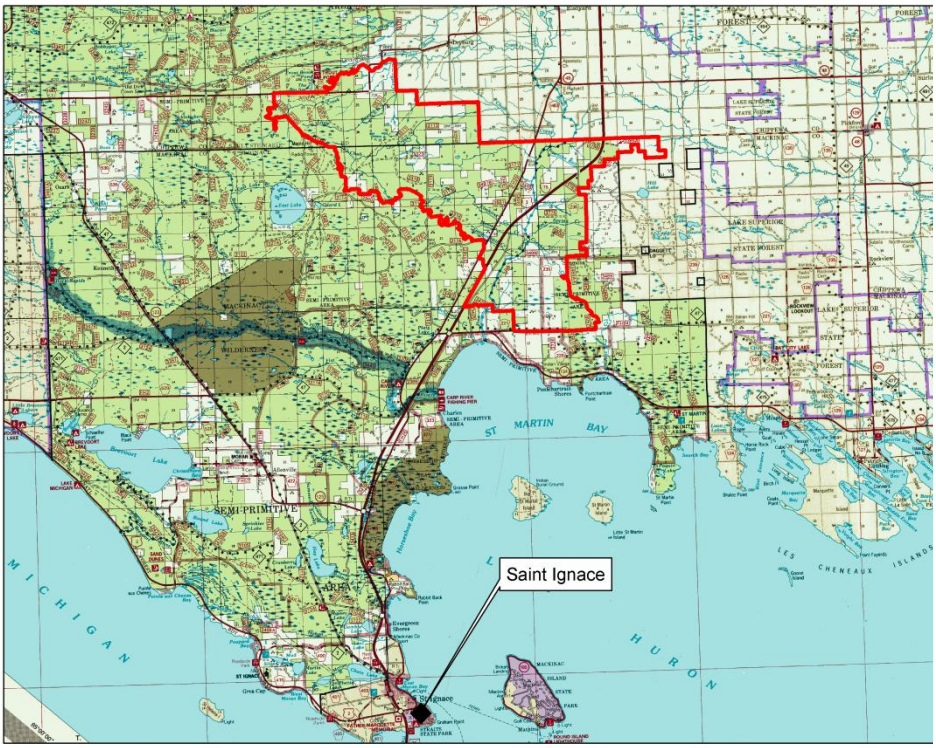
Environmental Assessment
Rudyard

United States Department of Agriculture

Forest Service Eastern Region

Hiawatha National Forest



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Cover picture: Rudyard vicinity map. The Rudyard Project Area is approximately 34,000 acres and is located on the Eastside of the Hiawatha National Forest in Mackinac and Chippewa Counties, Michigan.

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CHAPTER 1 – PURPOSE AND NEED FOR ACTION

1.1 Document Structure

The Forest Service has prepared this Environmental Assessment in compliance with the National Environmental Policy Act (NEPA) and other relevant federal and state laws and regulations. This Environmental Assessment discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into four parts:

- *Chapter 1 – Purpose and Need:* This section includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.
- *Chapter 2 – Alternatives, Including the Proposed Action:* This section provides a detailed description of the agency's proposed action, as well as alternative methods for achieving the stated purpose. These alternatives were developed based on issues raised by the public and other agencies. This discussion also includes possible mitigation measures. Finally, this section provides summary tables of the alternatives and of the environmental consequences associated with each alternative.
- *Chapter 3 – Environmental Consequences:* This section describes the environmental effects of implementing the proposed action and other alternatives. The analysis is organized by resource area. Within each section, the affected environment is described first, followed by the effects of each alternative. The No Action Alternative provides the baseline for evaluating and comparing the alternatives, including the proposed action.
- *Chapter 4 – Consultation and Coordination:* This section provides a list of agencies and individuals consulted during the development of the environmental assessment, as well as a list of preparers.
- *Appendices:* The appendices provide detailed information to support the analyses in the presented in the environmental assessment.

Additional documentation, including detailed analyses of project-area resources may be found in the project planning record located at the St. Ignace Ranger District Office in St. Ignace, Michigan.

