occur.

The large amount of slash and down wood would also inhibit growth of other species in the white spruce and red pine plantations, limiting any increase in species diversity in the stands. The large amount of down wood in the harvests in hardwood stands would also limit the amount and diversity of regeneration coming into the stands (although likely not as much as in the plantations where there is higher density of trees).

Alternative 4 will not be considered further because it would not meet the purpose and need: it would not provide sustainable timber products; would increase fuel hazard instead of decrease it and would limit restoration of native vegetation communities.

2.5 Comparison of Alternatives Considered in Detail

2.5.1 Comparison of Acres of Proposed Treatments

Table 2.8: Comparison of Activities and Acres Proposed Under Each Alternative by Forest Type for North Shore Project Area.

Primary Treatments	Forest Type	Alt. 1	Alt. 2
Clearcut with Reserves	Aspen-White Spruce-Fir	0	226
	Paper Birch	0	712
	Quaking Aspen	0	272
	TOTAL:	**0**	**1,210**
Selection Cut	Black Ash-American Elm-Maple	0	115
	Mixed Upland Hardwoods	0	32
	TOTAL:	**0**	**147**
Thinning	Aspen-White Spruce-Fir	0	100
	Red Pine	0	367
	White Spruce	0	563
	White Spruce-Fir-Aspen	0	25
	White Spruce-Fir		1,799
	TOTAL:	**0**	**2,854**
Variable Thinning	Red Pine	0	256
	White Spruce-Fir		80
	TOTAL:	**0**	**336**
Exclosure	Aspen-White Spruce-Fir	0	98
	Mixed Upland Hardwoods	0	51
	Northern White Cedar-Aspen-Birch		187
	Paper Birch		42
	Sugar Maple		124
	White Spruce-Fir		60
	TOTAL:	**0**	**562**
Hand Shearing	Paper Birch	0	43
	Sugar Maple-Beech-Yellow Birch	0	21
	TOTAL:	**0**	**63**
Mechanical Site Preparation	Aspen-White Spruce-Fir	0	238
	Balsam Fir-Aspen-Birch	0	5
	Mixed Upland Hardwoods	0	111
	Paper Birch	0	570
	Quaking Aspen	0	196
	Sugar Maple-Beech-Yellow Birch		53
	White Spruce-Fir		10
	TOTAL:	**0**	**1,183**

Table 2.8: Comparison of Activities and Acres Proposed Under Each Alternative by Forest Type for North Shore Project Area.

Release	Quaking Aspen	0	36
	White Spruce-Fir-Aspen		57
	TOTAL:	**0**	**93**
Single Tree Exclosure	Paper Birch	0	54
	Sugar Maple-Beech-Yellow Birch		21
	White Spruce-Fir-Aspen		19
	White Spruce-Fir		15
	TOTAL:	**0**	**109**
Single Tree Felling	Northern White Cedar	0	15
	Paper Birch		80
	Sugar Maple		118
	Sugar Maple-Beech-Yellow Birch		29
	Upland Northern White Cedar		65
	TOTAL:	**0**	**306**
Under Burn	Red Pine	0	63
	TOTAL:	**0**	**63**
Underplant	Aspen-White Spruce-Fir	0	607
	Balsam Fir-Aspen-Birch	0	121
	Balsam Poplar	0	25
	Lowland Shrubs	0	9
	Mixed Swamp Conifer	0	257
	Northern White Cedar-Aspen-Birch		33
	Northern White Cedar		32
	Paper Birch		2,243
	Quaking Aspen		1,254
	Red Pine		19
	Sugar Maple-Beech-Yellow Birch		116
	White Spruce-Fir-Aspen		291
	White Spruce-Fir		9
	TOTAL:	**0**	**5,063**

2.5.2 Comparison of Effects of Alternatives by Resource

This section summarizes and compares the effects of the two alternatives analyzed in detail. The salient indicators and conclusions of each resource analyzed in Chapter 3 or appendices are summarized here. For the detailed analysis, including analysis methods, data, cumulative effects, etc., see Chapter 3 and relevant appendices.

Table 2.9: Summary of Environmental Effects by Resource Area

Treaty Rights

Alternative 1-No Action would not be responsive to tribal interests to maintain paper birch and white cedar in the ecosystem. Both species are declining in the ecosystem and this trend would continue under No Action. Under Alternative 2, paper birch and white cedar regeneration would be increased through planting and natural regeneration in treatment units. Single tree exclosures or hard tubes would be used to protect the cedar seedlings.

Indicator	Alternative 1	Alternative 2
Acres with paper birch regeneration	0	979
Acres planted with a component of white cedar	0	344

Vegetation

Paper birch would continue to declining under Alternative 1. As a result, the amount of trees present in some stands would decrease as the amount of grasses and shrubs increased. Balsam fir and spruce regeneration would increase in a portion (but not all) of the decadent stands. There would be few disturbances under Alternative 1 that would create favorable conditions for white pine to seed and germinate. Due to heavy deer browse, little regeneration of white pine or white cedar is expected under Alternative 1.

Alternative 2 would increase species diversity, by planting 7,567 acres to different mixtures of white pine, white and black spruce, yellow and paper birch, cedar and tamarack. White pine would be the species with the greatest increase across the treatment units. Regeneration of species that are heavily browsed (white pine, white cedar, yellow birch) would be protected through large exclosures, single tree exclosures or bud capping. Many of the stands that were succeeding to brush species would be planted to tree species, improving the health and resiliency of the forest.

Indicator	Alternative 1	Alternative 2
Acres in young age class in the Mesic Birch Aspen Landscape Ecosystem	0	1,372

Threatened and Endangered Species

Under both alternatives, forest conditions would continue to provide for lynx denning, foraging, and movement across the analysis area. Alternative 1 would have no effect Canada lynx, nor would it adversely modify critical habitat. Alternative 2 may affect, but is not likely to adversely affect lynx or modify critical habitat and effects are expected to be beneficial, insignificant, or discountable.

Neither Alternative 1 nor Alternative 2 is likely to jeopardize the existence but Alternative 2 may adversely affect northern long-eared bat. Under both alternatives, forest conditions would continue to provide for bat roosting and hibernating habitat across the analysis area but under Alternative 2 some summer roosting habitat may be destroyed and individual bats may be harmed.

Regional Forester Sensitive Species/Management Indicator Species

Aquatic species

Alternative 1 would not impact the northern brook lamprey, Quebec emerald dragonfly, ebony boghaunter dragonfly and headwaters chilostigman caddisfly, but Alternative 2 may impact individuals. However, it is not likely to cause a trend to federal listing or loss of viability of the species or their populations.

Table 2.9: Summary of Environmental Effects by Resource Area

Terrestrial Wildlife

Alternative 1 would result in the least amount of disturbance to Regional Forester's Sensitive Species (RFSS) and generally results in a finding of *no impact*.

For Alternative 2, the proposed activities would have no impact on olive-sided flycatcher, Freija's grizzled skipper, Taiga alpine butterfly, Nabokov's blue butterfly or wood turtle. For Alternative 2, the proposed activities may impact individuals but are not likely to cause a trend to federal listing or loss of viability for gray wolf, little brown myotis, tri-colored bay, heather vole, bald eagle, northern goshawk, bay-breasted warbler, Connecticut warbler, American three-toed woodpecker, great gray owl, or boreal owl.

Plant Species

Alternative 1 may impact six RFSS plant species. However, this impact is not likely to cause a trend toward federally listing these species or loss in their population viability; none of the remaining RFSS plants would be directly, indirectly, or cumulatively impacted by Alternative 1.

Alternative 2 may impact 49 RFSS plant species. However, this impact is not likely to cause a trend toward federally listing these species or loss in their population viability; none of the remaining RFSS plants would be directly, indirectly, or cumulatively impacted by Alternative 2.

Soil Productivity and Wetlands

Alternative 1 would have no direct effects to soil productivity because no soil disturbing activities would take place as a result of this alternative. Impacts to soil productivity would be minimal under Alternative 2 because appropriate mitigation measures and Operational Standards and Guidelines would be followed during implementation to reduce effects to soil resources.

Indicator	Alternative 1	Alternative 2
Acres of landings and skid trails	0	192
Acres of slash disposal, site preparation, and prescribed burning on low nutrient Ecological Landtypes	0	585
Acres of wetland within mechanical treatment units	0	343

Non-Native Invasive Plants

When direct, indirect, and cumulative effects are considered together, Alternative 1 emerges as the alternative with the lower risk of weed spread and subsequent negative impacts because there would be no ground disturbance with this alternative. Alternative 2 has a higher risk of weed spread and negative impacts than Alternative 1, but overall the risk for Alternative 2 would still be relatively low.

Indicator	Alternative 1	Alternative 2
Miles of new upland road construction	0	12
Acres of upland treatment units within 50 feet of non-native invasive plant occurrence	0	1,172

Water Quality

Alternative 1 would have no direct effects to water quality because there would be no increase in road miles or increase in the percentage of watersheds in a young or open condition. Impacts to water quality would be minimal under Alternative 2 because Operational Standards and Guidelines and site specific mitigation measures would be followed during implementation. Also 1.0 miles of unauthorized roads would be decommissioned reducing potential sediment sources and improving the water quality.

Indicator	Alternative 1	Alternative 2
Miles of temporary roads crossing lowlands	0	2.1
Number of new temporary water crossings	0	30

Table 2.9: Summary of Environmental Effects by Resource Area

Percentage of upland open and upland young forest within each sixth level watershed	12-49	3-49
Recreation/Scenery Alternative 1 would have no impacts to scenery. The forest would continue to age and change according to natural processes. In some areas scenic quality would continue to decrease as birch forests died and there was little regeneration of long-lived conifer. Under Alternative 2, in the short-term trail users and visitors in the North Shore Project Area would hear and notice harvest activities such as clearcut with reserve or thinning along area trails and roads. In the long term, the planting and restoration of long-lived conifer and birch would improve scenic quality.		

2.5.3 Comparison of How Alternatives Meet Purpose and Need

This section explains how each alternative would meet the objectives of the purpose and need (see Section 1.4 for the Purpose and Need).

Restore Native Vegetation Communities

Alternative 1 would not treat any area in the North Shore Project Area. As the forest continues to age, succession would move some stands towards a spruce-fir forest. However, key species such as white pine, white cedar, and paper birch would continue to decline. In addition, stands would contain a lower stocking of trees and larger areas would be populated with grasses and shrubs. The loss of these components of the native vegetation communities might reduce the resiliency of the forest and further compound the effects of climate change.

Activities in Alternative 2 would increase or maintain key tree species of native vegetation communities. Various mixtures of white pine, white and black spruce, yellow and paper birch, cedar and tamarack would be planted in 7,567 acres (See Table 2.10). In addition to increasing within stand diversity, these trees would reduce the amount of grass and shrubs and would restore these units to conditions more typical of the native vegetative communities. The largest primary activity proposed is 5,063 acres of underplanting and 1,183 acres are proposed for mechanical treatment in order to prepare the unit for planting.

Table 2.10: Total Acres[1] Regenerated/Planted by Tree Species

Tree Species	Alternative 1	Alternative 2
Black Spruce	0	147
Paper Birch	0	979
Red and Bur Oak	0	250
Tamarack	0	147
White Cedar	0	344
White Pine	0	6,215
White Spruce	0	5,818
Yellow Birch	0	729

[1] Acres are counted more than once since an individual stand may be planted to multiple species. Includes regeneration after all primary treatments.

Nearly 700 acres of white pine, cedar and birch would be protected from deer browsing by placement of single and large tree exclosures. These exclosures would help protect all native vegetation, not just trees, and increase the diversity of plant life in these stands. There would also be hand shearing, single tree felling and underburning designed specifically to increase stand structure or maintain native community function. All of these activities would restore structure and heterogeneity. Bringing back this complexity to the forest ecosystem now would increase the resistance and resiliency of stands. This is particularly important to maintain options as the North Shore Project Area is predicted to see a greater increase in temperature as a result of climate change.

Clearcut harvesting in aspen and birch stands would contribute an even mix of age classes in the project area and reduce the amount of older forest that is dying at a rapid rate. Selection cuts would be planted to a species mix that would compensate for the potential loss of black ash due to Emerald Ash Borer.

Improve Wildlife Habitat

The North Shore Project Area has high deer densities, especially in the winter when many deer migrate from the interior of the forest to the shore of Lake Superior to take advantage of the warmer, south-facing slopes where food and water are more readily available and lesser snow depths reduce the energy needed to get through the winter. As a result of deer densities as high as 100-130 deer per square mile, preferred winter foods are often severely reduced in number and size, reducing plant diversity and preventing tree regeneration.

In Alternative 1 there would continue to be a severe amount of deer browse on small, regenerating white pine, white and yellow birch, and white cedar resulting in very few trees of those species surviving into sapling-size trees. Ground-layer plants would continue to be heavily browsed by deer reducing plant diversity in all areas of the project area.

In Alternative 2 protection from deer browse would increase seedling and sapling survival of white pine, red oak, bur oak, white and yellow birch, and white cedar. Up to 10 five acre to 20 acre exclosures would protect trees, shrubs, and forbs within the exclosures from the severe browsing currently taking place. Also, many planted and naturally regenerating trees would be individually protected from deer through standard methods of caging, spraying with deer deterrent, or bud capping.

The North Shore of Lake Superior is an important bird migration corridor. Many hawks, eagles, and neotropical migrants, including warblers, that breed on the Superior National Forest and farther north, travel south along the North Shore rather than crossing over the lake. The forested habitat along the shore provides food and roosting sites during migration and is critical to the health and survival of birds traveling thousands of miles to wintering habitat in the southern United States and Central and South America. Complex forest structure including tree species of all sizes and healthy plant biodiversity for this part of the continent are necessary to provide a wide diversity of food and shelter during migration.

In Alternative 1 young trees of most species other than spruce and fir would continue to be browsed by deer resulting in a continuation of older decadent trees and few young trees. Deer browsing would continue on all National Forest System land, keeping plant species diversity at the current level.

Alternative 2 would provide a new cohort of young trees that will improve forest structure by adding a subcanopy and a wider availability of tree leaf shapes and sizes to improve insect (prey species) diversity and abundance. Groundlayer plant diversity would increase within the large exclosures, adding beneficial complexity to the forest

Improve Watershed Health

Forest Plan management direction tells us to actively manage vegetation for the primary purpose of enhancing or restoring the functional linkage between aquatic and terrestrial ecosystems, and to favor long-lived site-suitable tree species such as white pine, red pine, black spruce, tamarack, etc. suitable for the site and at stand densities suitable for the site (FP, p. 2-8).

Figure 2.5: Underplanting in Riparian Area

Alternative 1 would not actively plant long-lived tree species within the riparian areas. Without any disturbance, balsam fir would begin to dominate these areas. Alternative 2 would manage for conifers in the riparian area. Approximately 1,353 acres would be underplanted with northern white cedar, red pine, white pine or white spruce (only a portion of each unit would be planted so actual implementation acres would be less) in the riparian area of the stand. The conifers would eventually grow into an overstory of trees creating shade for aquatic and wetland ecosystems, thermal cover for wildlife and nest sites for riparian associated species, such as eagles and osprey, and inputs of coarse woody debris and fine litter to provide instream/lake structure and nutrient input to the aquatic system (MFRC Guidelines - Riparian, p. 6; D-WS-10, FP, p. 2-11).

Provide Sustainable Timber Products

The North Shore Project Area contains a portion of the land classified as suitable to produce timber products. A Forest Plan desired condition is to provide a predominantly natural-appearing landscape that may be slightly modified by forest management activities. Similarly, one emphasis of the Recreation Use in a Scenic Landscape (RU) Management Area (MA) is that timber harvest and management-ignited fire may be used

to achieve Landscape Ecosystem objectives. There is demand for forest commodities, such as pulpwood and saw timber, and this project would contribute to provide sustainable forest products.

Alternative 1 would not provide timber products from this area at this time. It would not preclude providing timber products in the future, however. Alternative 2 would provide approximately 15.7 million board feet. Harvesting the timber stands proposed in Alternative 2 offer immediate economic returns to federal and local governments and to the timber industry. Harvesting in Alternative 2 would be above the economic returns from harvest in the past 10 years. Further discussion of economic impacts is presented in Appendix E.

Reduce hazardous fuels

Alternative 1 would not reduce existing fuel hazards near wildland urban interface areas. Existing fuel volumes would increase throughout most forested land within the project area. This is due to dead, dying, and/or wind thrown trees and successional trends toward spruce-fir forest types. This increase fuel loading can result in intense wildfires. Subsequently, values at risk, such as private property and recreation resources, could potentially be negatively impacted in the event of wildfire within the project area. While currently Lake Superior moderates the potential for large wildfire, changes in the climate that increase temperatures and/or decrease moisture may alter fire regimes in the future.

Alternative 2 would reduce fuel hazards on 218 acres and would reduce activity fuels (fuel created as a result of implementing proposed treatments) on 1,716 acres. Table 2.11 describes how different types of fuel reduction treatments target the different fuel types to reduce overall fuel loadings in an area. In developing the fuel reduction treatments for the North Shore Project Area, surface fuels, ladder fuels and crown fuels were targeted for treatment.

Table 2.11: Comparison of Amount and Type of Fuel Reduction Activities by Alternative.

Description of Treatment	Acres	
	Alternative 1	Alternative 2
Underburning: Low intensity fire used in the understory of pine stands to remove surface and ladder fuels.	0	63
Harvest: Removes crown fuels and crushes some of the ladder fuels through harvest activity.	0	22
Mechanical Site Preparation: Crushes and displaces surface and ladder fuels with heavy equipment.	0	133
Slash Disposal: A secondary treatment to reduce the surface fuel loading created during harvest and site preparation activities. Piling and burning or mechanically crushing the surface fuels are the most common methods.	0	1,716
Total	**0**	**1,934**

The fuel reduction treatments within Alternative 2 (including treating activity fuel) would be located primarily near forest boundaries with private land, near roadways, and near areas of high recreational use. By treating near these areas, defensible space would be

increased. Defensible space is the area between a fire and values at risk where firefighters are able to take suppression actions. Additionally, removing hazardous fuels near high travel corridors, would improve the safety of travel for forest visitors and local residents during a wildfire. All fuels reduction treatments within Alternative 2 would reduce hazardous fuels to a level in which fire behavior from a wildfire would be decreased. By decreasing fire behavior, firefighting tactics can be more effective. The combination of increasing defensible space and decreasing fire behavior would increase the likelihood that fire suppression activities can be conducted to minimize impacts to values at risk and provide for public safety.

Figure 2.6: Underburning Underneath White Pine.

An understory burn would occur in one red pine unit in Alternative 2. This treatment would reduce surface and ladder fuels in this area, thereby reducing potential resource impacts by decreasing potential wildfire behavior. This treatment would also accomplish the objective of restoring native vegetation communities through restoring the historical fire regime of pine stands. The lack of fire on the landscape has led to poor forest health and little regeneration in those areas. Understory burns help improve forest health by thinning out dense stands that can spread insect and disease outbreaks. Additionally, underburns prepare the soil so regeneration can take place.

Chapter 3: Environmental Consequences

3.1 Introduction

This chapter presents the scientific and analytic basis for the comparison of alternatives. The chapter is organized by resource area and for each resource includes a discussion of Affected Environment and Environmental Effects. The "Affected Environment" describes the current condition of the resource indicators and trends relative to their status. The "Environmental Effects" describes the direct, indirect and cumulative effects of the alternatives:

- **Direct effects** are impacts that occur at the same time and place as the initial action.
- **Indirect effects** are impacts that occur as a result of the initial action but are either later in time or are spatially removed from the action.
- **Cumulative effects** result from the incremental impacts of actions when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such further action. These potential cumulative actions are described in Appendix F.

The interdisciplinary team (IDT) examined and analyzed data to estimate the effects of each alternative. The data and level of analysis were proportionate with the importance of the possible impacts (40 CFR 1502.15). The effects are quantified where possible, although qualitative discussions may also be included.

The vegetation analysis used data from the Forest Service Spatial database. The database includes information such as forest type, age, basal area and site index. It is continually being updated based on field reconnaissance and past forest altering activities. Data used for the North Shore analysis was extracted from FS Spatial in 2013. Acreage figures in FS Spatial are estimates; acreages may change slightly during implementation based on more extensive field verification.

Road and trail data used in the analysis is from the INFRA tabular database in conjunction with the GIS Travel Routes spatial database. These databases are continually updated. Editing generally involves correcting errors between the INFRA and GIS Travel Routes such as inconsistent lengths or locations and inventorying unclassified roads.

The interdisciplinary team considered the possible inaccuracies and limitations of the vegetation and road/trail data. The team concluded it is the best available information and is adequate for the analysis conducted and for drawing conclusions. The basic data and central relationships are sufficiently well-established in the respective sciences that additional data, increasing accuracy, is unlikely to reverse or nullify understood relationships. Thus, additional data would be welcomed and add precision but it is not essential to provide adequate information for the decision-maker to make a reasoned choice among alternatives.

3.2 Treaty Rights

3.2.1 Introduction

Tribes are considered to be sovereign nations; the United States government and its departments have a responsibility to recognize this status. The federal relationship with each tribe was established by, and has been addressed through, the Constitution of the United States, treaties, executive orders, statutes, and court decisions. Government-to-government consultation between the federal government and federally recognized American Indian tribal governments acknowledges the sovereign status of these tribes. This consultation supports Executive Order 13175 (November 6, 2000), which recognizes the sovereignty of federally recognized American Indian tribes and the special government-to-government relationship.

Beginning in the mid-nineteenth century, the government of the United States made treaties with the Ojibwe that ceded areas of land in northern Minnesota to the federal government. In return, specific reservations were created for the tribes' use and other considerations specified. The treaties also preserved the right of the Ojibwe bands to hunt, fish, and gather off the reservations within the treaty area. Tribal interests and uses on National Forest lands are protected through various statutes. The federal trust doctrine requires that federal agencies manage the lands under their stewardship with full consideration of tribal rights and interests, particularly reserved rights, where they exist.

The Superior National Forest has a role in maintaining these rights, because it is an office of the federal government responsible for natural resource management on lands subject to these treaties. The Superior National Forest is located on lands ceded by the Ojibwe to the United States in 1854 and 1866. Three bands - Grand Portage, Fond du Lac, and Bois Forte (Nett, Lake) – live in proximity to the Forest and are directly affected by the treaties. The tribes consider many areas in the Superior National Forest important to them for cultural, historic, traditional, and spiritual reasons.

Article 11 of the 1854 Treaty states that Ojibwe within the treaty area would continue to have the right to hunt and fish on lands they ceded. A court decision (*Fond du Lac Band of Chippewa v. Carlson*, 1995) has confirmed this right to hunt, fish, and gather without regulation by the State of Minnesota.

North Shore Restoration Project

The District Ranger and the interdisciplinary team consulted with tribal representatives from 1854 Treaty Authority, Grand Portage Band of Lake Superior Chippewa, Fond du Lac Band of Lake Superior Chippewa and Boise Forte Band of Chippewa at various stages throughout the development of the North Shore Restoration Project. Contacts were made during data collection, formulation of the North Shore Forest Collaborative, pre-scoping (developing the purpose and need and proposed action), and scoping.

The North Shore Project Area is of interest to the tribes, particularly the Grand Portage Band of Lake Superior Chippewa. The forests in the North Shore Project Area have a

higher percentage of paper birch and white cedar than other areas on the district; both of these species are valuable to the bands for cultural and traditional practices.

The District Ranger and the interdisciplinary team have been collaborating on proposed restoration activities with Tim Miller, Grand Portage forester, individually and through the North Shore Forest Collaborative. Discussions have centered around sharing expertise and ideas on how to retain birch and cedar in the ecosystem. Additionally, opportunities for landscape level projects across ownership boundaries (such as where National Forest System land is adjacent to the reservation boundary) were discussed.

Alternative 1-No Action would not be responsive to tribal interests to maintain birch and cedar in the ecosystem. Both species are declining in the ecosystem and this trend would continue under No Action (See Section 3.3 Vegetation for more discussion on vegetation changes in the ecosystem.)

Under Alternative 2, treatments on 962 acres would strive to maintain those stands as paper birch forest type through natural regeneration and also planting of paper birch. Other species such as white pine and white spruce would also be planted. These stands regenerated to birch would not be “pure” birch stands such as what was created along the North Shore after intense logging fires, but would have a higher degree of species diversity from the artificial and natural regeneration. In addition, there would be a limited amount of natural birch regeneration by seeding or stump sprouting from harvest and mechanical treatments in all units that had at least some component of paper birch. The paper birch component in most mature stands not treated would be expected to decrease in this Alternative for the same reasons as in Alternative 1.

Alternative 2 strives to boost the amount of cedar in stands. There would be 344 acres of variable thinning, selection cut, hand shearing, underburning and large exclosures that would be planted to cedar. Since cedar is so desirable to deer, single tree exclosures or hard tubes would be used to protect the seedlings. The within-stand diversity of cedar would increase in Alternative 2.

Tribal interests also include access to the forest for exercising treaty rights. All of the roads proposed for decommissioning in the North Shore Restoration Project are currently grown-in. Closing roads that are currently grown-in would not be expected to lesson tribal access. When decommissioning temporary roads a parking area would be left when feasible to provide hunters and gatherers a place to park. Operational Standard and Guideline LG-TS-2 states “Roads designated for decommissioning will generally be subject to the following…When possible, the placement of material (slash, trees, and rocks) should begin 50 feet back from main roads to allow room for parking.”(Appendix D, pg D-16)

3.3 Vegetation

3.3.1 Introduction

This section discusses the effects that each alternative is expected to have on vegetation in the Project Area. The vegetation in the Project Area is experiencing considerable change as a result of natural succession and extra stresses such as drought and deer herbivory. The proposed activities may have both adverse and beneficial changes to current vegetation trends.

The North Shore project focuses on restoration and much of the emphasis in the project is on increasing diversity of tree species at the stand level. That brought potential within-stand diversity effects to the forefront of this analysis. The analysis also includes potential effects to landscape ecosystem composition and age class, addressing potential effects at a broader scale.

Landscape ecosystems represent the most current and best scientific information to use in analyzing forest vegetation and are described and delineated in the Forest Plan (FP) (FP, pp.2-55 to 2-78). Forest Plan landscape ecosystem objectives seek conditions more representative of native vegetation communities than those that currently exist.

3.3.2 Indicators

The Forest Plan provides four objectives for each landscape ecosystem; 1) age class distribution, 2) species composition, 3) Management Indicator Habitats, and 4) within-stand diversity. Because these objectives are measurable, they provide a good way to compare how the North Shore alternatives would move toward the Forest Plan's desired condition.

Indicator 1: Within-Stand Diversity.

Tree diversity objectives in the Forest Plan differ from the composition (forest type) objectives in that they address the desired direction for total percentage of trees within a stand, not total acres of forest type. This indicator also addresses data from the North Shore Till Plain Landtype Association (LTA) which closely follows the boundary of the North Shore Project Area and provides information at a finer scale about the native vegetation communities and ecological characteristics. (See Section 1.4 for more information on the North Shore Till Plan LTA.)

Indicator 2: Composition.

Forest type describes the dominant vegetation at the stand level and is delineated by areas that have similar species, such as paper birch, aspen-white spruce-balsam fir, etc. The forest type of a stand is based on the most dominant tree species in the stand, but other species may be present as smaller components. As an example, a stand could be typed paper birch but could also have aspen, balsam fir, or spruce in the stand. Forest composition refers to the amount (acres) of different forest types across the project area or landscape ecosystem.

Indicator 3: Age Class.

Each forest stand has an age class. Age class is broken down by decade or a range of decades such as 0-9, 10-49, or 50-79. Each landscape ecosystem has a different set of age class ranges. Table 3-Veg-5 displays the age classes for the Mesic Birch-Aspen-Spruce-Fir (MBA) Landscape Ecosystem (LE).

3.3.3 Analysis Parameters

The geographic boundary selected for analyzing the direct and indirect effects of the within-stand diversity indicator is the North Shore Project Area. This boundary was chosen because it will show how the proposed activities within the North Shore Project Area changes within-stand diversity at the project scale. The direct and indirect effects analysis includes National Forest System land only.

The cumulative effects analysis area for within-stand diversity indicator includes all National Forest System land and other ownership in the project area. This boundary was chosen because the activities on all ownerships in the project area would affect within-stand diversity and the other ownerships are adjacent to National Forest System land.

The geographic boundary selected for analyzing the direct and indirect effects of the age class and composition indicators is the Mesic Birch-Aspen-Spruce-Fir Landscape Ecosystem in the North Shore Project Area. The majority of units proposed for treatment are in this landscape ecosystem. The analysis of the other landscape ecosystems is in the project record. It is not summarized here because the acres to be treated would be small and the effects of alternatives would be limited in scale and context. The direct and indirect effects analysis includes National Forest System land only.

Two geographic boundaries with different spatial scales were selected for analyzing the cumulative effects for age class and composition indicators. The first analysis area included all ownership in the Mesic Birch-Aspen-Spruce-Fir Landscape Ecosystem in the project area. This boundary was chosen because activities on all ownerships in the project area would affect age class and composition at the project or local scale. The second boundary included all National Forest System land in the Mesic Birch-Aspen-Spruce-Fir Landscape Ecosystem forest-wide. This boundary was chosen because at this scale, changes in age class and composition can be compared directly to Forest Plan landscape ecosystem objectives.

The project proposal was developed in 2013; therefore, 2013 is the year for the existing condition and the base year of the analysis. The existing condition is a reliable snapshot of past cumulative effects on forest types and age class. The within-stand diversity, composition (forest type) and age class distribution of the area in the year 2013 would reflect all prior harvest, stand replacement natural disturbances or any other activity which would affect forest type and/or stand age.

The analysis timeframe for direct, indirect and cumulative effects is between the years 2013 and 2021. This time period covers nine years instead of the usual ten years because

of current limitations in our modeling capability. The scripts (modeling tools) the Superior National Forest uses to conduct vegetation analysis are limited in their ability to model forest age class and composition beyond 2021. The Superior National Forest is in the process of updating and testing new scripts; however they are not available for use at this time on the North Shore Project.

Resource specialists that use the vegetation analysis determined that modeling from 2013 to 2021 would provide an adequate basis to compare effects. A difference of one year in analysis time periods will not substantially alter conclusions about effects to forest vegetation. Resource specialists have sufficient knowledge of succession dynamics and expertise with interpreting modeling results to be able to draw sound conclusions about the possible effects of the North Shore Restoration Project.

This analysis used the same modeling assumptions as used in the Forest Plan FEIS. The model made assumptions about when older short-lived species such as aspen would succeed to younger forest and what the new forest type would be. The model is described in "Succession Modeling Rules for the Dualplan Harvest Model" (Forest Plan FEIS, Appendix B).

Research has been studying the possible effects to Minnesota forests as a result of a warming climate. Several climate change models were considered for this analysis (Appendix F and the project record contain more information on the models and research used). The models vary in their predictions of how and when the tree and shrub species will be affected. These predictions were considered by the interdisciplinary team when determining the effects of the alternatives.

3.3.4 Affected Environment

Prior to European settlement, the North Shore's forests were primarily composed of long-lived stands containing a mixture of white pine, white cedar, white spruce, balsam fir, paper birch, aspen, sugar maple, yellow birch, black spruce, tamarack, and black ash. The older white pine, cedar, white spruce, sugar maple and yellow birch maintained the upper canopies since they were tall and long lived. Stands were heterogeneous containing multi-stories of trees that provided a lot of structure and contained a diverse range of species.

White pine grew as a component within other stands as individuals or in patches throughout the analysis area. White spruce was prevalent throughout the analysis area similar to white pine. Both of these species were able to grow in a variety of soil and moisture conditions and provided a lot of structure within the different levels of the canopy. The hydrology and soil conditions, particular to the North Shore Till Plain Landtype Association was conducive for cedar habitat along with some of the other wet species such as black ash. It occupied the wetter areas interspersed within the stands or as a forest type. Yellow birch grew in the deeper richer soils as a component within the areas dominated with sugar maple.

In the early part of the last century white pine was heavily logged along the North Shore. Spruce and cedar followed soon after. Slash left over from logging burned the area from

Duluth to the Canadian border in 1910 and again in 1918. This drastically changed the landscape from a majority of long-lived stands to a majority of short-lived stands, particularly in the Mesic Birch-Aspen-Spruce-Fir Landscape Ecosystem. Stands were opened up to plenty of sunlight and the soils were free of competition from other plants. Paper birch and aspen, both a short lived species that do well after a large disturbance, replaced the long-lived conifer stands (History of Lumbering on the Minnesota North Shore).

Many of stands in the Project Area are at the end of their life span. Sixty-four percent of the stands in the North Shore analysis area are 50 years and older and there is only 1% in the young age class as shown in Table 3-Veg-5. Stands should be following succession, the normal stand progression where more shade tolerant species grow underneath the hardwood canopy without a stand replacing disturbance. However, tree regeneration in the understory is not filling in as would be expected.

Several factors are influencing the amount of regeneration. Several droughts, ice storms, infestations of insects such as spruce budworm and forest tent caterpillar have accelerated decline of the hardwood overstory. While many of these events are normal for this ecosystem, they have been occurring more frequently and older trees are less capable of withstanding their negative effects. This has resulted in more openings. Fewer white pine and cedar are available to cast seed and the openings are filling in with bluejoint grass and shrubs such as beaked hazel and mountain maple which choke off young conifer seedlings.

In addition, white pine, birch and especially cedar seedlings are heavily browsed by deer. The North Shore has high deer densities, especially in the winter when many deer migrate to the North Shore from inland forests. White spruce isn't usually affected by deer but in this area, with such a high population, they also are browsed.

There is a large component of plantations of white spruce and to a lesser extent, red pine in the North Shore Project Area. Older plantations of red pine and some white spruce have been thinned. White spruce plantations grow more slowly, are smaller in size and aren't as uniform as red pine plantations. They have had time to increase in size.

3.3.5 Environmental Consequences

Effects common to All Alternatives

Several climate change models predict aspen, paper birch, balsam fir and black spruce, typical of a boreal forest, would decrease in biomass and in suitable habitat in a warmer climate. White spruce, cedar, tamarack and black ash would also decrease but not as dramatically. White and red pine, yellow birch, red and sugar maple and elm all are expected to increase and might fill in behind when the other species die. The models make predictions for trees that run 50 to 100 years.

As the boreal trees are reduced in this area, species more typical of the cold temperate forests (situated generally south of the boreal forest) such as red and bur oak would be expected to expand northward. However, the models that predict a more rapid rate of

warming might not allow enough time for some of the southerly trees to expand into this area before the other species have left. This might affect how much area is occupied by tree species. In addition, trees that are stressed in drought conditions would be more susceptible to pests such as Gypsy Moths, spruce budworm, Emerald Ash borer and forest tent caterpillar and root and stem diseases.

The effects of blister rust, a fungus that attacks white pine, are predicted to be less severe in a drier climate in the North Shore project area. Blister rust has a complicated and narrow humidity window in which to transfer back and forth between the host plant and white pine. In a drier climate and with the expectation that the precipitation would be more episodic could reduce the amount of damage to regenerating white pine

Climate change could compound the impacts to the current suite of species living along the North Shore. A warmer climate and more unpredictable timing of precipitation could result in species being exposed to pressures such as drought, freezing temperatures, windthrow and fire more intensely and at lower predictability rates.

Indicator 1: Within-Stand Diversity

Alternative 1: Direct and Indirect Effects

Under Alternative 1, as stands in the North Shore Project Area age, within-stand diversity would be affected by natural succession and the expansion of nonnative insects. The aspen and birch would die within the older stands. Their upper canopies would continue to open up and provide growing space for other vegetation. The dying hardwoods would contribute to coarse woody debris and snags in the canopy. Grasses such as bluejoint, and shrubs such as beaked hazel and mountain maple would increase in presence by taking advantage of the openings created by the dead trees. This would create more vertical structure within the stands.

Natural regeneration of trees, especially balsam fir, spruce and aspen would come in but not as aggressively as the grasses and shrubs. Pines, birch and cedar would come in very sparsely due to the greater need for light and exposed mineral soil to regenerate. The deer pressure would still be high and many new seedlings would be browsed and die. There would be more variation in the tree ages and where they reside within the canopy. The amount of tree species would be reduced but there would be a more diverse mix of species. More of the aspen and birch stands would succeed to a spruce fir forest type.

The effect of individual species diversity is summarized below.

There would be few disturbances under Alternative 1 that would create favorable conditions for white pine to seed and germinate. White pine requires mineral soil and at least some partial light to successfully regenerate and there are few mature trees remaining to provide for natural regeneration. White pine is very susceptible to blister rust and the North Shore analysis area is considered a high risk area for the presence of this deadly fungus. Smaller disturbances such as wind throw or even when older trees die and fall over could create natural regeneration opportunities. However, the small amount

of white pine that did regenerate would face intense animal browsing pressure. Although white pine is expected to fare well in climate change predictions, because of the heavy deer browse, little regeneration of white pine is expected under Alternative 1.

Paper birch has been declining as it nears the upper limit of its life span. This trend would continue in Alternative 1. Originally the paper birch stands were very homogenous, but as the stands have aged the older trees have been dying and falling over. There has been and would continue to be an increase in brush species and conifer regeneration such as balsam fir and spruce. Without a disturbance such as fire to create light and a mixed humus seed bed paper birch cannot compete with these other species. Paper birch can regenerate through stump sprouting when the mature tree dies but the sprouting viability decreases as the trees age. As with white pine, these trees are also susceptible to animal browsing. There would be an increase in the different types of species as the paper birch dies out but the integrity of the stand would decline since more of the stand would be replaced with grasses, forbs or shrubs instead of trees. Paper birch regeneration would also be hampered by climate change. All stands with either a major or minor component of paper birch would decline in Alternative 2.

White spruce, a long lived conifer, would be expected to increase in Alternative 1. It regenerates naturally underneath a canopy of various light conditions, tolerates a wide variety of soil conditions and requires an average amount of moisture. It has been regenerating under the mature stands along the North Shore although it hasn't been as prevalent as expected. There have been several droughts in the last 15 years and the needles have been infected with diseases such as needle cast and needle rusts. Deer do not typically eat white spruce but in areas of heavy deer population, such as in the North Shore, deer will nip the buds and that has impacted the growth of the seedlings. White spruce requires more moisture and could be affected negatively by climate change. Overall, white spruce would increase the within-stand diversity in Alternative 1.

Aspen, a sun loving short-lived species would continue to decrease as the mature trees died and fell over. If enough light was opened up, root suckering could occur and young aspen would regenerate but at a slower pace. Most conditions wouldn't favor aspen and more shade tolerant species like balsam fir and spruce would fill in. The conditions would encourage more grass and shrubs to fill in also. Leaves of aspen would be consumed by the Gypsy Moth caterpillar, a nonnative invasive species. Reproducing adults and egg masses have been increasing and are being monitored all along the North Shore. Aspen is another species that would be negatively affected by climate change. The result would be less aspen in this Alternative.

There is a large component of white cedar in this analysis area and there is very minimal understory regeneration. It is one of the shade tolerant and long-lived species that would be expected to fill in as the overstory aspen and paper birch die. However, it is a preferred source of food for deer and any natural or artificial regeneration is immediately browsed. This is of particular concern in the North Shore Project Area because most deer populations reside here during the winter. There is disagreement in the research field as

to how white cedar would regenerate in climate change. White cedar would not be expected to increase in Alternative 1.

Yellow birch grows as a component within other forest types such as paper birch and sugar maple. It is limited in abundance because it requires highly productive soils and a moist environment to survive. Harvesting in the last century reduced the amount of mature yellow birch and the remaining older trees are rapidly dying out. It is difficult for birch to regenerate because of the more stringent growing conditions and competition from grasses and other vegetation. It is also heavily browsed by deer. Climate change could have a somewhat positive impact on yellow birch. The amount of yellow birch in the North Shore project area would be expected to decrease in Alternative 1.

The threat of Emerald Ash Borer (discovered in Minnesota in 2009) is expected to kill large amounts of black ash in Minnesota. Ash occupies moist areas such as depressions and swamps. It has a greater presence in the North Shore project area in both upland and lowland forest types. There is a particular concern if the borer kills a large amount of ash because there may not be enough tree species to fill in and the areas would be invaded with more brush and grass. This could negatively affect the water table. Black ash is predicted to decrease in a warming environment but not as dramatically as aspen or paper birch. However, black ash is predicted to decline greatly due to the borer in Alternative 1.

Alternative 1: Cumulative Effects

The effects to within-stand diversity across all ownerships in the project area would be similar to those on National Forest System land. The effects of climate change would also be similar across the other ownerships.

The North Shore boundary generally coincides with the eastern half of the North Shore Forest Collaborative boundary. Members of this collaborative include government agencies, including the Forest Service, public and private organizations and private individuals. Their mission is to restore native trees and associated forest communities. Their emphasis is on planting but could involve other activities such as mechanical site preparation. In addition, the State Parks along the North Shore have been restoring conifers through artificial and/or protection of natural regeneration. Their activities are also small in scale. Private landowners have been planting conifer species on their land and it is expected private landowners would continue to plant a limited amount of trees. These activities would increase the amount of within-stand diversity through planting of a mix of species.