1.2 Background

The Eastside Administrative Unit (St. Ignace and Sault Ste. Marie Ranger Districts) of the Hiawatha National Forest (HNF) is proposing a range of land management activities in an area referred to as the Rudyard project area (see Vicinity Map in Appendix G – Maps).

In 2010, a midscale assessment (MSA) was completed for Rudyard (HNF 2010, Rudyard Midscale Assessment). This assessment identified the existing condition and the desired conditions for various resources within the analysis boundary. Opportunities

and possible management practices which would move the resource conditions from the existing conditions toward the desired conditions of the Forest Plan (HNF 2006 Forest Plan) were identified. Information from the MSA was used to develop the purpose of and need for action for this analysis.

Brief Description of the Rudyard Area. The Rudyard Project is a 34,000-acre area in Mackinac and Chippewa counties, Michigan (See Appendix G – Vicinity Map). Land ownership in the analysis area is largely Forest Service (69%). Private lands are dispersed throughout the area but are primarily along the east side of the project. Some of the uses on private lands include timber, recreation, agriculture, and residential. The major agricultural crop in the area is hay. The majority of the project lies in the Pine River Patterned Wetland Land Type Association (LTA). Hydrologic Unit Code (HUC) 6th field watersheds that make up the majority of the project area are Bear Creek, Chub Creek, Elmhirst Creek-Pine River, and Pine River. Portions of Biscuit Creek, Trout Lake-Pine River, Upper Muniscong River, Martineau Creek-Frontal Lake Huron, and Nunns Creek at Mouth watersheds are also present (See Watershed Map in Appendix G – Maps). (Legal description of project area: T42N R2W, sections 4-6; T42N R3W, sections 1, 2; T43N R2W, sections 2-8, 17-20, 29, 30-32; T43N R3W, sections 1-16, 22-24, 25-27, 34-36; T43N R4W, sections 1, 2, 11, 12; T44N R3W, sections 18, 19, 27-34; T44N R4W, sections 23, 24, 25-28, 33-36)

1.3 Relation to Forest Plan

The Hiawatha National Forest Land and Resource Management Plan (Forest Plan) provides objectives, management direction, and desired conditions for large areas called management areas (MA). The Forest Plan used LTAs and social or legal criteria to establish these MA boundaries. The Rudyard project area lies within five MAs: MA 1.2, 2.3, 4.5, 6.4, 8.3 (Table 1-1), but activities are only being proposed in MAs 1.2 and 2.3. Appendix G – Maps includes a map of the MAs within the project area. Applicable Forest-wide and MA direction is in Chapters 2 and 3 of the Forest Plan, respectively. Some of these directions were used to design the specific activities so they meet Forest Plan direction (See Appendix B – Site-Specific Activities and Design Criteria).

Table 1-1. Management Areas within Rudyard

MA	Emphasis Summary of MA	Approximate Forest Service Acres	Activities Proposed
1.2	Manage aspen for fiber production to regional economy; to provide habitat and hunting opportunities for wildlife species; and to provide dispersed recreation.	31,781	Yes
2.3	Older forest management for uneven-age hardwoods and high quality sawlogs. Dispersed and developed recreation.	288	Yes
4.5	Older forest habitat for wildlife and wetland plant communities; to provide conifer sawlogs to regional economy, and to provide dispersed recreation.	767	No
6.4	Even and uneven-aged timber management, habitat for wildlife, and provide semi-primitive motorized recreation with access to hunting and fishing activities.	832	No
8.3	Even and uneven-aged timber management, wetland plant communities, secluded wildlife habitat, and dispersed recreation.	78	No

1.4 Purpose and Need for Action

The purpose of this project is to address site-specific vegetation composition, wildlife habitat, transportation system, and non-native invasive plant (NNIP) management needs in the project area. The project area boundary was created primarily using the Rudyard LTA. The boundary was then expanded to include a portion of MA 2.3 for some red pine stands that are ready for treatment and a portion along state highway H-40 to remove some scotch pine, an invasive species.