Alternative 2: Direct and Indirect Effects

Alterative 2 would strive to increase the resistance and resiliency of the stands by managing them with multiple species and multi-canopy layers. Planting would occur on 7,567 acres with a mix of white pine, white and black spruce, yellow and paper birch, cedar and tamarack as shown in Table 3-Veg-1. The amount of increase in diversity varies by treatment and unit, ranging from small increases through underplanting a few acres in a riparian corridor with cedar, to regenerating a stand to hardwoods, white pine, and white spruce through mechanical site preparation and planting. Selection cuts would

be planted to a species mix that would compensate for the potential loss of black ash due to Emerald Ash Borer. The same process of succession as described under Alternative 1 would happen in Alternative 2 outside of the treated units.

Table 3-Veg-1: Acres of Species Planted in the North Shore Project Area under Alternative 2[1]

Tree Species	Alt. 1 Acres	Alt. 2 Acres
Black Spruce	0	147
Paper Birch	0	979
Red and Bur Oak[2]	0	250
Tamarack	0	147
Northern White Cedar	0	344
White Pine	0	6,215
White Spruce	0	5,818
Yellow Birch	0	729

[1] Acres are counted more than once since several species can be planted in the same unit.
[2] Red and Bur Oak would be planted on an experimental basis in response to climate change and these numbers are not reflected in any of the document tables.

In Alternative 2 structure would decrease within the clearcut with reserve harvests. In order to maintain structural components in the treated stands, a minimum of 6-12 leave trees per acre would be left (see Appendix D Operational Standards and Guidelines). Standing dead and un-merchantable trees would be left to become future coarse woody debris, snags, and cavity nest trees. Some of the stands would be planted. Treatments other than clearcuts, such as selections and thinnings would not have as much of an effect on the structural diversity because a smaller portion of trees and vegetation would be removed.

Mechanical site preparation and/or slash disposal would vary in its affect to structural diversity. The secondary treatments after a clearcut harvest would remove the majority of the understory trees and shrubs in order to create a seedbed to establish hardwood and conifer regeneration. Primary mechanical site preparation would not remove as much structure as a harvest since the majority of the mature trees would be left. Stands with a thicker overstory would retain more structure because there would be less area for the equipment to operate. Conversely, many stands are being treated with this method because the overstory is so low. These stands would have more understory vegetation removed.

The effect of individual species diversity is summarized below.

White pine would be increased on 6,215 acres after various treatment methods (planting a component of white pine following harvesting, mechanical site preparation, and thinning or underplanting) as shown in Table 3-Veg-1. No white pine would be harvested under Alternative 2. All of these activities would reduce brush and expose mineral soil to

varying levels and would create conditions more favorable to regeneration of white pine. Measures would be taken to protect the planted trees considered most susceptible to animal damage. Forms of protection include single and large tree exclosures, deer repellent and planting larger stock. This would increase the amount of white pine within-stand diversity in this Alternative. Given that white pine is predicted to fare well under climate change, the increase in white pine would improve the resiliency of the forest.

Paper birch would be planted as a component on 979 acres (See Table 3-Veg-1). Seedlings would be protected in the areas considered more susceptible to animal browsing. There would be a limited amount of natural regeneration by seeding or stump sprouting from harvest and mechanical treatments in all stands that had at least some component of paper birch. This would further increase the amount of paper birch within the North Shore project area. The increased regeneration would help to reduce brush or stop the trend of increasing brush in some stands. In the long term, stocking in these stands would increase. The paper birch component in most mature stands not treated would be expected to decrease in this Alternative for the same reasons as in Alternative 1.

Clearcut with reserve harvest and mechanical site preparation treatment on 962 acres would strive to maintain those stands as paper birch forest type through natural regeneration and also planting of paper birch. Other species such as white pine and white spruce would also be planted. These stands regenerated to birch would not be “pure” birch stands such as what was created along the North Shore after intense logging fires, but would have a higher degree of species diversity from the artificial and natural regeneration. Other stands (351 acres) would succeed from a birch forest type to a mixed aspen or spruce forest type after treatment (See Table 3-Veg-2).

White spruce would increase the amount of within-stand diversity in Alternative 2 to a greater extent than in Alternative 1. Along with its ability to regenerate naturally, 5,818 acres would be planted to a species mix that would include white spruce (See Table 3-Veg-1).

There would be 3,190 acres of thinning in Alternative 2 of which 2,467, 77% would be in white spruce plantations. These stands vary in the amount of other species currently growing within them, but in general, they are more homogenous. Thinning strips and landings created from the harvest operation would create places that other species could invade and improve within-stand diversity. An additional 80 acres of variable thinning would create even larger openings to further encourage species such as aspen, yellow birch and cedar.

The amount of aspen would continue to decrease in Alternative 2 similarly as in Alternative 1 for the untreated stands. Planting would occur on 2,464 of aspen forest type to a mixture of white pine, white spruce, paper birch and yellow birch after primary treatments including clearcut with reserves, mechanical site preparation and underplanting. This would help to increase within-stand diversity in Alternative 2. Additionally, 544 acres would be treated primarily with a clearcut with reserves harvest and regenerated naturally to primarily an aspen forest type. Although these stands would

fill in with natural regeneration of different hardwood and conifer species, the amount of within stand diversity would be small. This would be particularly evident in aspen stands regenerating back to pure aspen.

White cedar faces an uphill battle in regards to regenerating in the North Shore Project Area, as described under Alternative 1 above. Alternative 2 strives to boost the amount of white cedar in stands. There would be 344 acres of variable thinning, selection cut, hand shearing, underburning and large exclosures that would be planted to cedar (See Table-3-Veg1). Since white cedar is so desirable to deer, single tree exclosures or hard tubes would be used to protect the seedlings. The amount of white cedar within stands would increase in Alternative 2.

Yellow birch would be planted on 729 acres (Table 3-Veg-1) using or following primary treatments ranging from underplanting to clearcuting with reserves, increasing the component of this species. Measures similar to those with white pine would be taken to protect the planted trees considered most susceptible to animal damage. The amount of yellow birch within stands would be increased in treated stands in Alternative 2. The amount of yellow birch would continue to decrease in Alternative 2 similarly as in Alternative 1 for the untreated stands.

Alternative 2 would treat 147 acres of black ash with a selection harvest. A small portion of the black ash trees would be removed. These areas would be planted to a mix of species that can grow in wet conditions and would not be infected by the Emerald Ash Borer such as yellow birch, tamarack and black spruce. The expectation is that these areas would serve as a buffer to a borer invasion and maintain a forested stand verses converting to brush and grass. As with Alternative 1, the amount of black ash is predicted to have a great decline due to the Emerald Ash Borer in Alternative 2.

Alternative 2: Cumulative Effects

The effects to within-stand diversity across all ownerships in the project area would be similar to those on National Forest System land. The effects of climate change would also be similar across the other ownerships. Potential future harvests on other agency land would simplify some of the structure and species diversity within the proposed stands, however, this affected area would be small (See Appendix F). There would be a limited amount of planting of conifer species on private land.

As discussed under the cumulative effects section under Alternative 1 for within-stand diversity, members of the North Shore Forest Collaborative and the State Parks would plant and/or protect conifers. These activities in addition to those in the North Shore project area would increase the amount of within-stand diversity through planting of a mix of species.

Indicator 2: Composition

Alternative 1 and 2: Direct and Indirect Effects

Table 3-Veg-2 shows the forest type conversions by acres for each alternative in the

North Shore Project Area. While Alternative 2 proposes increasing species diversity on thousands of acres through planting/underplanting, the density of planting that would occur would only be large enough on less than 500 acres to change the forest type; most of the actions/treatments to increase species diversity would not result in a change in forest type.

Table 3-Veg-2: Forest Type Conversion due to Proposed Management Activities.

Existing Forest Type	Resulting Forest Type	Acres	
		Alt. 1	Alt. 2
Aspen/White Spruce/Balsam Fir	White Spruce/Balsam Fir/Aspen	0	76
Balsam Fir/Aspen/Birch	White Spruce/Balsam Fir/Aspen	0	5
Paper Birch	White Pine	0	28
	Aspen/White Spruce/Balsam Fir	0	22
	White Spruce/Balsam Fir/Aspen	0	287
Quaking Aspen	White Spruce/Balsam Fir/Aspen	0	41
	Total	**0**	**459**

Table 3-Veg-3 displays how many acres of each forest type would be present under each of the alternatives in the Mesic Birch-Aspen-Spruce Landscape Ecosystem in the North Shore Project Area in the year 2021. In addition to changes created by the alternatives, it takes into account the likely changes to the composition that would occur naturally, through succession during the next nine years. Under the no action alternative, the amount of paper birch and aspen forest types would decrease because the stands would age and succeed to spruce-fir. Proposed actions in Alternative 2 would increase the amount of spruce-fir and white pine forest types.

Table 3-Veg-3: Comparison of Forest Type Acres within the Mesic Birch-Aspen-Spruce-Fir Landscape Ecosystem in the North Shore Project Area.

Forest Type	Existing Condition 2013	Alternative 1 2021	Alternative 2 2021
Jack pine	91	91	91
Red pine	623	623	623
Northern Hardwoods	5,386	5,386	5,386
Spruce-Fir	7,244	7,953	8,255
Aspen	9,077	8,534	8,515
Paper birch	6,189	6,023	5,712
White Pine	0	0	28
Total[1]	**28,610**	**28,610**	**28,610**

Data Source: Oct. 2013 Forest-wide Vegetation Analyses, Formated_Tables_Analysis_Runs, Project File. [1]Totals do not match age class tables because misclassified lowlands were removed from the calculations.

Alternative 1 and 2: Cumulative Effects

<u>All Ownership in the North Shore Project Area:</u> Harvested State lands could be expected to regenerate to aspen types along with some planting and seeding of conifers. The State also has a policy to promote and regenerate white pine. At this time, it is unknown if the State plans to convert stands to white pine. There are no expected composition changes

on private lands in the North Shore Project Area as a result of forest management actions. Cumulatively, little change in composition is expected across all ownerships in the project area.

Forest-wide Landscape Ecosystem: The composition of the landscape ecosystems forest-wide is the same for both alternatives. See Table 3-Veg-4 for further details. Even though Alternative 2 changes the forest type (composition) of some units, the overall change is relatively small (459 acres) and is not noticeable at the landscape scale. The increase in spruce-fir forest type and decrease in aspen forest type would be a result of succession.

Table 3-Veg-4: Forest-wide Vegetation Composition for the Mesic Birch-Aspen-Spruce-Fir Landscape Ecosystem.

Upland Forest Type	Decade 2 Objectives 2014	Existing Condition 2013	Alternative 1 2021	Alternative 2 2021
	%	%	%	%
Jack pine	4	3	3	3
Red pine	5	5	5	5
White pine	4	3	3	3
Spruce-Fir	26	25	29	29
Oak	0	0	0	0
Northern hardwoods	4	5	5	5
Aspen	42	45	41	41
Paper birch	14	14	13	13
Total [1]	**100**	**100**	**100**	**100**

Data Source: Oct. 2013 Forest-wide Vegetation Analyses, Formated_Tables_Analysis_Runs, Project File and Forest Plan.

Indicator 3: Age Class

Alternative 1 and 2: Direct and Indirect Effects

Table 3-Veg-5 displays what the age class distribution would be under each of the alternatives in the Mesic Birch-Aspen-Spruce-Fir Landscape Ecosystem in the North Shore Project Area (2021). In addition to changes created by alternatives, it takes into account past actions and changes to the age class distribution that would likely occur naturally through succession. Alternative 1 would not create young age class in either landscape ecosystem in the project area. Alternative 2 would create 1,372 acres of young age class in the MBA LE.

In addition to harvesting, there would be 14.7 miles of temporary road created in Alternative 2. The forest condition would be considered open while the roads were being used. It is expected that within ten years after the end of road use, the area would be re-vegetated and moving towards a forested condition.

Table 3-Veg-5: Age Class Distribution of the Mesic Birch-Aspen-Spruce-Fir Landscape Ecosystem in the North Shore Project Area.

Age Class	Existing Condition 2013		Alternative 1 2021		Alternative 2 2021	
	Acres	%	Acres	%	Acres	%
0-9	146	1	0	0	1,372	5
10-49	10,370	35	8,565	30	8,555	29
50-79	6,300	22	4,942	17	4,752	16
80-99	8,069	28	10,017	34	8,966	31
100+	4,240	14	5,601	19	5,479	19
Total	**29,125**	**100**	**29,125**	**100**	**29,125**	**100**

Data Source: Oct. 2013 Forest-wide Vegetation Analyses, Formated_Tables_Analysis_Runs, Project File.

Alternative 1 and 2 Cumulative Effects

All Ownership in North Shore Project Area: This section of the cumulative effects analysis considered vegetation management projects on federal, State, and private lands within the project area. The analysis considered any vegetation management projects from the past, present and into the future that have or would create young forest.

The Minnesota (MN) Department of Natural Resources (DNR) is currently proposing stand examinations and harvest needs on 258 acres in the North Shore Project Area (Appendix F). Of the possible State harvesting, 160 acres are planned for general harvest and roughly 98 acres require a field visit to determine a prescription or are not specified. These 258 acres were analyzed in this project as a harvest to create young age class and constitute a little over 1 percent of the state land in the project area. This estimate is based on areas proposed for survey and not for actual treatment; therefore, the actual harvest acres would likely be much lower.

There are no known plans for harvesting on private lands (Appendix F). Besides the North Shore Project, there are no other reasonable foreseeable projects on National Forest System land that would create young age class by 2021. Looking at activities on all ownerships in the project area, Alternative 2 would create more young age class than Alternative 1. Creation of young age class would move towards Forest Plan Objectives.

Forest-wide Landscape Ecosystem: This section of the cumulative effects analysis considered vegetation management projects on National Forest System land in the Mesic Birch-Aspen-Spruce-Fir Landscape Ecosystem across the Superior National Forest. The analysis included any vegetation management projects across the Forest from the past, present and into the foreseeable future that have or would change the age class of forest vegetation. Appendix F lists which projects were included in the analysis. Table 3-Veg-6 shows that Alternative 2, relative to Alternative 1, moves the forest closer to Forest Plan objectives for decade two.

Table 3-Veg-6: Forest-wide Age Class Distribution for the Mesic Birch-Aspen-Spruce-Fir Landscape Ecosystem.

Age Class	Decade 2 Objectives 2014	Existing Condition 2013	Alternative1 2021	Alternative 2 2021
	%	%	%	%
0-9	11	3	3	4
10-49	48	38	41	40
50-99	10	19	13	13
80-99	17	27	26	26
100+	14	13	17	17
Total	**100**	**100**	**100**	**100**

Data Source: Oct. 2013 Forest-wide Vegetation Analyses, Formated_Tables_Analysis_Runs, Project File and Forest Plan.

3.4 Threatened and Endangered Species

3.4.1 Introduction

Resource management projects that may affect federally listed threatened and endangered species or species proposed for listing are assessed in a biological assessment (BA). The North Shore Project Biological Assessment documents the potential effects on Canada lynx (listed as threatened) and its critical habitat and the northern long-eared bat (proposed as endangered).

The North Shore Project Biological Assessment tiers to the Programmatic Biological Assessments (USFS 2004, USFS 2011) for the revision of the Forest Plan (FP, pp. 83-193) and provides more specific information on site-specific effects of the project to proposed, threatened, and endangered species. Rather than repeat the information from the biological assessment, this section summarizes the key findings and determinations and incorporates by reference the North Shore Project Biological Assessment which is available in the project record or on the Superior National Forest website at www.fs.usda.gov/goto/superior/projects under the North Shore EA name.

The determinations of effects in the North Shore Biological Assessment were based on consideration of direct, indirect, and cumulative effects of the proposed activities. The effects of the alternatives were compared using quantitative indicators and other relevant scientific information. The key sources for species information include those developed for the Forest Plan (Forest Plan FEIS, vol. 1, Section 3.3.4; vol. 2, p. B-29), Forest Plan Biological Assessments (USDA 2004, USDA 2011), and new relevant information collected for this project and documented for each species in the North Shore Project Biological Assessment.

The determination of effects is used in conference and consultation with the U.S. Fish and Wildlife Service to help them determine whether or not a proposed action is likely to affect or jeopardize the continued existence of a listed species. The following definitions are used to make a conclusion on the effects of a project to proposed, threatened, and endangered species and critical habitat:

Threatened and Endangered Species

- **No Effect**
- **May affect but not likely to adversely affect** – used when it is determined that direct or indirect effects on listed species from the proposed alternatives are expected to be discountable, insignificant, or completely beneficial.
- **May affect and is likely to adversely affect** – used if any adverse effect to listed species may occur as a direct or indirect result of the proposed alternatives and the effect is not discountable, insignificant or beneficial, or the effect will harm, harass or wound the species.

Critical Habitat

- **May affect but not likely to adversely modify critical habitat -** used when it is determined a direct or indirect alteration appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical.

Proposed Listed Species

- **Is likely to jeopardize proposed species** – the appropriate conclusion when the proposed action is likely to jeopardize the proposed species. The definition of jeopardy is to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species.

3.4.2 Determination of Effects for Canada Lynx

Lynx and lynx tracks have been observed in the North Shore Project Area since 2000. Hair or scat samples have been collected for use in an ongoing lynx DNA analysis. The North Shore Project Area is large enough to support a resident breeding population of lynx but because of its linear shape and habitat warm winter conditions would only support lynx also occupying adjacent inland habitat. Lynx presence is assumed throughout the project area and their habitat needs were considered when planning the management activities.

The North Shore Project Area is within Lynx Analysis Units 29, 34, 37, 38, and Critical Habitat Areas 1 and 2. Table 3-TE-1 shows the total acreage of each lynx analysis unit. The definition of lynx analysis unit (LAU) can be found in the Forest Plan in Appendix E: Canada Lynx, 5 Scales of Analysis (FP, p. E-4). Critical Habitat Areas (CHA) are areas within the Superior National Forest that are outside LAUs but within designated lynx critical habitat.

Table 3-TE-1: Lynx Analysis Units (LAU) and Critical Habitat Areas (CHA) in the North Shore Project Area.

LAU/CHA	Gross Acres*	Acres within the Project Area**
LAU 29	31,541	606
LAU 34	17,748	1,478
LAU 37	25,734	1,635
LAU 38	37,638	3,040
CHA 1	7,761	3,752
CHA 2	32,670	30,539

Data Source: *2010 Forest-wide Biological Assessment revision, lake acreage removed, **2012 Forest LAU geodatabase (LAU.gdb)

Alternative 1 – No Action

This alternative will have *no effect on lynx and will not modify critical habitat*. Alternative 1 would comply with all applicable Forest Plan management direction related to Canada lynx and its habitat. There will be no cumulative effects because there are no direct effects. No effects are expected under Alternative 1 for the following reasons:

- **Foraging habitat:** Under this alternative, there would be no conifer planting to increase within stand structure and diversity; however, older stands would continue to provide a young fir and spruce component for hares. Between 45-58 percent of each LAU would provide forest conditions for snowshoe hare in 2021.
- **Denning habitat:** Denning habitat is not a limiting factor. Between 42 and 78 percent of the forest in the project area would be old enough to provide den site components such as large downed trees and dense cover. Lynx on the Superior National Forest would also use younger stands for denning if thick vertical cover provides den site concealment.
- **Roads and Trails:** The road and trail densities in Alternative 1 would range from 0.5 mile per square mile to 2.8 miles per square mile. These densities would remain the same since no road decommissioning would occur. There would be no temporary roads built under Alternative 1 – No Action.
- **Connectivity habitat:** The amount of lynx habitat ranges from 87 to 96 percent in 2013. The 2011 Programmatic Biological Assessment indicates that connectivity is not a factor at the LAU and Forest-wide levels due to new scientific information.
- **Other indicators:** Most of the ownership is National Forest System land where foraging, denning and matrix habitats are well-distributed. Less than six percent of existing lynx habitat on all ownerships within the four lynx analysis units is currently unsuitable.

Alternative 2 – Proposed Action

This alternative *may affect but is not likely to adversely affect lynx and it is not likely to adversely modify critical habitat*. Alternative 2 would comply with all applicable Forest Plan management direction related to Canada lynx and its habitat except for road density. Forest conditions would continue to provide for lynx denning, foraging, and movement across the analysis area. Effects of Alternative 2 are expected to be insignificant or discountable for the following reasons:

- **Foraging habitat:** Between 45 and 58 percent of each LAU or CHA would provide forest conditions for snowshoe hare in 2021. Older stands would continue to provide a young fir and spruce component for hares. Conifer planting on up to 6,500 acres would improve within stand diversity and cover for snowshoe hares.
- **Denning habitat:** Denning habitat is not a limiting factor. Between 42 and 78 percent of the forest would be old enough to provide den site components such as large downed trees and dense cover in patches larger than 5 acres. This measure is higher than the 10 percent guideline in the Forest Plan. Lynx on the Superior National Forest would also use younger stands for denning if thick vertical cover provides den site concealment.
- **Roads and Trails:** The road and trail densities in Alternative 2 would remain the same as in 2013 at a range of 0.5 mile per square mile to 2.8 miles per square

mile. A review of road needs was completed for the project and all Forest Service roads were determined to be needed to provide access to federal, state, county, or private lands. Roads in the project area provide access to many private homes and land along the North Shore corridor. One mile of unauthorized road would be decommissioned but this is too small a decrease to show up in the current figures. This alternative has 14.7 miles of temporary roads proposed. Temporary roads are expected to have an insignificant and short-term effect on lynx. All temporary roads needed to access harvest units would be obliterated and allowed to return to a more natural state once reforestation objectives have been met.