1.4.1 Vegetation Management (including Wildlife Habitat Improvements)

The Forest Plan establishes vegetation composition goals for MAs by Ecological Landtype (ELT) (Forest Plan, p. 3-7). Within this framework, minimum and maximum percentages are provided for each seral class and tree class sizes for each ELT. The Rudyard MSA used ELTs, stand data, and suitability class to determine the current vegetation composition of management area 1.2 within the Rudyard area (See Table 1-2 below). The current vegetation composition was then compared to the desired condition (Forest Plan, pp. 3-7 and 3-10).

Based on the comparison of existing and desired vegetation composition, there is a need to move the current vegetation composition in MA 1.2 closer to the desired range in the Forest Plan. Table 1-2 highlights those vegetation composition goals from the Rudyard MSA that relate to the proposed action.

Table 1-2. Need for Management by Ecological Land Types in order to move MA 1.2 towards the Forest Plan Vegetation Composition and Size Class Goals (Rudyard Midscale, 2400 Timber Management, pp 5-10)

ELT	Need for Management
ELT 20:	
Openings	There are too many acres of openings. There is a need to change land suitability in order to reduce the amount of openings
ELT 30:	
Mid Seral	There are too many acres of size class 4 mid-seral forest types. There is an opportunity to convert some of this to size class 1 aspen, which is lacking[1].
Openings	There is a need to maintain existing openings as early successional habitat in order to meet Forest Plan vegetation composition guidelines (1-3% of ELT). Additionally, there are several concerns about the effectiveness of and ability to manage some areas currently classified as openings (limited access, current state of vegetation, cold water streams, etc.). There is a need to change land suitability in order to meet composition guidelines in areas that are better suited for current and future early successional/opening management.
ELT 40/50/90:	
Aspen	There are too many acres of size class 4 aspen and not enough acres of size class 1, 2, and 3 aspen[1].
Mid Seral	There are too many acres of size class 4 mid-seral forest types, and too few in size classes 1 and 2[1].
Openings	Openings are not part of the Forest Plan composition guidelines for these ELTs. There is a need to change land suitability to eliminate areas classified as openings and manage these areas according to Forest Plan direction.
ELT 60:	
Aspen	There are too many acres of size class 4 aspen and not enough acres of size class 1, 2, and 3 aspen[1].
Late Seral	There is a need to move some late seral stands into size class 5[1].
Openings	There is a need to maintain existing openings as early successional habitat in order to meet Forest Plan composition guidelines (1-3% of ELT). Additionally, there are several concerns about the effectiveness of and ability to manage some areas currently classified as openings (limited access, current state of vegetation, cold water streams, etc.). There is a need to change land suitability in order to meet composition guidelines in areas that are better suited for current and future early successional/opening management.

[1] Size classes:
Size class 0 – Open lands (upland and lowland)
Size class 1 – Less than 4.5 feet tall
Size class 2 – Greater than 4.5 feet tall to 4.9” DBH
Size class 3 – 5.0” to 8.9” DBH
Size class 4 – 9.0” to 17.9” DBH
Size class 5 – Greater than 18” DBH

ELT	Need for Management
ELT 70 A/B:	
Openings	Openings are not part of the Forest Plan vegetation composition guidelines for this ELT. The existing openings are growing in. They can be allowed to continue to grow in. There is a need to change land suitability to eliminate areas classified as openings and manage these areas according to Forest Plan direction.
ELT 80B:	
Openings	There are no Forest vegetation composition goals for this ELT.

In addition to the needs described in the above table, there are some additional needs that result in timber harvest. There is a need to thin some stands to increase growth and vigor of individual trees (Smith, 1962). There is a need to create stands resilient to future insect and disease outbreaks. There is also a need to support the local economy. This includes the need to manage some red pine stands in MA 2.3.

Providing commercial wood products for mills in the Upper Great Lakes Region is part of the purpose and need for this project (Forest Plan p. 2-10).

In some stands, there is a need to remove small trees as part of the site preparation for natural regeneration. This work has typically been accomplished by sending people using chainsaws in after the harvesting to cut and lay on the ground small diameter (greater than 2" to less than 5" DBH) trees to allow full sunlight to reach the forest floor and stimulate the natural regeneration of desired species (Manager's Handbook for Aspen in the North Central States, 1977). Traditional timber merchantability specifications on the Hiawatha NF include trees LARGER than 5" DBH up to a minimum diameter inside bark at the top of 4". If it is possible to find loggers who are willing to either cut and leave or cut and remove the smaller diameter trees at the same time they are harvesting the larger trees it could decrease reforestation costs.

The Forest Plan guideline for timber rotation age of aspen in MA 1.2 is 35-70 years (Forest Plan, p. 2-12). Normally the Forest Service would not propose regeneration of aspen stands until they are at least 35 years old. In past management, large blocks (40 to 180 acres) were created from aspen salvage harvesting (Rudyard EA, 2001, p. 57). Because of these large blocks, there is a need to cut some aspen stands younger than 35 to create a balanced successional age class structure. MA 1.2 places a strong emphasis on aspen habitat for wildlife, particularly in blocks which range from 10 to 25 acres in size (Forest Plan, p. 3-5). In several ELTs there is a need to create more acres of size class 1 aspen habitat. If it is possible to find loggers who are willing to either cut and remove or cut and lay on the ground the trees in stands that are younger than 35 years old and dominated by trees that are 3" to 7" in diameter, these smaller blocks of young aspen regeneration could be created. This would require a site-specific, non-significant amendment for these stands (See Appendix I, Non-Significant Forest Plan Amendment 1).

As illustrated in Table 1-2, some wildlife openings do not meet Forest Plan direction (See Forest Plan, page 3-6 and Table 3-2, page 3-7). There is a need to maintain, create, and reclassify upland openings to reflect Forest Plan vegetation and wildlife habitat goals. Needs are reflected in the following 3 areas:

- There is a need to remove some areas currently classified as openings that do not meet Forest Plan direction and reclassify them as areas suitable for timber production. (See Appendix I, Non-significant Forest Plan Amendment 2).

- There is a need to remove some areas classified as suitable for timber production and create wildlife openings in more desirable areas. (See Appendix I, Non-significant Forest Plan Amendment 2).

- There is a need to maintain some wildlife opening areas that are growing into tree cover as early successional areas.

1.4.2 Transportation

The project area contains numerous roads, but some are too narrow and bumpy for the heavy truck traffic associated with management activities. Some stands proposed for management activities do not have road access. For this reason, there is a need to reconstruct some existing roads and to construct some new roads to meet modern design standards and to provide safe access to stands proposed for management activities.

There is also a need to decommission roads within the project area that are no longer needed for management access, have no recreation value, or are causing resource damage.

1.4.3 Non-Native Invasive Plants (NNIP)

NNIP can impact the composition, structure, and function of native plant communities. Typically, NNIP spread rapidly because they produce many seeds from a single plant. This allows them to displace native plants and to alter native plant communities. For this reason, there is a need to treat existing and potential future NNIP infestations, including the non-native Scotch pine, by manual, mechanical, or chemical methods.

1.5 Proposed Action

To meet the purpose and need, the St. Ignace/Sault Ste. Marie District Ranger is proposing the following activities. Implementation would occur over the next 5-8 years. The proposed action is described in detail in Chapter 2, section 2.2.1. See also Proposed Action Map in Appendix G – Maps.

- Harvest approximately 1,459 acres using commercial thinning, commercial thinning/liberation cut, coppice cut, improvement cut, single-tree selection cut, and clearcut harvest methods.

- Wildlife habitat improvement actions on approximately 315 acres

- Prepare sites for planting, seeding and natural regeneration on approximately 142 acres by mechanical methods and 667 acres by either mechanical or manual site preparation.

- Plant trees on approximately 142 acres.

In addition, the following connected actions are proposed:

- Construct approximately 4.3 miles of permanent and 2.1 miles of temporary roads.