- **Connectivity habitat:** The amount of lynx habitat would be range from 94 to 100 percent in 2021. Proximity between denning and foraging habitat would be maintained. The 2011 Programmatic Biological Assessment indicates that connectivity is not a factor at the LAU and Forest-wide levels.
- **Other indicators:** Foraging, denning, and matrix habitats are well-distributed. Less than six percent of existing lynx habitat on all ownerships in the LAUs is currently unsuitable. The amount of habitat on federal lands should offset any short-term loss in habitat on non-federal lands.

3.4.3 Determination of Effects for Northern Long-eared Bat

This species was proposed for listing as endangered in late September 2013. Critical habitat has not been defined at this time. Analysis indicators for northern long-eared bat have not been defined by the Fish and Wildlife Service or the Forest Service. The best indicators considered for use at this time, after discussion with the Fish and Wildlife Service and Superior National Forest biologists, are the amount of mature upland forest and protection of known summer roosts and known hibernacula. The amount of upland mature forest needed to provide adequate summer habitat has not been defined and is discussed here as changes from current conditions.

Alternative 1 – No Action

This alternative will have *no effect* on northern long-eared bat because no activities will take place. There are no known summer roosts or hibernacula in the project area and therefore no effects to them. The amount of upland mature forested habitat will change from the existing condition of 27.9 percent in 2013 to 38.4 percent in 2021. There will be no cumulative effects because there are no direct effects. Current levels of snags are high because of the age of the existing forest and a reduction in existing snags may occur over time as snags decay.

Alternative 2 – Proposed Action

The effects of the North Shore Restoration Project *are likely to adversely affect individuals and summer roosting habitat within the project area, but not likely to result in jeopardy* to the northern long-eared bat. Critical habitat has not been defined at this time.

The amount of upland mature forested habitat will change from the existing condition of 27.9 percent in 2013 to 34.4 percent in 2021 and continue to provide summer roosting and foraging habitat. Based on the analyses for this project, the forest-wide trend for large

patches in Spatial Zone 2 is consistent with objectives, standards and guidelines from the Forest Plan and would provide well distributed, closed-canopy forest conditions containing small wetlands and creeks for foraging habitat. Loss of suitable summer habitat alone is not likely to have significant population-level effects.

Summer roosting locations found during project activities would be protected by project mitigations that would reduce adverse effects to individuals. However, all locations of summer roost sites would not be known and as a result an unknown number may be destroyed by clear-cutting, mechanical site preparation, and debris piling and burning during the breeding season. Activities taking place during the breeding period, generally April through October, may remove summer roost sites and result in the loss of individuals. In clear-cutting, piling and burning, and mechanical site preparation areas guidelines for large tree and snag retention may provide and/or protect summer roosting habitat.

3.5 Regional Forester's Sensitive Species

3.5.1 Introduction

Regional Forester's Sensitive Species (RFSS) are species for which population viability is a concern due to one or a combination of several factors: habitat and species rarity or poor distribution; a declining trend in population; risk to habitat integrity; and population vulnerability.

The Biological Evaluation is the tool used to consider the effects of a project on RFSS. The determinations in a biological evaluation address the question of how alternatives affect species viability at the local level, and resulting implications for species viability and distribution throughout the range. The analysis of effects results in one of the following determinations:

- **No impact**
- **Beneficial effects** – used when proposed alternative is determined to be wholly beneficial without potential negative impacts.
- **May impact individuals but is not likely to cause a trend to federal listing or loss of viability** – used when it is determined the proposed alternative may cause some negative effects, even if overall effect to species may be beneficial
- **High risk of loss of viability** in the planning area (National Forest), but not likely to cause a trend toward federal listing. Or, likely to result in a loss of viability and a trend toward federal listing.

The effects of the North Shore Restoration Project alternatives to Regional Forester Sensitive Species are documented in three biological evaluations: 1) terrestrial animals, 2) aquatic species, and 3) plants. The North Shore Restoration Project Biological Evaluations are available on the Superior National Forest website at www.fs.usda.gov/goto/superior/projects under the North Shore Project EA and in the project record.

3.5.2 Determination of Effects Summary for other Terrestrial Animals

Alternative 1 would result in the least amount of disturbance to Regional Forester's Sensitive Species (RFSS) and generally results in a finding of *no impact*.

For Alternative 2, the proposed activities would have no impact on olive-sided flycatcher, Freija's grizzled skipper, Taiga alpine butterfly, Nabokov's blue butterfly or wood turtle. For Alternative 2, the proposed activities may impact individuals but are not likely to cause a trend to federal listing or loss of viability for gray wolf, little brown myotis, tri-colored bay, heather vole, bald eagle, northern goshawk, bay-breasted warbler, Connecticut warbler, American three-toed woodpecker, great gray owl, or boreal owl.

3.5.3 Determination of Effects Summary for Aquatic Animals

Alternative 1 proposes no activities and no disturbance to the existing vegetation and the lake and stream habitat. In general, this alternative would result in *no impact* to the aquatic Regional Forester Sensitive Species (RFSS) animals, including: lake sturgeon, shortjaw cisco, nipigon cisco, northern brook lamprey, creek heelsplitter and black

sandshell mussels, Quebec emerald dragonfly, ebony boghaunter dragonfly and headwaters chilostigman caddisfly.

Alternative 2 would have no impact on the lake sturgeon, nipigon cisco, creek heelsplitter and black sandshell mussels since there are no known occurrences within the project area. Alternative 2 may impact individuals or its habitat of shortjaw cisco, northern brook lamprey, Quebec emerald dragonfly, ebony boghaunter dragonfly and headwaters chilostigman caddisfly; but is not likely to cause a trend to federal listing or loss of their viability.

3.5.4 Determination of Effects Summary for Plants

Alternative 1 would have no direct, indirect, or cumulative effects to moschatel, long-leaved arnica, swamp beggar-ticks, goblin fern, floating marsh marigold, fairy slipper, New England sedge, ram's head lady's slipper, maidenhair spleenwort, triangle grapefern, linear leaved sundew, neat spike-rush, Appalachian fir club moss, moor rush, large-leaved sandwort, auricled twayblade, fall dropseed muhly, dwarf waterlily, Canada rice grass, Chilean sweet cicely, Braun's holly fern, Oakes pondweed, small shinleaf, cloudberry, nodding saxifrage, encrusted saxifrage, Canada yew, false-asphodel, lance-leaved violet, barren strawberry, smooth woodsia, *Arctoparmelia centrifuga*, *Arctoparmelia subcentrifuga*, *Caloplaca parvula*, *Cetraria aurescens*, *Cladonia wainoi*, *Frullania selwyniana*, *Menegazzia terebrata*, *Peltigera venosa*, *Ramalina thrausta*, *Sticta fuliginosa*, *Usnea longissima* or *Pseudocyphellaria crocata*.

The proposed activities in Alternatives 1 and 2, may impact individuals of common moonwort, Michigan moonwort, pale moonwort, ternate grapefern, least moonwort and Douglas's hawthorn, but are not likely to cause a trend to federal listing or loss of viability.

The proposed activities in Alternative 2 may impact individuals of swamp beggar-ticks, floating marsh-marigold, linear-leaved sundew, neat spike rush, moor rush, auricled twayblade, fall dropseed muhly, dwarf waterlily, Oakes' pondweed, false-asphodel, lance-leaved violet, long-leaved arnica, maidenhair spleenwort, Appalachian fir club moss, large-leaved sandwort, nodding saxifrage, encrusted saxifrage, smooth woodsia, *Arctoparmelia centrifuga*, *Arctoparmelia subcentrifuga*, *Cladonia wainoi*, small shinleaf, cloudberry, fairy slipper, ram's head lady's slipper, *Caloplaca parvula*, *Cetraria aurescens*, *Frullania selwyniana*, *Menegazzia terebrata*, *Ramalina thrausta*, *Sticta fuliginosa*, *Usnea longissima*, *Pseudocyphellaria crocata*, moschatel, triangle grapefern, goblin fern, New England sedge, Chilean sweet cicely, Braun's holly fern, Canada yew, barren strawberry, Canada rice grass, or *Peltigera venosa* but are not likely to cause a trend to federal listing or loss of viability.

3.6 Soil Productivity and Wetlands

3.6.1 Introduction

This section addresses concerns that proposed management activities may impact soil quality and productivity through erosion, compaction, displacement and nutrient drain. An analysis of these impacts for implementing the Forest Plan was also performed in Chapter 3.6 of the *Chippewa and Superior National Forests Forest Plan Revision Final Environmental Impact Statement, Volume I* (USDA Forest Service 2004). Appendix D of the North Shore EIS summarizes the Forest Plan Standards and Guidelines (referred to in this document as Operational Standards and Guidelines) for resources, including soils, which would be used for implementation. Forest Plan standards and guidelines for the soil resource comply with Region 9 Soil Quality Standards (USDA Forest Service 2012). Additionally, Appendix D incorporates the Best Management Practices (BMPs) referenced in this document.

3.6.2 Indicators

Indicator 1: Acres affected by mechanical treatment.
The first indicator for the soil resource is acres proposed for mechanical treatment and associated temporary roads, skid trails and landings. This indicator analyzes the differences between alternatives related to the potential influence mechanical treatments have on erosion, compaction, and displacement.

Indicator 2: Miles of system road being added or removed.
The second indicator for the soil resource is miles of road being added to the system and miles of road being decommissioned. This indicator examines the difference in the amount of road that would be used for vegetation management and the potential impacts from erosion, compaction and displacement. In addition, this indicator examines the difference in the amount of road being decommissioned and as a result the amount of land being returned to a productive status.

Indicator 3: Acres of slash disposal, site preparation, biomass harvest and prescribed burning on nutrient sensitive ELTs.
The third indicator for the soil resource is proposed acres of slash disposal, site preparation, biomass harvest and prescribed burning on ELTs 11, 16, 17 and 18.This indicator highlights the differences between alternatives related to the effect these particular treatments have on potential nutrient drain on nutrient sensitive sites.

Indicator 4: Acres of wetland within proposed mechanical treatment.
The forth indicator is acres proposed mechanical treatment on ELTs 2, 4 and 6.This indicator highlights the differences between alternatives related to the potential effects of mechanical operations to wetlands.

3.6.3 Analysis Parameters

The Analysis Area used to examine the direct, indirect and cumulative effects of each alternative includes the mapped soil units (ecological landtypes: ELTs) on National Forest System land within the North Shore Project Area where management activities are proposed. Ecological landtypes are mapped soil units whose natural boundaries best define site-specific soil resource information for the Superior National Forest. Potential effects to the soil resource are logically confined to the soil directly beneath where the activity takes place. An example would be a piece of heavy equipment causing soil compaction that reduces pore space for air, water and roots within a section of a treatment area does not impact pore space on adjacent areas.

The time period used for analyzing the direct and indirect effects of the proposed activities is fifteen years. The time period for cumulative effects is fifteen years prior to and after proposed management activities. This time frame was selected because the effects of the management actions would diminish over time and would not be measurable fifteen years from the time the management activity has occurred.

3.6.4 Affected Environment

The classification system used for the North Shore Project is discussed in the *National Hierarchical Framework of Ecological Units* by Cleland and others (1997). This system classifies and maps ecological units based on associations of climate, topography, soils, water, and potential natural communities. An overview of the Ecological Classification System for ecological units is useful to understand the soils information presented in this document, including design criteria.

Within this hierarchical system, mapping units range from provinces that are thousands of square miles in size, to landtype associations (LTAs) that are broad geographic areas, to ecological landtypes (ELTs) which are more site-specific. The province is the largest unit representing the climate zones of North America. The Superior National Forest falls into the Laurentian Mixed Forest Province (212) with short, warm summers and long, cold winters. Accordingly, within the province there are increasingly smaller ecological units called sections, subsections, landtype associations, and ecological landtypes.

The North Shore Project Area is located in the Northern Superior Uplands Section (212L), the Border Lakes (212La) and North Shore Highlands (212Lb) Subsections, and the Swamp River Till Plain (212La11), North Shore Till Plain (212Lb02), Honeymoon Mountain Till Plain (212Lb08), Tettegouche Till Plain (212Lb10) and Sawtooth Mountain Bedrock Complex (212Lb11) LTAs. Often treatment units contain multiple ELTs. Lists of all the ELTs and acreage for each treatment unit are located in the project record. More detailed information concerning project area LTAs and ELTs can be found in the project record.

Table 3-Soil-1 displays how many acres of all the North Shore Project Area lies in ELTs which are classified as wetlands and Table 3-Soil-2 displays the other ELTs in the project area.

Table 3-Soil-1: Wetland ELT acres within the North Shore Project Area.

ELT	Description	Acres
ELT 2	Poorly drained loamy soil	980
ELT 4	Poorly drained clay loam, silty clay and clay soils	3,832
ELT 6	Poorly drained organic soil	1,528
	Total:	6,340

Table 3-Soil-2: Transitional and upland ELT acres within the North Shore Project Area.

ELT	Description	Acres
ELT 1	Somewhat poorly drained loamy soil	1,275
ELT 3	Somewhat poorly drained silty clay loam and clay soils	1,572
ELT 10	Moderately well-drained silty clay loam and clay soils	16,732
ELT 11	Well-drained sandy loam and loamy sand soil with gravely subsurface and thin surface organic layer	2,894
ELT 12	Poor to well-drained, bouldery, loamy soil	14
ELT 13	Well-drained sandy loam and loamy sand soil with gravelly subsurface	187
ELT 14	Moderately well-drained, sandy loam to silt loam soils	9,586
ELT 15	Well-drained to moderately well-drained loam, clay loam and silt loam soils	11,825
ELT 16	Well-drained sandy loam or loam soils	8,029
ELT 17	Well-drained sandy loam soils	5,626
ELT 18	Droughty loam and sandy loam soils	1,636
	Total:	59,376

3.6.5 Environmental Consequences

Alternative 1 (No Action)
Direct, Indirect and Cumulative Effects

Alternative 1 (No Action) would result in no future vegetation management activities associated with the North Shore Project and no impacts from those treatments. No new roads would be constructed and no existing roads would be decommissioned. As a result, these roads would remain open for motor vehicle traffic in their current condition. Existing resource damage, such as erosion and rutting, would persist.

Additional damage from continued use could also occur. This damage would potentially result in sediment delivery to adjacent waterways and wetlands. Consequently, overall soil quality would decline in the impacted area resulting in a diminished capacity to support vegetation and function for watershed health. Areas of road that would not be decommissioned under the No Action Alternative would remain unproductive.

Alternative 2
Direct and Indirect Effects

Indicator 1: Acres affected by mechanical treatment.
Alternative 2 would result in future vegetation management activities. By following Operational Standards and Guidelines described in Appendix D, these treatments would result in minimal impacts to the soil.

To determine overall impacts to soil quality, the amount and area impacted and the degree of impact was analyzed. Table 3-Soil-4 shows the acres of harvest and the acres of mechanical site preparation or mechanical site preparation and prescribed fire.

Table 3-Soil-3: Acres of Harvest and Site Preparation.

Treatment Type	Alternative 1	Alternative 2
Harvest[1]	0	4,547
Site Preparation[2]	0	1,508

[1]Acres shown are stand acres. Actual treated acres would be less than the acres shown to account for legacy patches, reserve islands, and other resource protection measures.
[2]Acres of site preparation could include mechanical treatments or mechanical treatments and prescribed fire treatments for the purpose of site preparation.

Much of the impact to the soil within harvest areas, including mechanical site preparation, is associated with landings and primary skid trails. Landing and primary skid trail impacts to soil include soil compaction and, as a result of compaction, reduced water infiltration and an increased potential for erosion. Additionally, soil compaction resulting from vehicle and skidder traffic usually results in reduced vegetation growth and regeneration. Units scheduled for summer harvest would have the greatest potential for compaction. Frost action and floral and faunal activity tend to reduce compaction within three to eleven years after activity (Mace 1971; Thorud and Frissell 1976; Zenner et. al 2007; Puettmann et. al. 2008). The estimated amount of area impacted by landings and skid trails are shown in Table 3-Soil-4.

Table 3-Soil-4: Acres impacted by Landings and Skid Trails.

	Alternative 1	Alternative 2
Landings[1]	0	45
Skid Trails[2]	0	147

[1]Landings calculation assumed 1% of harvested area would be utilized (See Forest Plan)
[2]Skid trail calculations assumed 3% of harvested area would be utilized. Figures obtained by averaging actual monitoring data on the Superior National Forest.

Management activities could also include biomass utilization. Biomass utilization would be allowed on those soils listed in Table G-WS-8 of the Forest Plan (FP p. 2-16) as being acceptable areas for “Whole tree Logging.” Those soils are considered to have a high nutrient capacity, because of their soil characteristics, and therefore would not likely be susceptible to detrimental nutrient loss as a result of biomass harvest. Additional areas analyzed for slash removal but not included in those ELTs acceptable for “Whole tree Logging” may also include biomass utilization. The analysis of the associated impacts is included in the Indicator 3 discussion.

Nutrient removal associated with harvest activity and biomass utilization is a potential impact to site productivity. Results of the five-year analysis of treatment areas in the long-term site productivity study on the Marcell Experimental Forest, in northern Minnesota indicated that total tree harvest had no impact on site productivity. Aspen stands where total tree harvest occurred within the study area produced 40,400 suckers per hectare. This is well within the typical range of 25,000 to 50,000 per hectare (Stone and Eiloff 1998). Impacts to site productivity associated with harvest activity in the North Shore Project Area are expected to be minimal.

Impacts of temporary road construction include compaction and displacement of soil and potential sediment delivery to nearby wetlands and waterways. However, the impacts would be minimized by using existing corridors where possible. Impacts would also be greatly reduced through the use of Best Management Practices along with Forest Plan standards and guidelines (S-TS-3, G-TS-13). Most of these impacts would be short-term (less than fifteen years). Once treatment activities were completed the road would be rehabilitated and revegetated.

Indicator 2: Miles of system road being added or removed.
Some existing National Forest System roads within the North Shore Project Area are not needed for management activities. These roads would be decommissioned under Alternative 2. The road decommissioning would allow for that land to be returned to a productive status. No system roads would be constructed to facilitate resource management within the North Shore Project Area. The amount of road that would be decommissioned through the implementation of each alternative is shown in Table 3.6.Soil-5.

Table 3-Soil-5: Miles and Acres of Road removed from the National Forest Road System.

	Alternative 1		Alternative 2	
	Miles	Acres	Miles	Acres[1]
Roads being decommissioned.	0	0	1.0	2.4

[1]Acreage calculated using a 20 foot road width

Indicator 3: Acres of mechanical site preparation and slash disposal on low nutrient ELTs
Alternative 2 would include 585 acres of mechanical site preparation and/or slash disposal, which could include prescribed burning or biomass utilization, on low nutrient ELTs (ELTs 11, 16, 17, and 18). Those ELTs impacted by Table 3-Soil-6.

Short term reductions in soil nutrients are possible in those areas where mechanical site preparation and/or slash disposal would occur, which in the short term could reduce vegetative growth. This reduction of soil nutrients would occur infrequently, every 60-100 years depending on the rotation age, and therefore would have a minimal impact (Grigal 2004). Over time nutrients are replaced from the atmosphere, parent materials from below, and to a lesser extent from the regenerating stand.

Table 3-Soil-6: Acres of Nutrient Low ELTs (11, 16, 17, and 18) with Mechanical Site Preparation and/or Slash Disposal within the North Shore Project Area.

	Alternative 1	Alternative 2
ELT 11	0	100
ELT 16	0	275
ELT 17	0	175
ELT 18	0	35
Total	**0**	**585**

Mechanical site preparation and slash disposal would not occur across entire treatment units; therefore all of the vegetation would not be removed from the site. Additionally only a portion of the slash would be removed from treatment units. Figure 3-Soil-1 shows a typical site after slash disposal.

Figure 3-Soil-1: Typical slash disposal treatment. Note the amount of material left on site.

The Clara Environmental Assessment (USDA 2009) modeled the amount of slash that would be left after different treatments. The Clara Environmental Assessment estimated slash disposal would reduce the amount of material from 17.5 tons per acre before treatment to 10 tons per acre after treatment (Clara Table 3-FUEL-5 p. 3-75). Thus, over half of the biomass would remain on site after treatment to provide nutrients and reduce potential erosion. The remaining 10 tons would include a substantial proportion of twigs, leaves, and needles. These fine materials would be more readily available as nutrients than larger branches (MFRC Site Level Biomass Harvest Guidelines p. 14), and contain a substantial proportion of nutrients compared to the rest of the tree (Forest Plan FEIS, p. 3.6-13). Precipitation, dust deposition and nitrogen fixation would also add nutrients to sites (MFRC Site Level Guidelines, p. 18).

Indicator 4: Acres of wetland within proposed mechanical treatment.
Alternative 2 includes 343 acres of wetland ELTs, or less than one percent of the North Shore Project Area, proposed for mechanical treatments. Not all wetland acres within the Project Area would be impacted because some of the mapped wetlands would be excluded from the units during implementation. For wetlands that would be treated, Operational Standards and Guidelines require that all mechanical operation occur during frozen conditions. Under frozen conditions, effects to wetlands such as rutting or compaction would not occur or would be minimal. Through the use of Operational Standards and Guidelines, and based on past experience, it is anticipated the North Shore

Project would have minimal impacts to wetlands. Table 3-Soil-7 displays the wetland ELT treatment acres within each alternative.

Table 3-Soil-7: Wetland ELT Acres Proposed for Treatment within the North Shore Project Area.

	Alternative 1	Alternative 2
ELT 2	0	81
ELT 4	0	234
ELT 6	0	28
Total	**0**	**343**

Cumulative Effects

Management activities on non-federal lands would have minimal impacts to the soil through the implementation of Best Management Practices. Monitoring of impacts from timber harvest on public and private land in Minnesota show minimal amounts of erosion and rutting as a result of timber harvest activities. Erosion that resulted in sediment delivery to a wetland or water body from roads and skid trails was observed on 4% and 0.5% respectively. Rutting from management activities was detected in 11.3% of 6,147 locations assessed for rutting. Of those locations where rutting was observed, 64% had less than 5% of the surface area in ruts. Also, on 88.7% of the sites the rutting was limited to roads, skid trails and landings (Dahlman 2008). Minimal cumulative effects are anticipated through the use of Forest Plan standards and guidelines and the use of Best Management Practices.

No discernible impacts to long-term soil productivity have been identified as a result of past management activities within the North Shore Project Area. Grigal (2004) reviewed the analysis for long-term site productivity completed as a portion of the Generic Environmental Impact Statement done for timber harvest in the state of Minnesota. In his review of the Generic Environmental Impact Statement, he concluded that updated nutrient budgets and results of long-term studies indicate the nutrient capital is sufficient to tolerate numerous biomass removals and harvest rotations with minimal impacts to site productivity for most mineral soils in Minnesota. Known past and reasonably foreseeable future management actions that would occur on land impacted by proposed management activities would have minimal cumulative impacts to the soil resource.

3.7 Non-Native Invasive Plants

3.7.1 Introduction

Non-native invasive species are generally defined by two characteristics: 1) they were not historically (i.e., pre-European settlement) present in a region's ecosystems, and 2) they have the ecological ability to invade and persist in native plant and animal communities, and often become dominant species at the expense of native species.

Ground disturbance associated with North Shore Restoration Project activities could create conditions favorable to the introduction or spread of non-native invasive plants (NNIP). This potential effect is analyzed in this section, which describes the NNIP that are currently known to exist in the Project Area, as well as the effects of the alternatives on NNIP.

3.7.2 Analysis Methods

Indicator 1: Miles of new upland road construction on National Forest System land.
All of the new upland roads being constructed in the North Shore Restoration Project Area are temporary roads or roads being used for a short term by the county or state. This indicator is useful for distinguishing among alternatives because currently the vast majority of terrestrial non-native invasive plant impacts are along roads on the Superior National Forest. New roads are areas that are likely to be invaded by non-native invasive plants.

Indicator 2: Acres of upland timber harvest and restoration units within 50 feet of NNIP occurrence.
This indicator is useful for distinguishing among alternatives because NNIP occurrences near timber harvest or restoration units have the highest likelihood of spreading as a result of management activities, and the areas where they would likely spread are those where ground disturbance has occurred, such as nearby units. This analysis only includes inventoried NNIP populations, not NNIP for which no inventory exists, such as orange and yellow hawkweed, or oxeye daisy.

3.7.3 Analysis Parameters

The area covered by the analysis of direct and indirect effects includes all lands administered by the Superior National Forest within the North Shore Restoration Project Area. This area was selected because this is where project activities would occur which cause the direct and indirect effects. The area covered by the cumulative effects analysis includes lands of all ownerships within the North Shore Restoration Project Area. This cumulative effects analysis area was selected because private lands within project area boundaries share a number of physical characteristics (e.g. soils, landforms, etc.) with adjacent National Forest System lands. These characteristics influence land uses, which in turn influence NNIP distribution throughout the project area, so the North Shore Restoration Project boundary makes a logical analysis unit for cumulative effects.

The time period for direct effects is ten years from the time project activities begin, because no effects of project activities would occur until implementation, and because most project activities should be completed within ten years. Indirect and cumulative effects, for the most part, are also confined to this ten year time frame however, when evaluating whether any effects are likely from climate change, long-term time frames are also considered.

3.7.4 Affected Environment

Table 3-NNIP-1 displays the non-native invasive plants that are known to occur in the analysis area. This list was developed based on results from NNIP inventory data collected on the Superior National Forest. Non-native invasive plants are typically spread in several ways such as vehicle wheels or bodies, livestock, wildlife, boat traffic, or human foot traffic. Non-native invasive plants typically enter an area along a corridor of ground disturbance such as a road or trail. Depending on numerous factors such as shade tolerance, degree of invasiveness, dispersal mechanisms, and habitat availability, NNIP may or may not spread into adjacent forested or non-forested ecosystems. Typical areas that have some weed infestation in the analysis area are roadsides, trails, portages, gravel pits, parking areas, campgrounds, helispots, and administrative sites.

Mesic forested sites with shady understories on the Superior National Forest are fairly resistant to invasion by most NNIP. NNIP that disperse into such plant communities tend to get out-competed quickly by native shrubs, forbs, and trees. However, some NNIP are exceptions to this general observation. For example, common buckthorn and Siberian peashrub can thrive in the understory of mesic native plant communities. There are no known occurrences of common buckthorn in the analysis area. Siberian peashrub is found on one location in the project area.

Conversely, there are a number of native plant communities typical of droughty, shallow-soiled sites that are susceptible to invasion by NNIP. These sites have less abundant shrub and forb layers, and as a result are more susceptible to being invaded by NNIP, especially if some ground disturbance occurs. These types of sites correspond to Ecological Landtypes (ELTs) 7, 9, 11, 16, 17, and 18. Most susceptible among these are rock outcrops, which correspond to ELT 18. ELT 18 is zero to eight inches of soil over bedrock. The amount of actual rock outcropping within areas of mapped ELT 18 would be less. There is very little (approximately 1% of analysis area) mapped ELT 18 in the analysis area.

In general, the analysis area has a moderate level of NNIP infestation (Table 3-NNIP-1). Orange hawkweed, yellow hawkweeds, and oxeye daisy are the most abundant NNIP. They are found at low abundance levels along most roads in the analysis area and pose a moderate ecological risk to native plant species. The high ecological risk species, Siberian peashrub, spotted knapweed, Canada thistle, purple loosestrife and reed canary grass are much less abundant, totaling approximately 9.6 acres of infestations. The other moderate ecological risk species, plumeless thistle, common tansy and St. Johnswort, occupy approximately 6.0 acres in the analysis area. The following analysis only

considers the effects of moderate and high risk species. The low risk species do not pose enough of a threat to native plant communities to warrant consideration in the analysis.

Table 3-NNIP-1: Non-native Invasive Plants known in the North Shore Restoration Project Area.

Species	MN Status*	Life History/ Habitat Summary	Acres	Ecological Risk**
Siberian peashrub *Caragana arborescens*	No status	Perennial shrub, can spread by seed or vegetatively, used in past as reclamation species for mine tailings and as an ornamental shrub (MNDNR 2012)	0.006	High
Plumeless thistle *Carduus acanthoides*	P	Biennial, reproduces by seed, occupies disturbed sites (MN Dept. of Agriculture 2013)	0.0009	Moderate
Spotted knapweed *Centaurea maculosa*	P	Short lived perennial, spread entirely by seeds, dry to mesic uplands (Wilson and Randall 2002)	4.9	High
Canada thistle *Cirsium arvense*	P	Perennial, spread by seed and rhizome, occupies disturbed sites (Lym and Christianson 1996)	4.7	High
Bull thistle *Cirsium vulgare*	No status	Biennial, spread by seed, occupies disturbed sites (Lym and Christianson 1996)	0.2	Low
Orange hawkweed *Hieracium auranticum*	No status	Perennial, spread by seed and rhizome, widespread in disturbed upland sites (Callihan et al. 1982)	51***	Moderate
Yellow hawkweeds *Hieracium* sp.	No status	Several similar non-native invasive yellow hawkweeds occur in Project Area; perennial, spread by seed and rhizome, widespread in disturbed upland sites (Gleason and Cronquist 1991)	51***	Moderate
St. Johnswort *Hypericum perforatum*	No status	Herbaceous perennial; spread by seed and lateral roots, dry to mesic uplands (Krueger and Sheley 2002)	0.2	Moderate
Oxeye daisy *Leucanthemum vulgare*	No status	Perennial, spread by seed and rhizome, widespread in disturbed upland sites (Gleason and Cronquist 1991)	51***	Moderate
Lupine *Lupinus polyphyllus*	No status	Perennial, spread by seed; road rights-of-way (Czarapata 2005)	0.4	Low
Purple loosestrife *Lythrum salicaria*	P	Aggressive herbaceous perennial; spread by seed and rhizome; wetlands and road ditches (MNDNR 2012)	0.004	High
Reed canary grass *Phalaris arundinacea*	No status	Perennial grass, vegetatively spread by rhizome, ditches, disturbed and wetland sites (MNDNR 2013)	0.002	High
Common tansy *Tanacetum vulgare*	P	Herbaceous rhizomatous perennial, spread mostly by seed; disturbed uplands (LeCain and Sheley 2011)	5.8	Moderate

* **P** = Prohibited noxious weed (Minnesota Statutes 18.76 to 18.91) that must be controlled.
** Species represents either a low, moderate, or high threat to natural communities (USDA Forest Service 2010). Risk given in table represents risk in most susceptible habitat.
*** Estimated acres based on miles of road in Project Area.

3.7.5 Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects

Although all the indicators are zero for Alternative 1 and no ground disturbance would occur, this alternative would still have direct effects on NNIP. Any non-native invasive plant in the analysis area would continue to exist and would probably be spread in the analysis area along typical corridors for weed dispersal such as roads, trails, gravel pits, and parking lots. Any public or administrative vehicle use in the analysis area (e.g., passenger vehicles, trucks, road maintenance equipment, ATVs) would have the potential to spread NNIP. Wildlife and human foot traffic in the analysis area would also have the potential to spread NNIP, but the likelihood of spread by these means would be lower than from vehicle use. Overall, this alternative would have the least amount of ground disturbance and, therefore, the least risk of weed spread.

Table 3-NNIP-2: Summary of Indicators by Alternative

Indicator	Alternative 1	Alternative 2
Miles of new upland road construction on National Forest System lands	0	12
Acres of upland timber harvest and restoration units within 50 feet of NNIP occurrence.	0	1172

Alternative 2 (Proposed Action)

Direct and Indirect Effects

Indicator 1—Miles of new upland road construction on National Forest System land

Approximately 12 miles of new upland temporary road would be constructed in Alternative 2. Non-native invasive plant species would be likely to spread along the sides of some of the new upland road construction in the analysis area. Some species, like oxeye daisy and orange and yellow hawkweed, are already found along most roads in the analysis area, and would probably quickly colonize the sides of some new upland roads. However, the ecological consequences of the spread of these species would be minor, since they primarily stay on roadsides and do not compete well with native upland vegetation.

Other species, such as Canada thistle, spotted knapweed, reed canary grass, Siberian peashrub and purple loosestrife, are not as common in the analysis area, but have a high ecological risk (Table 3-NNIP-1). These species can outcompete native vegetation and degrade wildlife habitat. Project activities would probably cause some of these species to spread, and most new infestations would be confined to the disturbed areas. There is a risk that these species could spread to nearby undisturbed susceptible habitat (like

wetland edges for Canada thistle, reed canary grass or purple loosestrife) and degrade native plant communities.

Tansy, plumeless thistle and St. Johnswort have a moderate risk of ecological consequences. Project activities would probably cause new infestations of these species in disturbed areas such as along temporary roads. The ecological consequences of the spread of these species would be minor, since they primarily stay on roadsides and do not compete well with native upland vegetation. Furthermore, roadside infestations are easier to find and manage than infestations in forested communities.

A number of factors would minimize NNIP impacts in Alternative 2. Some of the potential NNIP spread would be offset by the fact that all the new roads proposed in the North Shore Restoration project area are temporary and would be decommissioned after use. As native forbs, shrubs, and trees start to re-vegetate decommissioned roads after road use stops, these species would gradually begin to outcompete moderately invasive species like yellow hawkweed. Also, some potential NNIP spread would be offset by the 12.5 acres (136 sites) of weed treatments conducted in 2012 in the project area with similar acreage expected to be treated in 2013. Herbicides were used to treat weed infestations across the project area during the past two years. Lastly, the risk of NNIP spread would be minimized by an operational standard and guideline that specifies treatment of known infestations prior to mechanical or burning treatments. This would also reduce the risk of spreading NNIP.

For these reasons, there would be a low risk of impacts from weed spread tied to road construction.

Indicator 2 – Acres of upland timber harvest and restoration units within 50 feet of NNIP occurrence

Approximately 1,172 acres of upland timber harvest and restoration units would occur within 50 feet of an inventoried NNIP occurrence in Alternative 2. For this alternative, there is a risk that NNIP occurrences near a treatment unit could spread to the unit as a result of ground disturbance associated with timber harvest and mechanical site preparation. The risk of NNIP spread would be minimized by an operational standard and guideline that specifies treatment of known infestations prior to vegetation management activities. Furthermore, as noted above for indicator 1, herbicides were used in 2012 and 2013 to treat invasive plant infestations in the analysis area, which will help reduce the risk of future NNIP spread. Alternative 2 would have a greater risk of weed spread associated with vegetative treatments than Alternative 1, but following Operational Standards and Guidelines would minimize the risk of ecological consequences of NNIP spread due to management activities. For the observed occurrence of Siberian peashrub, a high risk invasive species known to thrive in mesic understories, special precautions will be taken at that site including herbicide treatment to minimize the risk of spreading this species.

Cumulative Effects Common to All Alternatives

Based on analysis of past, present, and reasonably foreseeable actions (Appendix F), the cumulative effects of the North Shore Restoration Project on NNIP would be negligible and would not differ much between Alternatives 1and 2. Some effects would be negative and others would be beneficial.

Past actions influenced the composition and distribution of NNIP in the cumulative effects analysis area. For example, development of a transportation system (i.e. roads and railroads) and recreational trail system provided corridors for the introduction and spread of these species. Mixed land ownership patterns in the analysis area have also contributed to development of the transportation system and NNIP spread. Most non-native invasive plant species, like tansy, were introduced unintentionally. Past timber harvest in the cumulative effects analysis area has also contributed to NNIP. Cumulatively, these past actions influenced the present composition and distribution of these species in the analysis area.

NNIP would continue to spread in the analysis area under all alternatives as a result of present and reasonably foreseeable actions on National Forest System land and lands under other ownership. The effects of NNIP would continue to be concentrated in developed areas (e.g. roadsides, trails, powerlines) and not undeveloped forestlands. Some road construction is likely on county or state lands in the analysis area. For example, some new roads could be built in connection with county or state timber harvest, and this could result in a small amount of NNIP spread. Also, ongoing and future special use authorizations (Appendix F) could also contribute to some small increases in NNIP along the special use roads. In contrast, the Superior National Forest Travel Management Project would result in 3.9 fewer miles of road open to motorized recreation in the project area (Appendix F). Road decommissioning associated with the travel management rule would be beneficial and result in a small reduction in potential weed spread. Overall, road construction and use of existing roads could lead to small increases in NNIP infestation on both National Forest System land and lands under other ownership in the cumulative effects analysis area via spread along travel corridors for Alternatives 1and 2.

New trail construction by outside groups is proposed on National Forest System land which could also lead to small increases in NNIP by creating new corridors for invasion and dispersal, however this impact would be smaller than the risk associated with newly constructed roads due to the small amount of ground disturbance associated with the activity.

Timber harvest on non-federal ownership, such as future vegetation management on state lands (projected 98 acres of vegetation treatments, Appendix E) or Cook County lands, would also make a small contribution to the spread of NNIP. There are no ongoing federal timber sales within the analysis area. Monitoring (see below) has shown that when timber harvest results in weed spread, the new infestations tend to be small and located on access roads and landings where they can be easily treated.

In 2012, 12.5 acres of weed treatments occurred at 136 sites in the project area and more will continue in the future. This is a beneficial effect with respect to NNIP spread. On April 27, 2006, Forest Supervisor Jim Sanders signed a decision to implement a Forestwide NNIP management EA, which would provide for treatments of NNIP in the project area (USDA Forest Service 2006) under all alternatives. Such treatments would minimize impacts from NNIP spread directly, indirectly, and cumulatively caused by project activities.

It is difficult to quantify a threshold for cumulative weed impacts. One way of approaching this question is to compare the abundance of NNIP on high risk sites in the project area to their abundance on high risk sites forest-wide. There are approximately 0.1 acres of NNIP infesting sites at increased risk of NNIP invasion (i.e. ELTs 7, 9, 11, 16, 17, and 18) in the analysis area. This represents a small fraction (approximately 0%) of NNIP on high risk sites Forest-wide, which further demonstrates that North Shore Restoration Project activities would pose minimal risk of cumulative effects of weed spread.

Monitoring of a sample of North Shore Restoration Project activities for NNIP spread (see Section 2.3.1.1) would help detect new infestations that arise as a result of project activities; new infestations would be treated under the 2006 Forestwide NNIP Management EA. Monitoring results to date suggest that Superior National Forest invasive plant mitigations are successful in minimizing the spread of these species. Monitoring of harvested stands treated under the Silver Island Environmental Assessment (Tofte Ranger District) found only 0.008 acres of new infestations that appeared tied to harvest activities (USDA Forest Service 2007). No spread was observed into forested stands; for example, one stand next to Sawbill Landing (which has a heavy spotted knapweed infestation) was thinned and burned, but no spotted knapweed was found in the treated stand. In 2007 monitoring of harvested stands treated under the Virginia EIS (Laurentian Ranger District) found only 0.1 acres of new infestations on skid trails and landings in harvest units, but no infestations within the regenerating stands themselves (USDA Forest Service 2008). For these reasons, the cumulative impacts of the North Shore Restoration Project on NNIP would be negligible.

Projected climate change in the project area is also likely to contribute to cumulative effects (Appendix F). Projected warmer temperatures in the project area might allow current invasive species to expand their range and new species to colonize the project area and areas further inland. The North Shore Restoration Project area receives high recreational use and the cumulative effect of increased temperatures and trail use/road construction could potentially exacerbate NNIP populations in the area under future projected conditions.

3.8 Water Quality

3.8.1 Introduction

There is concern about the water quality and watershed health in the North Shore Project Area. The proposed harvest treatments and temporary road construction through uplands and lowlands to access forest stands in the project area may negatively affect the water quality of the lakes, streams and open water wetlands for the forest users. This section addresses the direct, indirect and cumulative effects to water quality and watershed health.

3.8.2 Indicators

Three indicators were chosen from the Forest Plan Final Environmental Impact Statement (FEIS) to evaluate the effects to water quality from harvest activities – temporary road construction to access forest stands through uplands, temporary road construction on ecological landtypes (ELT) 1-6 (lowlands) and the percentage of watershed in upland open and upland young forest less than 16 years old (Forest Plan FEIS, pp. 3.6-1 – 3.6-60).

> A **watershed** is defined as the area from which all surface water drains to a common point, commonly thought of as the area that drains water into a given lake or stream (Forest Plan Glossary-30). The mapping system for watersheds consists of multiple levels. These watershed levels are described in detail in the Forest Plan FEIS pages 3.6-1 -3.6-2.

Indicator 1: Miles of new temporary roads crossing lowlands to access vegetation treatment activities.
Indicator 1 evaluates the potential effects of new temporary road construction crossing ecological landtype (ELT) 1-6 to access the proposed vegetation treatment activities. ELTs 1-6 are classified as lowlands as defined in the Superior National Forest Land Management Plan, 1994. Indicator 1 is a good indicator for its potential to inundate or desiccate habitat due to water level and/or flow regime disruption. If not properly designed and mitigated, roads crossing lowlands can lead to changes in hydrologic function, and may directly affect aquatic populations and habitat.