- Maintain or reconstruct approximately 26.9 miles of existing system roads to access vegetation management actions.

- Add approximately 1.4 miles of roads to existing roads database (administrative change).

- Construct 2 log landings.

- Decommission approximately 0.6 miles of roads

- Close approximately 0.2 miles of roads.

- Treat NNIP along approximately 6.25 miles of roadside and 67 acres of infestation sites.

1.5.1 Modifications to the Proposed Action

Two roads will remain closed instead of decommissioned. A response to scoping from the Shore to Shore Chapter of the North Country Trail Association (NCTA) proposed a reroute of a portion of the trail within the project area. It was determined that the proposed reroute did not meet the purpose and need of this project. However, the proposed action has been modified to close forest roads (FR) S132J and S132H instead of decommissioning them to allow a separate environmental analysis of the trail in the future to consider using these roads as portions of the trail. This change results in reducing the mileage of roads to be decommissioned from 2 miles to 0.6 miles. These roads are already classified as operational maintenance level (OML) 1, closed to motorized traffic in the system roads database.

1.6 Decision Framework

The District Ranger of the St. Ignace and Sault Ste. Marie Ranger Districts will make the following decisions based on the interdisciplinary analysis.

- Is an environmental impact statement (EIS) needed? If an EIS is not needed, the responsible official will issue a decision notice and finding of no significant

impact. The decision notice will describe the selected alternative and the rationale for that alternative.

- Do the proposed activities and alternatives implement Forest Plan direction, and meet the purpose and need for the project?

- Do the alternatives respond to the issues?

- Should the proposed action, portions of the proposed action (modified), one of the action alternatives, or the no action alternative be selected?

- If an action alternative is selected, what mitigation measure(s) and monitoring will be required during implementation?

- Are there any Forest Plan amendments needed?

1.7 Tribal Consultation and Public Involvement

1.7.1 Tribal Consultation

The following Tribes were contacted during March 2012: Bay Mills Indian Community, Bad River Chippewa Tribe, Fond Du Lac Chippewa Tribe, Great Lakes Indian Fish and Wildlife Commission, Keweenaw Bay Indian Community, Lac Courte Oreilles Tribal Government, Lac Vieux Desert Tribe, Lac Du Flambeau Tribe, Mille Lacs Chippewa Tribe, St. Croix Chippewa Tribe, Little River Band of Ottawa Indians, Sault Ste. Marie Tribe of Chippewa Indians, Grand Traverse Band of Ottawa and Chippewa Indians. Comments were received from the Bay Mills Indian Community, which were used by the Interdisciplinary Team to develop the list of issues to address.

1.7.2 Public Involvement

The proposal was listed in the April 2012 Schedule of Proposed Actions (SOPA), and in each subsequent SOPA since then. The proposal was provided to the public and other agencies for comment during scoping in March 2012. Letters were mailed to adjacent landowners, and to individuals and organizations on the HNF mailing list that have expressed an interest in receiving information pertaining to this or similar projects. In addition, as part of the public involvement process, the agency had a notice published in Sault Ste. Marie's *The Evening News* newspaper on March 29, 2012. The scoping package was posted on the HNF website. Twenty eight responses were received.

After receiving written comments, a field trip was held by the Forest Service on July 12, 2012 to provide the opportunity for interested individuals to visit some of the sites and ask questions of Forest Service specialists. Two members of the public attended the field trip.

Using comments from the public and other agencies, the interdisciplinary team developed a list of issues to address.

1.8 Issues

Comments from the public, other agencies, and the Bay Mills Indian Community were used to formulate issues concerning the proposed action. The Forest Service separated the issues into two groups: issues and non-issues. Issues are defined as those directly or indirectly caused by implementing the proposed action. Non-issues are identified as those: 1) beyond the scope of the proposed action; 2) already decided by law, regulation, policy, Forest Plan, or other higher level decision; 3) irrelevant to the decision to be made; 4) conjectural or not supported by scientific or factual evidence. A summary of comments and the Forest Service response to the comments can be found in Appednix A (Appendix A – Response to Scoping Comments).