Indicator 2: Number of new temporary water crossings to access vegetation treatment activities.
Indicator 2 evaluates the potential effects of water crossings to aquatic species measuring the potential change in sediment input, stream flow regimes, channel conditions, stream connectivity and fish migration barriers. This can lead to aquatic habitat loss.

Indicator 3: Proportion of upland open and upland young forest within each sixth level hydrologic unit code (HUC) watershed.
Indicator 3 assesses the portion of upland open and upland young forest within each sixth level hydrologic unit code (HUC) watershed that occurs within or intersects the project area. The goal is vegetation treatment activities would not increase the total acreage of upland young forest (<16 years), and upland openings to the point where the combined acreage exceeds 60% of the total area of any sixth level watershed on all ownerships (Forest Plan, S-WS-1, pp. 2-13). Indicator 3 is also the cumulative effects indicator and

was chosen for the analysis because potential effects from vegetation treatment activities and other activities associated with each alternative could influence peak stream flows. This could potentially reshape stream channels, increase erosion, and decrease biological integrity which would be evident at the watershed scale (Verry et al. 2000).

3.8.3 Analysis Parameters

The analysis area for direct, indirect and cumulative effects for Indicator 1 includes both lands within the project area as well as outside that are within one mile of any new proposed temporary road construction necessary to access the vegetation. This analysis area was chosen because the effects to water quality and watershed health from roads are evident and relevant within one mile or less of the road (Verry et al. 2000). Indicator 2 would include the lands within the project area, because the effects to aquatic habitat from road crossings are evident at the location of the crossing. Indicator 3, the cumulative effects analysis, includes lands of all ownerships of the sixth level HUC watersheds that intersect the project area. This was selected because watersheds are natural integrators for effects related to water flow and water quality, account for the amount of open and young forest resulting from harvest on National Forest lands and at the same time recognize and allow for similar conditions on other lands within the watershed (FEIS pp. 3.6-5 and 3.6-6).

The timeframe selected for Indicator 1 is 20 years because the effects from road construction and vegetation treatment activities may be observable for many years following the initial impact of activity. The timeframe for Indicator 2 is 10 years as identified in the Forest Plan, FEIS, (pg. 3.6-6). The timeframe selected for Indicator 3 is 10 - 20 years because sediment into the stream flow and the channel conditions can be measured during this timeframe as well as measuring vegetation growth. The Forest Plan FEIS, (pg. 3.6-6) identified the time scale of 10 – 20 years for this indicator.

3.8.4 Affected Environment

The North Shore Project Area contains approximately 77 acres of named lakes, 191 miles of named streams (see North Shore Mid-Level Report: Water Resources for list); and numerous intermittent streams, open water wetlands, ephemeral ponds, wet meadows, seeps and springs. They flow into the Lake Superior watershed basin, and many of these streams depend upon runoff. Their flows are unstable; surging after a rain, dwindling to a trickle during drought and the winter season (Managing Minnesota's Fish, MN DNR). The named lakes and streams are classified by the Minnesota Department of Natural Resources as supporting a cold-water and warm-water fisheries. Cold-water fisheries originates from the family Salmonidae (trout species such as brook, brown and splake) and warm-water fisheries from the following families: Percidae (walleye pike); Catostomidae (white sucker); Esocidae (northern pike, muskellunge); and Centrarchidae (bass) families; along with numerous minnow species of the Cyprinidae family (chubs, dace, shiners).

Within the North Shore Project Area boundary, there is other aquatic "wildlife" such as reptiles and amphibians associated with open water wetlands, ephemeral ponds, wet meadows, seeps and springs. Many rely on ephemeral wetlands for successful

metamorphosis from larva to adult. They are the following: Tiger Salamanders (*Ambystoma tigrinum*), Blue-spotted Salamanders (*Ambystoma laterale*) and Wood Frogs (*Rana sylvatica*) (Moriarty et al. pp. 5-12). See the North Shore Project File for a listing of amphibians, reptiles and their habitats found within the project area. Some reptiles and amphibians, while not dependent on ephemeral wetlands, opportunistically use these habitats. Because breeding amphibians sometimes number in the thousands in these wetlands, other species such as the Common Garter Snake (*Thamnophis sirtalis*) and the Snapping Turtle (Chelydra serpentina), can benefit from foraging on the temporarily abundant prey.

Indicator 1 and 2: Roads and Crossings

Currently, there are 366 miles of roads and trails on all land ownership within the North Shore Project Area (North Shore Mid-Level Report: Water Resources). Roads and trails are often the primary source of sediment in streams and lakes associated with land use activities. Most impacts occur during initial road construction, and gradually decrease as roadside vegetation is reestablished and disturbed soil surfaces stabilize.

A coarse level stream crossing survey occurred at six crossings on federal roads. It determined the crossings on federal roads were undersized, perched and/or required replacement to enhance aquatic organism passage, improve stream flow, sediment transport, riparian function, and maintain flood flow. As funding allows, crossings would be replaced following the Forest Plan standards and guidelines. In addition, a joint effort between the Forest Service, Minnesota Department of Transportation and Minnesota Department of Natural Resources funded a fish passage course level stream crossing survey along the north shore of Lake Superior and the upper reaches of the watersheds in the North Shore Project Area. Twenty six crossings were surveyed. Issues raised were perching, erosion around crossings, high gradient, barriers downstream or upstream, and plugged culverts. A list of these stream crossings is in the North Shore Mid-Level Report: Water Resources located in the Project Record.

Replacement of undersized and perched culverts, would help address concerns about climate change and its potentail impacts from predicted increases in heavy precipitation events. This can lead to increases in flooding and soil erosion which can cause infrastructure damage (stream crossings); and increases in landslides and stream bank erosion as experienced by the June 2012 floods in northern Minnesota. Stream bank erosion can lead to water turbidity and an increase in contaminants and nutrients in streams.

Other impacts from climate change are increases in temperatures in streams impacting thermal habitat in cold water streams and ultimately impairing the fisheries, as well as other aquatic organisms. For example, eggs and fry associated with gravel habitats and fine sediments appear to have been most affected by the June 2012 floods in northern Minnesota, as opposed to other life stages (S. Handler, et al. 2013); and cold-water fish species like ciscos are likely to be impacted in many lakes across the assessment area as temperatures increase. Increases in heavy rainfall events have been increasing in the

upper Midwest in general and for Minnesota in particular. The models indicate this trend will continue over the next century (S. Handler, et al. 2013).

Indicator 3: Watersheds

When assessing the effects to water quality, sixth level hydrologic unit code (HUC) watersheds are examined. The surface water from watersheds eventually drain into a given lake or stream and the watersheds' ecological composition, structure and function can be impacted through land management activities and natural disturbances such as road building, water crossings, harvesting, flood events, and climate change effects, etc. The North Shore Project Area drains into the Lake Superior Basin and it is divided into eighteen sixth level watersheds. Table 3-WQ-1 shows total acres of the watersheds and their existing portion of upland young. Watersheds such as Good Harbor Bay and City of Lutsen-Frontal Lake Superior are primarily within the North Shore Project Area but for most of the other watersheds only a portion of it is within the project area.

In 2012, the North Shore Mid-level Report: Water Resources concluded the existing condition of all eighteen sixth level watersheds that intersect the North Shore Project Area was well within Forest Plan desired conditions, in particular S-WS-1 (Forest Plan, pp. 2-13) for vegetative cover and age at the watershed scale.

Table 3-WQ-1: Sixth Level Watersheds Intersecting the North Shore Project Area.

Watershed Name	Total Acres of Watershed	Acres of Watershed in North Shore Project Area	Portion of Total Watershed in Upland Young (%)
Swamp River	31,753	1,421	16
Reservation River –Frontal Lake Superior	26,082	9,547	7
City of Hovland-Frontal Lake Superior	16,080	9,684	6
Brule River	19,017	4,424	6
Kadunce River-Frontal Lake Superior	31,718	18,795	8
Devil Track River	20,083	3,884	7
City of Grand Marais-Frontal Lake Superior	9,112	8,458	4
Good Harbor Bay-Frontal Lake Superior	6,874	6,683	3
Lower Cascade River	22,454	6,131	5
Deer Yard Lake-Frontal Lake Superior	9,488	6,527	2
City of Lutsen-Frontal Lake Superior	7,914	7,658	3
Caribou Creek	11,954	337	6
Poplar River	26,731	1,369	5
City of Tofte-Frontal Lake Superior	16,633	10,710	4
Heartbreak Creek	11,329	281	0.1
Lower Temperence River	24,590	2,652	3
Cross River	13,107	2,517	5
Taconite Harbor-Frontal Lake Superior	19,575	738	5

Data Source: T:\FS\NFS\Superior\Project\GUN\TimberVeg\North Shore\GIS\Covers\NSML_Run06 \NSML_60 percent.xlsx. All numbers in table are rounded to the nearest tenth.

3.8.5 Environmental Consequences

Alternative 1 – No Action

Direct and Indirect and Cumulative Effects

Indicator 1: Miles of new temporary roads crossing lowlands to access vegetation treatment activities.
Alternative 1 would maintain the existing road transportation system in the North Shore Project Area. No new temporary roads would be constructed over ELT 1-6 (lowlands). There would be no new direct, indirect, or cumulative effects from Indicator 1.

Indicator 2: Number of new temporary water crossings to access vegetation treatment activities.
Alternative 1 would maintain the existing number of water crossings; and no new crossings would be constructed to access the vegetation treatment activities. There would be no new direct, indirect or cumulative effects from Indicator 2.

Indicator 3: Proportion of upland open and upland young forest within each sixth level watershed.
Under Alternative 1, there would be no additional young forest created through vegetation treatment activities other than what would occur naturally. Water quality and watershed health as measured by Indicator 3 is rated high under the existing condition and would remain so under Alternative 1. There would be no new direct, indirect, or cumulative effects from Alternative 1.

Alternative 2 – Proposed Action

Direct and Indirect Effects

Indicator 1: Miles of new temporary roads crossing ecological landtypes 1-6 (lowlands) to access vegetation treatment activities.
Alternative 2 would construct 2.1 miles of new temporary roads on ecological land-type (ELT) 1-6 (lowlands). This could potentially change water levels or flow regimes in lowlands which could impact aquatic habitat; and can lead to blockage of cross-drainage and down road channelization which could take 20 years to recover (MFRC Guidelines, Forest Roads - p. 44). Adherence to Operational Standards and Guidelines and site specific mitigation measures during project implementation would minimize these impacts to water quality and aquatic habitat from road construction.

Indicator 2: Number of new temporary water crossings to access vegetation treatment activities.
Alternative 2 would install 30 temporary water crossings on temporary roads to access timber stands. Water crossings can increase sediment transport, disrupt natural stream flow and flood flow, reduce riparian function, and impede aquatic organism passage. Adherence to Operational Standards and Guidelines and site specific mitigation measures during project implementation and installing culverts/bridges of sufficient size to handle hydrologic flows for the site would minimize impacts and enhance the water quality and

overall watershed health of the project area. Structures would be removed when the roadbed is decommissioned.

Indicator 3: Proportion of upland open and upland young forest within each 6th level watershed in the project area.

Alternative 2 would convert some of the land into upland open forest classification; however, the maximum percentage of the eighteen watersheds would still remain below the 60 percent threshold (Table 3-WQ-2). Thus, it is expected that peak stream flows within the North Shore Project Area would have minimal effects on the health of the water quality from reshaping stream channels, increasing erosion, and decreasing the biological integrity.

Table 3-WQ-2: Percentage of Upland Open, Upland Young Forests in Sixth Level HUC Watersheds in year 2021.

Watershed Name	Alternative 2 Portion of watershed in upland young (%)*
Swamp River	16
Reservation River-Frontal Lake Superior	7
City of Hovland-Frontal Lake Superior	4
Brule River	5
Kadunce River-Frontal Lake Superior	7
Devil Track River	9
City of Grand Marais-Frontal Lake Superior	20
Good Harbor Bay-Frontal Lake Superior	0.91
Lower Cascade River	4
Deer Yard Lake-Frontal Lake Superior	4
City of Lutsen-Frontal Lake Superior	2
Caribou Creek	6
Poplar River	7
City of Tofte-Frontal Lake Superior	7
Heartbreak Creek	3
Lower Temperance River	3
Cross River	2
Taconite Harbor-Frontal Lake Superior	4

Data Source:
T:\FS\NFS\Superior\Project\GUN\TimberVeg\NorthShore\GIS\Analysis\NorthShore AnalysisProducts\NorthShoreR04_AnalysisProducts\x_NSsixtyPercent.
*All numbers in table are rounded to the nearest tenth.

Cumulative Effects

The list of potential cumulative actions in Appendix F was reviewed; and the past, present and reasonably foreseeable future actions that may contribute to cumulative effects that affect water quality were considered. This would include any road construction and/or water crossings related to a timber sale, vegetation management, trail construction that crosses water, fuels reduction (prescribed burns), special use

permits for road access, as well as routine road maintenance activities and private development.

The State is proposing harvest needs on 98 acres and the Superior National Forest anticipates minimal harvesting on private lands within the project boundary. As long as Minnesota Forest Resource Council Voluntary Site-Level Guidelines are followed during road construction and the placement of water crossings, impacts to water quality would be minimized.

Prescribe burning in wildlife openings occurs on the average between 50 – 100 acres annually. Mitigation measures would be applied to reduce impacts to water quality.

Ten on-going special use road permits have been issued to the Minnesota Department of Natural Resources (MN DNR) and private holders. Two of the ten permits will expire in 2017, and the portions of road the MN DNR built would be decommissioned. Under the Forest-Wide Travel Management Project, 3.99 miles of unclassified roads within the North Shore Project Area would be decommissioned and allowed to return to their natural state. Decommissioning roads would reduce impacts to water quality issues.

In the future, bike trails are proposed at Britton Peak and Pincushion - 5-7 new miles at Pincushion and 22 miles at Britton Peak with a 13 mile connector to Lutsen. This could impact water quality issues, but they would be reduced if landowners follow the North Shore Project Operational Standard and Guidelines and MFRC guidelines.

Based upon the proposed percentage of upland open and upland young forest as the result of the proposed Alternative 2, and a review of the shared drainage areas, the watersheds would not be expected to exceed the 60 percent threshold when combined with cumulative actions.

Overall, implementation of the North Shore Project Operational Standards and Guidelines, the Superior National Forest Management Plan standard and guidelines, the North Shore Project mitigation measures and MFRC guidelines would reduce impacts to the water resources and biota from erosion and sediment, compaction, rutting, chemical contamination, and changes in water flow; thus, reducing the changes in the surface water resources.

3.9 Scenic Quality

3.9.1 Introduction

The North Shore Project Area is commonly known to be one of the most scenic places in the State of Minnesota. From the shores of Lake Superior to the forested stands inland, this area is a highly visited and well-known tourist destination because of the scenic quality that is readily observable within the Project Area. Over the past decade, natural processes and the increasing age of current forested stands has led to an observable change in the scenic quality of the North Shore Project Area. The dieback of old birch trees, natural processes such as wind and ice storms, and climate change have led to a dramatic change in the historical condition of this area.

The Forest Service uses the Scenery Management System to determine the relative value and importance of scenery. Scenic integrity, or the state of naturalness, is a key concept within the Scenery Management System. The Forest Plan established Scenic Integrity Objectives (SIO) for the North Shore Project Area, as well as the rest of the Forest, to guide the amount, degree, intensity, and distribution of management activities needed to achieve desired scenic conditions (FP, pp. 2-46 to 2-48).

Mechanical treatment types vary in how they impact scenic quality. This section addresses concerns about how proposed management activities may impact scenic resources and recreational experiences.

3.9.2 Indicators

Indicator 1: Acres proposed for mechanical treatment adjacent to trails, recreation sites and roads with High Scenic Integrity Objectives (SIO).

Acres of treatment adjacent to trails, recreation sites, and roads are used to compare scenery effects among the alternatives because the qualities of recreational experiences are often dependent upon the aesthetic character of the surrounding forest. In addition, the quality of recreational experiences are also impacted by sights, sounds and other intrusions which may occur during vegetation management activities. This indicator describes the different effects each alternative would have on scenery adjacent to trails, recreational sites, and roads within the project area. This analysis also considered the effects of the project on the recreation sites and roads with High SIOs that are directly adjacent to any type of mechanical treatment units.

3.9.3 Analysis Parameters

The analysis area for the direct, and indirect covers recreation sites, trails or roads with a High SIO on National Forest System land that overlap mechanical treatment units. Only recreation sites with mechanical treatment activity directly adjacent are considered because the effects on the recreation resource are expected to diminish rapidly beyond the treatment boundaries and would not likely be distinguishable from other activities occurring in the area. The cumulative effects analysis includes recreation sites, trails or roads with a High SIO on all ownership that overlap mechanical treatment units.

The time period selected for analyzing the direct and indirect effects is ten years, beginning at the time of treatment. This time frame is appropriate because the effects of the project on the scenery and recreation resource would occur predominantly while the timber harvest or other project work was occurring. The effects from these activities would result from seeing and hearing mechanized activity. The greatest amount of noticeable change to scenery would occur directly after harvest from logging debris, site preparation activities, and changes in vegetation composition and structure. After ten years the harvested area would be re-vegetated and logging slash would have settled. Under planting treatments are not analyzed because they would not impact the current forest-type within this ten year period.

The time frame selected for analyzing the cumulative effects is short-term (one to ten years post-harvest) and long-term (10 to 50 years post-harvest). The long-term effects would disclose changes in species composition and structure that relate to scenery and would disclose what would occur over a long period of time as a result of taking no management action compared to taking action.

3.9.4 Affected Environment

The existing condition of the North Shore Project Area is characterized by a predominately natural landscape which has been modified in areas to support the local tourism industry. Several resorts and shops can be found along Highway 61, a National Scenic Byway and within the project area. The project area is also home to many area residents, seasonal homeowners, and rental properties and is characterized by a patchwork of federal, state and private ownership. There is minimal development on National Forest System lands within the Project Area with the exception of trailheads and parking areas.

The North Shore Project Area is used year-round for both summer and winter recreational activities. This area serves as one of the premier tourist destinations in the State of Minnesota and in addition to recreational opportunities on National Forest System land; this project area includes two Minnesota State Parks which are managed by the Minnesota Department of Natural Resources.

Summer use is extensive and consists of camping at state and privately managed campgrounds, camping at rustic Forest Service campsites, picnicking, swimming, hiking, rock collecting, berry picking, fishing, road biking, mountain biking, driving for pleasure and sightseeing. There are very few boating or canoeing opportunities within the project area although some of the rivers within the project area are used by kayakers who seek a whitewater experience. Winter use is also extensive and consists of snowmobiling, cross country skiing, snow shoeing, hiking, and driving for pleasure. The area is also utilized for year-round birding, fall hunting and a popular fall color driving tour.

The Superior Hiking Trail and North Shore State Snowmobile Trail are located within the North Shore Project Area. These are the two most used trails within the project area and are used by thousands of people from around the United States annually. Other trails

within the North Shore Project Area include a myriad of snowmobile trails, ski trails, hiking trails, biking trails, and hunter hiking trails.

Snowmobile trails within the project area include but are not limited to: the Schroeder Trail, the Tofte Trail, the LeVeaux Trail, the Lynx Trail, the Eagle Trail, the Fox Trail, the Lutsen Access Trail, the Mountain Access Trail, the Caribou Trail, the Beaver Trail, the Ward Lake Access Trail, and the Deer Trail. Popular hiking trails within the project area include but are not limited to: Britton Peak Trail, Carlton Peak Trail, LeVeaux Mountain Trail, Oberg Mountain Trail, Artist's Point Trail, Pincushion Mountain Trails, as well as the Superior Hiking Trail. There are two single-track mountain bike trail systems within the North Shore Project Area at Britton Peak and Pincushion Mountain. Many of these trail systems are managed by the Forest Service with maintenance assistance coming from a wide variety of trail partners and volunteer groups.

Throughout the North Shore Project Area, the forest viewed by trail users, visitors and residents alike is changing. Large areas of paper birch are an iconic feature of North Shore forest. They are prevalent along Highway 61 and are also scattered throughout the project area. However, a majority of birch stands are reaching the end of their typical life span and are dying. Recent wind and ice storms have increased the visibility of the mortality of birch trees especially along Highway 61 and the North Shore Project Area that is visible from Lake Superior. Another valued feature of the landscape that is declining is the occasional old, tall trees such as white spruce, cedar and white pine.

3.9.5 Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Effects

No new management actions would occur; there would be no harvesting, mechanical site preparation, planting or construction of exclosures. There would be no direct, indirect, or cumulative effects to scenery or recreation from the North Shore Project under Alternative 1. The forest would continue to change through natural processes and the stands would be viewed as mature forest by recreational users.

This alternative would not address the aging forested stands and the readily observable mortality of birch trees within the North Shore Project Area. Under this alternative, no actions would be taken to re-vegetate decadent stands and these stands would continue to deteriorate causing a loss in scenic quality along the North Shore of Lake Superior. In addition, climate change would continue to affect the ability of these stands to regenerate through natural methods and a loss of diversity may become apparent as some trees would adapt to changing climate conditions and others would not.

Cumulative Effects

Minimal harvest would be expected to occur on other ownership within the North Shore Project Area. The State of Minnesota has less than 100 acres currently proposed for harvest and little harvesting is expected on private land. It is likely any harvest would have limited scenic impacts because the scale of harvest would be small. Restoration

activities such as planting long-live conifer, on other ownership would continue. This would improve the scenic quality in the restoration areas in the long term.

The proposed treatments in the North Shore Restoration Project would not take place, and overall the long-term scenic quality some paper birch stands (proposed for treatment in Alternative 2) would be adversely since the over-mature birch would not be replaced with conifer or other young species to create 'big tree character' and other desirable scenic conditions. As these stands continue to age, forest visitors would likely see more dead, dying, and downed trees with a higher component of balsam fir growing in the under-story, which tends to block the viewshed and inhibit the growth of white pine. The scenic value of these stands would continue to diminish without natural disturbance such as fire or from lack of direct management activities such as underplanting, mechanical site preparation or harvest.

Alternative 2 – Modified Proposed Action

Direct and Indirect Effects

Scenic integrity indicates the degree of intactness and wholeness of the landscape character (*Landscape Aesthetics: A Handbook for Scenery Management*, page 7). The effects from these activities would be viewed as a change in in the degree of intactness of the landscape character observed by users after the harvest is complete. The greatest amount of noticeable change to scenic integrity would occur directly after harvest from logging debris, site preparation activities, and changes in vegetation composition and structure. After a period of time, vegetation management activities would create additional diversity in the treated stands including large, mature trees. Vegetation management activities would be designed to reduce the number of dead and dying birch trees while replacing them with long-lived coniferous species. One of the desired conditions for high quality scenery is diversity of species including large, mature trees. Alternative 2 would help move the scenery in the project area towards these desired conditions over the long-term as the vegetation in treatment units transition towards having a greater component of large, mature trees, including long-lived conifers.

<u>Superior Hiking Trail and other Non-motorized Trails</u>

Under Alternative 2 most of the mechanical treatment along the Superior Hiking Trail would be thinning. There would be a lesser amount of mechanical site preparation and only two units would have a clearcut with reserves treatment as shown in Table REC-1. Though there would be proposed treatments adjacent to approximately 24,000 feet of trail, actual unit boundaries may substantially decrease the amount of trail that would be impacted during implementation.

In the units proposed for thinning, less than a third of the basal area would be removed, leaving the majority of the overstory trees intact; the stand would still appear as a mature forest stand with more visibility into the stand. During actual harvest operations, equipment (log skidders, dozers, log loaders, logging trucks) would be seen and heard moving over the harvest units. Logs would be stacked or "decked" in some cases before being removed to processing mills. Operational Standards and Guidelines (OSG) in Appendix D would be in place to prevent these from being seen from visually sensitive

areas, but if no suitable location for landings or log decks is available outside these sensitive visual areas, they would be seen by visitors traveling through the area. To the greatest extent practical, slash from the logging operation would be removed within 100 feet of roads in High Scenic Integrity Objective areas and 25 feet of private property.

In units with mechanical site preparation, equipment (skidders, dozers, etc.) would be visible moving about the unit. Each unit would take anywhere from a few days to a few weeks to have the mechanical site preparation completed, depending on size. These units currently have few large mature trees and mechanical site preparation would not typically impact those trees.

Clearcut with reserve harvest units would have the most impact on the scenic resource along the Superior Hiking Trail as most of the overstory trees would be removed. However in all harvests, all standing live cedar, white pine and tamarack would be left except in a rare situation because of a safety hazard concern. Short-term adverse impacts to scenery along the Superior Hiking Trail would be minimized by using Operational Standards and Guidelines and additional mitigation measures. These include Forest Plan guideline G-SC-1, temporary openings from harvest activity would be similar in size, shape and edge characteristics to natural openings in the landscape being viewed. Or, temporary openings would mimic a natural disturbance process typical for the area, so that when ground cover has been established the opening appears to be a natural occurrence. G-SC-4 would be followed to immediately remove any equipment or human-made materials used in treatment activities such as staking or flagging. G-SC-5 would be followed to screen log landings from view of the Superior Hiking Trail. A complete listing of Operational Standards and Guidelines can be found in Appendix D.

Table 3-REC-1. Proposed Mechanical Treatment Units adjacent to Superior Hiking Trail

Unit	Treatment Method	Acres	Linear feet of Trail adjacent to Treatment
02-225-13	Thinning	17	1,075
02-225-37	Thinning	28	2,250
02-225-40	Thinning	22	565
02-225-56	Clearcut with Reserves	62	1,525
02-227-19	Under burn	39	2,425
02-228-23	Mechanical Site Preparation	61	1,250
02-229-02	Thinning	286	5,100
02-230-12	Thinning	46	450
02-240-11	Mechanical Site Preparation	59	1,060
02-246-17	Thinning	39	990
02-248-14	Thinning	176	2,700
07-138-63	Mechanical Site Preparation	10	250
07-154.54	Mechanical Site Preparation	87	375
07-176-13	Clearcut with Reserves	25	1,460
07-177-07	Mechanical Site Preparation	31	630
07-177-08	Mechanical Site Preparation	25	1,350
07-179-26	Thinning	31	530
Total		**1,044**	**23,985**

In the long term, the scenery along the Superior Hiking Trail would have beneficial impacts as vegetation in treatment units transitions towards having a greater component of large, mature trees, including long-lived conifers to help achieve Forest Plan Desired Condition D-SC-2.

An under burn would occur adjacent to a parking area for the Superior Hiking Trail in unit 02-222-19. The unit is about 24 acres and encompasses about 1,600 feet of the Superior Hiking Trail. This treatment would be completed after ensuring public safety signs and lookouts are in place. This operation would be completed in a matter of days which would minimize the duration of the adverse impact of this treatment. After the burn is completed, blackened stems of trees and underbrush would be visible until the grasses/forbs re-grew. This re-growth would occur within the first growing season following the burn. Longer term, blackened stems would be visible until the charring weathered away. Within about two years, the understory would attain about 3-5 feet of growth and the blackened stems would no longer be as visible.

Visitors to the Superior Hiking Trail, ski trails, or other hiking trails would experience the effects of vegetation management treatments most prominently while they are hiking or skiing on trails adjacent to treatment activities. The duration in which visitors would experience the effects of harvesting activities would be much greater per unit than those who are on mechanized trails while conversely they would not cover as long of a distance so the effects based upon the number of treatment units is reduced. Units proposed for harvest or mechanical treatment along other hiking, skiing, or dogsled trails are identified in Table 3-REC-2. Effects to users of these trail systems would be similar to the effects described above.

Table 3-REC-2: Units Proposed for Mechanical Treatment adjacent to Skiing, Hiking and Dogsled Trails.

Unit	Treatment Method	Acres	Linear feet of Trail adjacent to Treatment
Bally Creek Ski Trail			
02-220-03	Thinning	46	2,234
02-220-05	Thinning	76	1,545
02-237-10	Thinning	125	2,744
02-237-24	Thinning	74	1,304
02-237-27	Thinning	17	730
Massie Hall Trail/ Deeryard			
02-247-01	Thinning	11	1,165
02-247-05	Mechanical Site Preparation	12	200
02-248-02	Thinning	16	870
02-248-22	Thinning	16	1,050
Sugarbush Ski Trail			
07-138-63	Mechanical Site Preparation	10	1,200
Kimball Creek Hiking Trail			
02-203-06	Mechanical Site Preparation	28	555
Kimball Dogsled Trail			
02-195-11	Thinning	40	3,775

02-195-34	Thinning	25	840
	Total	**496**	**18,212**

Motorized Trails and Roads with High Scenic Integrity Objectives

Users of motorized trails in the project area would experience the effects of vegetation management activities for a shorter duration of time per unit, but these users would travel a greater distance and the effects of vegetation management activities would be more noticeable in the number of units encountered as opposed to the duration of time spent travelling through individual units. Proposed harvest or mechanical treatment units adjacent to motorized trails are identified in Table 3-REC-3.

Within the North Shore Project Area, roads such as the Sawbill Trail, the Temperance River Road, the Onion River Road, the Caribou Trail, the Massie Road, the Hall Road, the Pike Lake Road, the Lindskoog Road, Cook County 60 and the Colvill road are used by the homeowners and recreating public for travel to and from recreation sites as well as for driving for pleasure recreational opportunities. Harvest units along these road corridors would be designed to limit the amount of opening that could be seen from the road to less than 10 acres. Limiting the visible opening would minimize the adverse impacts to scenery along these roads. There are no units proposed for treatment adjacent to Highway 61.

Under Forest Plan guideline G-SC-1, for high scenic integrity areas, temporary openings from harvest activity would be similar in size, shape and edge characteristics to natural openings in the landscape being viewed. Or, temporary openings would mimic a natural disturbance process typical for the area, so that when ground cover has been established the opening appears to be a natural occurrence. Adverse impacts to these roads and trails would also be minimized by applying Forest Plan guidelines G-SC-4, G-SC-5 and G-SC-6 as discussed above.

Units proposed for harvest along snowmobile trails would require that logging debris within 100 feet of the trail to be removed or crushed to a height of less than 12 inches. Abrupt transitions between harvest area and adjacent area not harvested would be avoided. Mid-story shrub-layer species would be left in the transition zones between cut areas and adjacent trails and stands to minimize the impacts to scenery as well as reducing the impacts of blowing and drifting snow along the trail corridor. In the long term, the scenery along the affected trails and roads would have beneficial impacts from the treatments as vegetation in treatment units transitions towards having a greater component of large, mature trees, including long-lived conifers to help achieve Forest Plan Desired Condition D-SC-2.

Portions of snowmobile trails may be required for the hauling of timber harvested in units adjacent to snowmobile trails. Depending on the season in which the timber is hauled, there could be “dual use” of trails by harvest machinery and snowmobile recreation visitors. Recreational visitors may experience impacts from the sight and sound of machinery. Operational Standards and Guidelines (Appendix D) would be followed and would lessen impacts to recreation. For example, G-REC-2 of the Forest Plan states that forest management activities will generally reflect recreation objectives while minimizing

conflicts with recreation uses by:

- Avoiding use of system trails for skidding logs
- Minimizing crossing skid trails over system trails
- Placing safety signing to warn recreation visitors of harvest activity in the area
- Piling slash and other logging debris out of view of recreation sites and system trails
- Scheduling activities during low recreation-use periods

Table 3: REC-3. Units Proposed for Mechanical Treatment adjacent to Motorized Trails.

Trail Name	Type of Trail	Units
North Shore State Trail	Snowmobile	225-37, 225-40, 225-56
LeVeaux Trail	Snowmobile	158-07,16, & 26, 176-46, 177-31, 32, & 37
AmericInn/ Holiday Access Trail	Snowmobile	177-24, 177-25
Fox Trail	Snowmobile	155-14
Lynx Trail	Snowmobile	155-14, 177-07, 177-08,
Deer Trail	Snowmobile	241-01, 241-12, 241-47, 241-48
Beaver Trail	Snowmobile	246-17, 247-08, 248-14,
Caribou Trail	Snowmobile	131-10, 131-29
Tofte Trail	Snowmobile	177-04
T2-303C	ATV	229-02
Kimball Trail/ 21372	ATV	196-20, 196-27
Overbys Spur/ 21373	ATV	202-02
T2-303L	ATV	202-02
T7-341, Schroeder Tote road	ATV	179-02, 179-26, 179-53, 179-54

Cumulative Effects of Alternative 2

Minimal harvest would be expected to occur on other ownership within the North Shore Project Area. The State of Minnesota has less than 100 acres currently proposed for harvest and little harvesting is expected on private land. It is likely any harvest would have limited scenic impacts because the scale of harvest would be small. Restoration activities such as planting long-live conifer, on other ownership would continue. This would improve the scenic quality in the restoration areas in the long term.

Management activities associated with Alternative 2 have the potential to combine with completed past projects, current projects, or foreseeable future projects. In the short-term, some visitors traveling in the project area would observe an increase in temporary openings and a loss of mature vegetation as a result of harvest activities. Over the longer-term, visitors would see a greater amount of younger trees in the analysis area as the harvested stands begin to re-vegetate and these younger age classes would be found in larger patches of forest. A long-range effect of the project would be an increase in the amount of vigorous trees in the North Shore Project Area along with a reduction in over-mature, dying trees. This would lead to an increase in the aesthetic quality of the North

Shore Project Area as over-mature birch trees are replaced with healthier and more vigorous long-lived species.

Because of the Operational Standards and Guidelines and mitigation measures associated with units within the North Shore Project Area, impacts to scenic resources from management of National Forest System lands, added to the impacts from development of private lands, is not expected to change the scenic character of the area, and would lead to an increase in aesthetic quality through the project area. In the first ten years post-treatment, openings in the forest created by management activity would be noticeable. Beyond ten years, these openings would re-vegetate through natural processes or by intentional planting. Management of these stands may continue within or beyond ten years to release the longer lived species as they become established.

3.10 Other Determinations

3.10.1 Heritage Resources

To satisfy the Forest's responsibilities for undertakings under Section 106 of the National Historic Preservation Act, a heritage resource inventory has been conducted for the project area. Results of this inventory were documented in the *North Shore EA*, Cultural Resource Reconnaissance Report (CRRR), #1402003. This document lists all heritage survey reports conducted to date and previously identified heritage resources within or adjacent to the project area. This document identifies heritage mitigations including locations which will need additional survey coverage prior to project implementation and heritage sites which will need to be avoided during implementation ("CRRR #1402003"; North Shore Proj. Rec). The *North Shore EA* CRRR #1402003 was signed by the Forest Archeologist on 4 November, 2013 (North Shore Proj. Rec.).

The analysis area for heritage resources includes all proposed treatment units and proposed road treatments, including access roads to treatment units and proposed road decommissioning, within the project boundary.

No new vegetation management actions would occur under Alternative 1, therefore there would be no direct, indirect, or cumulative effects to heritage resources.

Under Alternative 2, impacts to all heritage resource sites would be avoided through application of Operational Standards and Guidelines (S-HR-9, Appendix D) and site specific mitigation measures. Heritage resource sites would be excluded from the treatment units, with the boundaries marked (where appropriate), in the field prior to project implementation.

The direct, indirect, and cumulative effects of Alternative 2 on heritage resources have been evaluated following the provisions of the 2013 Continuing Programmatic Agreement with Minnesota State Historic Preservation Officer and acknowledged by the Bois Forte Band of Chippewa, Grand Portage Band of Lake Superior Chippewa, Fond du Lac Band of Lake Superior Chippewa, and the Advisory Council of Historic Preservation. Based on review of existing data and literature and contingent upon the implementation of specified mitigation measures prior to project implementation, the Superior National Forest Heritage Resources Staff determines that there would be no effects to heritage resources under Alternative 2 (No Effects Letter Heritage, North Shore Proj. Rec.). Implementation of Operational Standards and Guidelines, mitigation measures (i.e. flag and avoid), post treatment monitoring, and maintenance of confidentiality with respect to heritage resource locations would effectively eliminate direct and indirect effects as they relate to the action alternative of the North Shore Project. There would be no cumulative effects to heritage resources, as all potential direct and indirect effects would be mitigated.

3.10.2 Eligible Wild and Scenic River Resources

The segment of the Brule River in the North Shore Project Area is classified as Scenic. The portion of the Brule River that falls within the North Shore Project Area is located in Judge C.R. Magney State Park and ownership of the adjacent land falls under the jurisdiction of the State of Minnesota. No management actions are planned in the area adjacent to the Brule River in the North Shore Project consequently no analysis is required.

The segment of the Temperance River in the North Shore Project Area is classified as Scenic. The scenic portion of the river runs from Plouff Creek to Lake Superior. The Forest Plan explains that within the scenic segment of the WSR Management Area, "silvicultural practices are allowed provided methods used would have no substantial adverse effect within the river corridor to the river's free flow, water quality, and outstanding remarkable values" (FP, p. 3-18, G-WSR-4). "Vegetative management will enhance the recreation experience and will maintain the near natural environment of the river corridor" (FP, p. 3-18, S-WSR-5). The Forest Plan also encourages vegetation management to promote long-lived tree species, leading toward the development of big-tree characteristics (FP, p. 3-19, G-WSR-6).

No new vegetation management actions would occur under Alternative 1 and therefore there would be no direct, indirect or cumulative effects to the Wild, Scenic, and Recreational resource within the North Shore Project Area.

Alternative 2 proposes vegetation management in approximately 516 acres within the one-quarter mile Wild and Scenic River corridor of the Temperance River. Of those acres, 404 acres are proposed for underplanting, where no mechanical operations would occur. The vegetation changes produce by the underplanting and other treatments would move the area toward Forest Plan desired conditions; including retaining the existing larger-sized trees and enhancing the longer-lived conifers. These types of activities are suitable within the river corridors, per Forest Plan direction (D-WSR-2, FP, p. 3-17). Since Operational Standards and Guidelines would be followed, there would be minimal resource damage. For further detail about treatment effects and specific mitigation measures applied to the corridor stands, see Wild and Scenic Rivers Resource Report in the Project Record.

At this time there are no past, present or reasonably foreseeable future actions which would impact the Temperance or Brule River Corridors within the North Shore Project Area.

3.10.3 Unique Biological Areas

The Fall River Patterned Fen, located approximately 2 miles northwest of Grand Marais, MN, in T61N R1E Sections 7, 8, 17, and 18, is classified as a Unique Biological Area (UBA) by the Superior National Forest Land and Resource Management Plan. The primary reason for this designation is that this is the northeasternmost patterned fen in Minnesota and because it is located in an unusual physiographic position just over the ridge line from Lake Superior. At the heart of this 988 acre UBA is the approximately 73

acre fen. Also within the UBA and surrounding the fen are approximately 416 acres of forested uplands and 499 acres of forested and non-forested wetlands. There are several rare plant occurrences within the patterned fen, and the North Shore State Snowmobile Trail runs through the center of the UBA.

The Forest Plan states that UBAs are managed primarily for their outstanding biological and other special values and are not suitable for timber management. With respect to UBAs, the Forest Plan states that, "Vegetation, habitat, soil productivity, and water quality are affected little by present human use. Native plant communities are maintained, restored, or enhanced." (FP, p. 3-28, D-UB-2)

Under Alternative 1 there would be no vegetation management activities; therefore, there would be no direct, indirect, or cumulative effects of project activities on the UBA. The two white spruce plantations (225-37 and 225-38) in the UBA would continue to be densely stocked with little sunlight reaching the forest floor and consequently, little vegetative diversity in the forest understory. Succession would continue throughout the UBA and paper birch stand (234-18) would continue to develop into a stand dominated by balsam fir, with little paper birch regeneration.

Alternative 2 proposes 49 acres of vegetation management activities in the Fall River Patterned Fen UBA. Different silvicultural management practices would be used to help restore and enhance the vegetation in the UBA. Unit 225-29 is an 82 year old aspen stand that would be underplanted with white pine and white spruce to increase the species diversity. Unit 234-18 is an 80 year old paper birch stand that would be mechanically site prepped to reduce balsam fir cover and prepare a seed bed for paper birch regeneration; this action would help maintain the paper birch component in the stand which is currently succeeding to balsam fir. Two units (225-37 and 225-38) are densely stocked 30 year old white spruce plantations with dense overstories and little understory diversity. These stands would be thinned to encourage development of understory plant diversity which would help restore vegetative conditions in the UBA.

The vegetation treatments proposed under Alternative 2 would occur both inside and outside of the UBA since all of the stands except 234-18 overlap the UBA boundary. The 49 acres of treatments would affect approximately 5% of the UBA area. While the treatments are intended to help restore vegetative conditions in the upland stands of the UBA, none of the treatments would affect the patterned fen for which the area was designated. None of the stands border the fen and there would be no indirect effects of the treatments on the patterned fen or the rare plants found there. Operational Standards and Guidelines for the North Shore Project would help minimize any potential spread of non-native invasive plants that could result from vegetative management in the UBA.

Chapter 4: Lists and References

4.1 Lists of Preparers and Contributors

Interdisciplinary Planning Team for the North Shore Project: This is a list of the core interdisciplinary team (IDT).

David Avery, Transportation Planner
Becky Bartol, Environmental Coordinator, Team Leader
Mike Crook, Fuels Technician
Melissa Grover, Wildlife Biologist
Myra Theimer, Silviculturist

Ad Hoc Members: This list includes individuals not on the core interdisciplinary team but contributed substantial portions to the analysis.