The Forest Service identified five topics raised during scoping. These issues include:

1.8.1 Cultural Resources

A chert outcrop was identified in the Project Area. Ground disturbance may affect the cultural resources in this site (see comment from respondent # 13 in Appendix A – Response to Scoping Comments).

The concern expressed about the chert outcrop is not an issue because the site will be protected through the implementation of the site avoidance measures described in Chapter 2, Section 2.3.6.

1.8.2 Vegetation including Timber Management and Wildlife Habitat (Non-significant Forest Plan Amendments)

Comments were received from several people with concerns about the vegetation management proposed actions. Specifically, many expressed concern that the need identified in the scoping letter to have two non-significant Forest Plan amendments was driven by a desire to supply a proposed cellulosic ethanol plant slated for construction in 2013.

It is the understanding of the Forest Service that the only product such a plant would utilize would meet traditional pulp mill specifications. Pulp mills in the Upper Peninsula of Michigan generally use trees greater than 5” DBH.

Current markets for smaller than 5” diameter stems have been highly variable but generally restricted to firewood and wood chips for landscaping uses or generation of electricity. By amending the Forest Plan, the Rudyard Proposed Action would give the Forest Service the opportunity to try a different approach to meeting resource objectives in a cost-effective manner if there is a way to market a small quantity of smaller trees by allowing the removal of the smaller trees instead of paying to have them cut to meet site preparation needs.

Although disagreement over the purpose and need is not an issue, given the comments received, the following issues statements are related to the environmental effects since some commenters were concerned that the Purpose and Need for harvesting smaller, younger trees was only to provide more material to a certain market:

Specific Issue Statements (see comments from respondents # 14, 16, 17, 19, and 20 in Appendix A – Response to Scoping Comments):

1. The site-specific amendment of the Forest Plan may lead to a Forest-wide cutting before rotation age and does not represent the management of those stands for the best value if it produces low-value biomass now instead of high-value pulpwood later.

2. The site-specific amendment of the Forest Plan to allow some of the wildlife openings to become reforested may lead to the cutting of trees in other areas to create new wildlife openings in order to provide more biomass.

3. Removal of trees that results in an increase in distance between trees may result in drier conditions due to increased sunlight and there may be a significant reduction in growth of trees and ground cover.

These issues will be addressed through alternative development in chapter 2 and the effects analysis for vegetation, wildlife, and soils in chapter 3.

Unit(s) of measure:

- Acres of early seral wildlife habitat

- Age class distribution

1.8.3 Spread of NNIS

Use of heavy equipment and other ground disturbing activities in roads and stands could increase the spread of NNIS, particularly in C129 S32 where site preparation is proposed (see comments from respondents # 17 and 27 in Appendix A – Response to Scoping Comments).

This issue will be addressed through effects analysis for Non-native Invasive Species.

Unit(s) of measure:

- Risk of spread by each alternative

1.8.4 Recreational Experience

Timber harvesting activities will adversely impact recreational experience (see comment from respondent # 20 in Appendix A – Response to Scoping Comments).

This issue will be addressed through the Mitigation Measures Common to All Action Alternatives section in chapter 2 and the effects analysis for recreation in chapter 3.

Unit(s) of measure:

- Number of days recreationists could be displaced from dispersed and developed recreation sites, and trails.

1.8.5 Sedimentation

Improvement cuts could contribute to sedimentation of waterways (see comment from respondent # 27 in Appendix A – Response to Scoping Comments).

This issue will be addressed in the Water Quality/Quantity effects section in chapter 3. Appendix B – Site-specific Activities and Design Criteria describes requirements for equipment operations by each soil type.