Dave Bartol, Forester
Jon Benson, Recreation Specialist
Ryan Brown, Heritage Resources
Suzanne Cable, East Zone Recreation and Wilderness Manager
Katie Frerker, East Zone Ecologist
Jack Greenlee, Forest Ecologist
Dave Grosshuesch, Wildlife and Silviculture Technician
Tom McCann, GIS Analyst
Casey McQuiston, Forest Soil Scientist
Harvey Sobieck, Surveying Technician
Amy Wilfahrt, Fisheries Biologist

Other Contributors: This list includes individuals who were not formal members of the interdisciplinary team but who gathered information used in the analysis process, contributed to the development of alternatives and/or prepared the environmental analysis.

Mark Beckwith, Timber Sale Administrator
Jason Butcher, Forest Fisheries Biologist
Gene Dressely, Timber Management Assistant
Kathy McTighe, Forest Silviculturalist
John Olson, Engineer
Peg Robertson, Wildlife Biologist
Brianna Schueller, Fuels Planner
Mary Shed, Forest Natural Resources Team Leader
Jill Schug, Cartographic Technician
Peter Taylor, Forest Environmental Coordinator

4.2 Distribution Lists

Scoping Package

The following individuals and organizations received a notification letter or email that the North Shore Restoration Project Scoping Report was available on the Superior National

Forest website. They were on a mailing list that was generated by the Forest Supervisor's Office and had indicated they wanted to receive information about vegetation management projects in the Gunflint District or Forest-wide.

All Terrain Vehicle Assoc. of MN	David MacLean
Arrowhead Coalition for Multiple Use	Chris Maloney
Duluth Public Library	Debbie Mark, Seagull Outfitters
Ely Echo	Thomas Martinson, Lake Co. Land Dept. (MFRP)
Forestry Library, University of MN	Peter McClelland
Town of Morse	Leslie McInenly, Minnesota Forest Resources Council
Cook County News Herald	Nancy McReady, Conservationists With Common Sense (CWCS)
Andrea Allison ,John B. Ridley Research Library	Bruce Mellor
Joanne Alt	Greg Merritt
Alan Anderson	Ray And Connie Mickolajak
Bob Anderson	Martin & Rebecca Milanese
Mike Anderson , Wilderness Society	Mike Miller
Frederick Anderson	J Phillip Morud
Curt Anderson	Judi Motschenbacher
Lori Andresen	Susan Mulholland
John Baird, Minnesota Land Trust	Daniel Mundt, Mundt & Associates
Tim Bassett	Jon & Ruth Nelson, Saganaga/seagull Homeowners Assoc.
Bruce Bates	Scott Neustel
Daniel & Teresa Baumann, Golden Eagle Lodge Inc.	Ken Norenberg, United Northern Sportsmen
Don Beans, Jasper Creek Guide Service	Lois Norrgard, Sierra Club
Rose Berens, Boise Fort Heritage Center	John Norton
Jean Bergerson	Tim O'Hara, MN Forest Industries Inc
Jim Berkeland , Blandin Forestry	Gerald Olsen
Ray Bisco	Robert And Kay Olson
Denny Bone, St. Louis Co. Land Dept.	Michael O'Phelan
Barry Bonoff	Bob Owens, Owens Forest Products
Bart Boyer	Randy Palm
Joseph Bradel	Forrest Parson, HUNGRY JACK LODGE
Wayne Brandt, MFI/MN Timber ProdAssoc.	John Paulson, Minnesota Power/land And Water
Mickey Brazell	Ray Payne
Randall Breeden	D. Robert Peterson
James Brewer	Thomas Peterson
Ron Brodigan, Great Lakes School of Log Bldg	Fred Pick, USDA Forest Service
John & Gloria Buetow	Jean Probst
Leonard Cersine	MATT PURO, Potlatch Corp.
Michael Christensen	Lee Radzak, Minnesota Historical Society
Thomas Christiansen	Wilma Rahn, Lake County Board of Commissioners
Charles Cieluch	Jim Raml
Sam Cook, Duluth News Tribune	Charles Rasor
William Corrigan	Kevin Reuther, MN. Center for Environmental Advocacy
Cindy Craig, United Northern Sportsmen	Joseph Roberts
Jim Crouch	Randy Roff
Tony Damato, UM Dept of Forest Resources	Ron Rude
Bud Darling, Gunflint Trail Outfitters' Assn	Bradley Sagen
Matthew Davis, North Country Trail Assoc.	Craig Salo
Leroy DeFoe, Fond Du Lac Tribal Office	Wilmar Salo
Norman Deschampe, Grand Portage Reservation	Jerry Schliep

Director of Ecological Services MN DNR	Lori Schmidt
Karen Diver, Fond Du Lac Tribal Office	Susan Schubert
Jeff Drew	Connie Schumann
Robert Dunn	Harmon & Karla Seaver
Scott Elkins, Sierra Club	Connie Schumann
Donald Emery	Harmon & Karla Seaver
Craig Engwall, MN DNR	Janet Simonen, Cook County Board of Commissioners
Gary Erickson, Sappi	Marilyn D. Sly
Stephen Erickson	Tamara Smith, Fish and Wildlife Services
Marc Fink, FSEEE	Mark Stange
Ric Foster, Blue Ribbon Coalition	Gwen Steel, IZAAK WALTON LEAGUE OF AMERICA
John Ganey	James And Arlene Stirratt
Thomas Gardner	Robert Stodola Jr.
Don Germain	Bud Stone
Glenn Gilyard	Jim Sulerud
Stephen Good	Bill & Helen Swanson
Alan Goodman, Lake County Highway Department	John Todd
Janet Green, MN Center for Environmental Advocacy (MCEA)	Mary & Greg Truex
Diane Greenley, ACMU	Ronald Tveiten
Greg Grell, WDSE-TV	Jim Uhrinak
Duane Gustafson	James Van Tassel
Janice Hall, Cook County Board of Commissioners	Mary Verrill
Len Hardy, Range Riders ATV Club	Darren Vogt, 1854 Authority
George Harris	Doug Wallace
Howard Hedstrom, Hedstrom Lumber Company Inc.	Robert & Sandra Walton
Bert Heep, Piragis Northwoods Co.	Jay and Ella Warmington
Jim Heinz	Kris Wegerson
Brian Henry	Jane Davis Weida
Darlene Hill	Michael West, West Logging Construction
Lynne Hill	Ken Westlake, EPA
Howard Hoganson, NCFES, University of MN	Thomas Wetzel
Lynda Horman, Kakabeka Falls Provincial Park	Mark Wiarda
Jim Howe	Dyke Williams
John Hughes	Dave Williams, Bear Track Outfitters
Scott Hull	M Wisti
John Hunt, Minnesota Trout Unlimited	Barbara Young, PoplarCreek Guesthouse B&B
William Ion	Peter Leschak
Rick Jannett	Michael Levig, Arrowhead ATV Club
Jim Jensen	Steve Loch
Douglas Johnson	John Lofgren
Warren Johnson	John Leinen, North Country Trail Assoc
Darrel Johnson	Mr. Thomas Lentz
James Johnston, FSEEE	Kevin Leecy, Nett Lake (Bois Forte) Tribal Office
David Jones, Midwest 4WD Association	
William Karow	
Richard Kayser, STORA ENSO NORTH AMERICA	
Bob and Georgine Koschak	
Martin Kubik	
Carl Kunnari	
Richard Lachenmayer	
David Larson, Bois Forte Reservation	
Robert LaTourell, LaTourell's Resort & Outfitters	

In addition, approximately 1,100 landowners in the project area received a notification letter that the North Shore Restoration Project Scoping Report was available on the Superior National Forest website. They were on a mailing list that was generated by a search of property owners within the North Shore Project Area and adjacent to proposed treatments (FinalScopingMailingList, Project Record).

Update Letter

All interested parties on the North Shore mailing list were sent a letter (or email notification) in May 2013 that provided an update on the project, as well as information on a North Shore Forest Collaborative private land owner meeting in June (UpdateMailingList, Project Record).

Environmental Assessment

The following tribal contacts will be notified of the availability of the Environmental Assessment.

Tribal Band	Contact
Grand Portage Band of Chippewa	Norman Deschampe Darren Vogt
Bois Forte Band of Chippewa	Kevin Leecy Corey Strong
	Darren Vogt
	Dave Larson
	Bill Latady
Fond du Lac Band of Chippewa	Karen Diver Nancy Schuldt
	Wayne Dupuis
1854 Treaty Authority	Millard “Sonny” Myers

Individuals and organizations who provided scoping comments or requested to keep their names on the mailing list for the North Shore Restoration Project Environmental Assessment will receive notification of its publication. Those who will receive a hard copy of the notification letter are listed below. In addition, an email notification letter will be sent to an additional approximately 80 email addresses (EAMailingList, Project Record).

Mark Adams
Mark Robin Johnson
Mary Levins
David Johanna Lockner
Gerald Shirley Olsen
Kenneth Sharon Rutford
Jane Starr
Patricia Zankman trustee
Betsy Zavoral
Michael Barbara Zins
Thomas Clifford, MD
Daniel Mundt
Mrs. Gary Graham
Geri Jensen
Polly Erickson
Paul or Jan Wicklund
Bernie Kukar
Darrel Johnson
Eric Hansen
Larry Weiss
Nancy Kasner
Duane and Sue Gustafson
Dean and Carol Einwalter
Deb Steenbakker

4.3 References and Literature Cited

Note: The Superior Forest Plan is cited simply as "FP" instead of using standard convention (USDA Forest Service 2004…) because it is so commonly referenced throughout the document. Similarly, the Record of Decision and Final Environmental Impact Statement for the Forest Plan Revision is cited as "Forest Plan ROD" and "Forest Plan FEIS" respectively. Documents that support the Forest Plan FEIS, such as the biological evaluation, are cited conventionally. The Forest Plan and Forest Plan FEIS and ROD are on the Superior National Forest website: www.fs.fed.us/r9/forests/superior.

Allombert, S., A.J. Gaston, and J-L. Martin. 2005. A natural experiment on the impact of overabundant deer on songbird populations. Biological Conservation 126 (2005). Pp.1-13.

American Bird Conservancy. 2012. Globally important bird areas of the United States. Available at: http://www.abcbirds.org/abcprograms/domestic/iba/index.html.

Callihan, R.H., D.C. Thill, Wattenbarger, D. W. 1982. Hawkweeds. University of Idaho Cooperative Extension Service, Moscow, Idaho. Publication 633. 4 p.

Cleland, D. T., Avers, P.E., McNab, W. H., Jensen, M. E., Bailey, R. G., King, T., Russell, W. E. 1997. National Hierarchical Framework of Ecological Units. In: *Ecosystem Management Applications for Sustainable Forest and Wildlife Resources*. Ed. Boyce, M.S. and A. Haney. Yale University Press, New Haven, Conn. Pp. 181-200.

Cohen, J. D., Butler, B. W. 1998. Modeling potential ignitions from flame radiation exposure with implications for wildland/urban interface fire management. In: Proceedings of the 13th conference on fire and forest meteorology, vol. 1. 1996 October 27-31; Lorne, Victoria, Australia. Fairfield, WA: International Association of Wildland Fire; Hood, 2010. Pp. 81-86.

Cook County Historical Society. 2013. Photos of wildfires along the north shore of Lake Superior, Minnesota. Available at: http://www.cookcountyhistory.org/index.php.

Council on Environmental Quality. 1981. Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations. Memorandum to Agencies. 46 Fed. Reg. 18026 (March 16, 1981). Available at: http://ceq.hss.doe.gov/nepa/regs/40/40P1.htm.

Czarapata, E. J. 2005. Invasive Plants of the Upper Midwest. University of Wisconsin Press, Madison, Wisconsin. 138 p.

Dahlman, R. 2008. Timber Harvest and Forest Management Guidelines on Public and Private Forest Land in Minnesota. Monitoring for Implementation 2004, 2005, 2006 Results Compared to Baseline Monitoring Report. St. Paul: Department of Natural Resources.

Directives: US Department of Agriculture, Forest Service. Forest Service Manual 2300 Recreation, Wilderness, and Related Resource Management, Chapter 2380 – Landscape Management.

Directives: US Department of Agriculture, Forest Service. Agriculture Handbook , No. 701, Dec. 1995, Landscape Aesthetics, A Handbook for Scenery Management.

Frerker K., Sonnier, G., Waller, D.M. 2013. Browsing rates and ratios provide reliable indices of ungulate impacts on forest plant communities. Forest Ecology and Management. Volume 291. Pp. 55–64.

Fritzen, John. The History of Lumbering on the Minnesota North Shore. 48 p.

Gleason, H.A., Cronquist A. 1991. Manual of vascular plants of northeastern United States and adjacent Canada. Willard Grant Press, Boston, Massachusetts. Pp. 552, 623.

Grigal, D. F. 2004. An Update of Forest Soils. A Technical Paper for a Generic Environmental Impact Statement on Timber Harvesting and Forest Management in Minnesota. David F Grigal, Forestry/Soils Consulting, Roseville, MN. 32 p.

Handler, S. et al. Minnesota Forest Ecosystem Vulnerability Assessment and Synthesis - A report from the Northwoods Climate Change Response Framework project, Draft, 214 p.

Krueger, J. and Sheley, R. 2002. St Johnswort (*Hypericum perforatum*). Montana State University Extension Service, MT199810AG, 7/2002.

LeCain, R. and Sheley, R. 2002. Common Tansy (*Tanacetum vulgare*). Montana State University Extension Service, MT199911AG, 2/2011.

Litchy, R., McIntosh, C., Smith, E., Simonson, J., Jacobson, J. 2001. Northern Minnesota Forestry Analysis. University of Minnesota Duluth, Bureau of Business and Economic Research, Minnesota Forest Resources Council. Available at: https://lsbe.d.umn.edu/departments/bber/projects/FEMAT/final%20report.pdf.

Lym, R.G., Christianson, K. M. 1996. The thistles of North Dakota. North Dakota State University Extension Service, Publication W-1120. 25 p.

Mace, A.C., Jr. 1971. *Recovery of forest soils from compaction by rubber-tired skidders.* Minnesota Forestry Notes No. 226. University of Minnesota, St. Paul, MN.

Minnesota Administrative Rules 1505.0640 and 1505.0730. Minnesota Office of the Reviser of Statues. Available at: www.revisor.mn.gov/pubs/.

Minnesota Department of Agriculture. 2013. Prohibited Noxious Weeds: Plumeless Thistle. September 27, 2013. Available at: www.mda.state.mn.us/en/plants/badplants/noxiouslist/plumelessthistle.aspx.

Minnesota Forest Resource Council. 2005 and 2007. Sustaining Minnesota Forest Resources: Voluntary Site-Level Forest Management Guidelines for Landowners, Loggers and Resource Managers. Minnesota Forest Resources Council, St. Paul, MN.

Minnesota Department of Natural Resources. Managing Minnesota Fish. Department of Natural Resources, Section of Fisheries, 500 Lafayette Road, St. Paul, MN 55155-4012, pp. 4-5.

Minnesota Department of Natural Resources. 2012. Invasive Aquatic Plants: Purple Loosestrife (*Lythrum salicaria*). Available at: http://www.dnr.state.mn.us/invasives/aquaticplants/purpleloosestrife/index.html.

Minnesota Department of Natural Resources. 2012. Invasive Terrestrial Plants: Siberian Peashrub (*Caragana arborescens*). Available at: http://www.dnr.state.mn.us/invasives/terrestrialplants/woody/siberianpeashrub.html.

Minnesota Department of Natural Resources. 2013. Invasive Terrestrial Plants: Reed Canary Grass (*Phalaris arundinacea*). September 27, 2013. Available at: www.dnr.state.mn.us/invasives/terrestrialplants/grasses/reedcanarygrass.html.

Minnesota Department of Natural Resources. Managing Minnesota Fish. Department of Natural Resources, Section of Fisheries, 500 Lafayette Road, St. Paul, MN 55155-4012. Pp. 4-5.

Moriarty, J. J., Oldfield, B. 1994. "Habitats" In: Amphibians and reptiles Native to Minnesota. Ed. Oldfield, Barney and John J. Moriarty. University of Minnesota Press, Minneapolis, MN. Pp. 5-12.

North Shore Mid-Level Report: Water Resources, August 2012, Amy J. Wilfahrt.

Powers, B. 2010. Conversation with Adam Felts and Braidy Powers, Cook County Auditor-Treasurer, November 1, 2010.

Puettmann, K. J., A.W. D'Amato, M. Arikian and J.C. Zasada. 2008. Spatial impacts of Soil disturbance and residual overstory on density and growth of regenerating aspen. *Forest Ecology and Management*, 256: 2110 - 2120.

Stone, D.M., Elioff, J. D. 1998. Soil properties and aspen development five years after compaction and forest floor removal. Canadian Journal of Soil Science, 78. Pp. 51-58.

Sugarloaf: The North Shore Stewardship Association. December 2005. Restoring the North Shore's Lost Costal Forest.

Thorud, D.B., and S.S. Firssell Jr. 1976. *Time changes in soil density following compaction under an oak forest.* Minnesota Forestry Notes No. 257. University of Minnesota, St. Paul, MN.

USDA Forest Service. 1998. *Characteristics of the Superior National Forest Land-type Associations.*

USDA Forest Service 2004. Forest Plan Revision Biological Assessment. Superior National Forest, Duluth, MN.

USDA Forest Service. July, 2004. Superior National Forest Land and Resource Management Plan. Available at: http://www.fs.usda.gov/superior.

USDA Forest Service. 2004b. Superior National Forest Land and Resource Management Plan Record of Decision. Available at: http://www.fs.usda.gov/superior.

USDA Forest Service. 2004c. Forest Plan Revision Final Environmental Impact Statement for Chippewa and Superior National Forests. Available at: http://www.fs.usda.gov/main/superior/landmanagement/planning.

USDA Forest Service. 2005. Forest Service Handbook 2509.18, Soil Management, Chapter 2, Soil Quality Monitoring.

USDA Forest Service. 2006a. Environmental Assessment, Superior National Forest non-native invasive plant management project. 92 p. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, MN. 55808.

USDA Forest Service. 2007. Fiscal Year 2005 Monitoring and Evaluation Report. P. 76-84. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, MN. 55808.

USDA Forest Service. 2008b. Fiscal Year 2007 Monitoring and Evaluation Report. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, MN. 55808

USDA Forest Service. 2009a. Environmental Assessment, Clara Project. Superior National Forest, Tofte Ranger District, Tofte MN. Available at: www.fs.usda.gov/goto/superior/projects.

USDA Forest Service. 2010a. Superior National Forest Non-native invasive plant species – ecological risk assessment factors and rating. Unpublished report, Duluth, Minnesota. 5 p.

USDA Forest Service. 2011. Programmatic Biological Assessment for Federally Listed Species: Gray wolf, Canada lynx, and their critical habitats for the Superior National Forest. Superior National Forest, Duluth, MN.

USDA Forest Service. 2012. Mid-Level Report, North Shore - Water Resources. Superior National Forest, Gunflint Ranger District, Grand Marais, MN. Available at the Gunflint Ranger District Office, Grand Marais, MN. 13 p.

USDA Research: Arnn, Matt; Beard, James; Mosier, Jerry. Oct. 28, 2010. Forest Service Scenery Management, Introduction and Background to SMS. USDA Forest Service, Flagstaff, AZ.

USDI Fish and Wildlife Service. 2013. Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition to List the Eastern Small-Footed Bat and the Northern Long-Eared Bat as Endangered or Threatened Species; Listing the Northern Long-Eared Bat as an Endangered Species; Proposed Rule. Federal Register 50 CFR Part 17, Docket No. FWS–R5–ES–2011–0024; 4500030113] RIN 1018–AY98.

Verry E. S., Hornbeck J. W., Dolloff C. A. 2000. Water flow in soils and streams: Sustaining hydrologic function, Riparian Management in Forests of the Continental Eastern United States. Lewis Publishers, Washington D.C. Pp. 99-124.

Verry, E. S. 2001. Land Fragmentation and Impacts to Streams and Fish in the Central and Upper Midwest. In: Proceedings. Society of American Foresters 2000 National Convention; 2000 November 12-20; Washington, DC. SAF publ 01-02. Bethesda, Maryland: Society of American Foresters. Pp. 38-44.

Wikum, D. A., Shanholtzer, G. F. 1978. Application of the Braun-Blanquet cover-abundance scale for vegetation analysis in land development studies. Environmental Management. Volume 2.4. Pp. 323-329.

Wilson, L.M., and C.B. Randall. 2002. Biology and biological control of knapweed. Forest Health Technology Enterprise Team, Morgantown, West Virginia. FHTET-2001-07, 8 p.

Zenner, E. K., J.T. Fauskee, A. L. Berger and K. J. Puettmann. 2007. Impacts of Skidding Traffic Intensity on Soil Disturbance, Soil Recovery, and Aspen Regeneration in North Central Minnesota. *Northern Journal of Applied Forestry*, 24(3). Pp. 177-183.