Unit(s) of measure:

- Miles of streams with impaired water quality

CHAPTER 2 – ALTERNATIVES, INCLUDING THE PROPOSED ACTION

2.1 Introduction

This chapter describes and compares the alternatives considered for the Rudyard project. It includes a description of each alternative considered. Map(s) for each alternative can be found in Appendix G – Maps. This section also presents the alternatives in comparative form, sharply defining the differences between each alternative for the public and providing a clear basis for choice among options by the decision maker. Some of the information used to compare the alternatives is based upon the design of the alternative and some of the information is based upon the environmental, social, and economic effects of implementing each alternative. The proposed action was modified to close FR S132J and S132H, instead of decommissioning them. This was done so that these roads may be used as possible alternative routes of the North Country Trail (NCT) under a separate environmental assessment and decision document in the future.

2.2 Alternatives Considered in Detail

Based on issues identified through public comment on the proposed action, the Forest Service developed one additional alternative that would meet the purpose and need described in section 1.4. A no-action alternative is being analyzed to provide a baseline for estimating the effects of other alternatives. The following section describes in detail the proposed action, the alternative, and no action.

2.2.1 Proposed Action

The Proposed Action was developed to meet the purpose and need for action in Section 1.4 (see Appendix C – Silviculture and Transportation and Appendix G – Maps). The Proposed Action would include activities in vegetation management (to include wildlife habitat improvement), transportation management, and NNIP management. Some issues were addressed as design criteria for the Proposed Action (Issue 1.8.1).

2.2.1.1 Vegetation Management – Proposed Action

Table 2-1 is a summary of the proposed treatment types, including treatments to improve wildlife habitat.

Table 2-1. Proposed Action Vegetation Management Actions

Activity	Approximate Acres
Commercial Thin	141
Commercial Thin/Liberation Cut	409
Coppice Cut	154
Improvement Cut	309
Single-tree Selection Cut	144
Clearcut	302
Wildlife Habitat Improvement 1. Wildlife improvement Clearcuts 2. Convert wildlife openings to forested lands 3. Convert Forested lands to wildlife openings 4. Maintain wildlife openings	 63 174 55 25
Mechanical Site Preparation	56
Mechanical or Manual Site Preparation	667
Natural Regeneration	667
Plant Trees	142

The commercial thinning would be in red pine plantations to improve quality of the stand and to reduce “row” appearance of the plantations. Some red pine stands have interplanted rows of yellow birch and white pine and the liberation cuts would release the birch and white pine from competing trees. The white pine would also be pruned to control blister rust.

Coppice cuts are clearcuts of about 10 acres designed to provide early successional habitat and improve age class diversity. While this type of cut has some commercial value, it is not being proposed for the purpose of lumber or fiber production, but to address wildlife habitat needs. These cuts would be candidates for stewardship contracting, as both the commercial and non-commercial trees would need to be cut. Because these are young stands, a non-significant Forest Plan amendment (see Appendix I – Forest Plan Amendments) is needed in order to cut before the stand reaches rotation age.

The majority of the improvement cuts would be in northern hardwoods with aspen mixed in. The aspen pockets would be cut, creating small regenerating patches. The hardwoods would be thinned to improve growth and form. One stand of aspen and white pine would be cut to release the white pine.

Single-tree selection would occur in one stand that has a mixture of most tree species that occur on the HNF. Poorly formed and diseased trees would be removed and red oak would be planted in canopy gaps.

Twenty-two clearcuts would be created, ranging between 10 and 25 acres each. They would be primarily aspen or aspen with a mixture of conifers. This treatment method would retain, if present, some overstory of white pine, spruce, or cedar.

About 52 acres would be divided into10-acre clearcuts designed to provide early successional habitat and improve future age class diversity. Because these stands are younger than 35 years, a non-significant Forest Plan amendment (Appendix I – Forest Plan Amendments) is needed in order to cut before the stand reaches rotation age.

About 30 acres of commercial and non-commercial harvest in designated upland openings would remove encroaching vegetation and result in these areas being managed as wildlife openings. Additionally, about 50 acres of suited, early successional habitat would be harvested and designated for future management as wildlife openings. Suitability classification would be updated in the second Forest Plan amendment (Appendix I Forest Plan Amendments) to reflect the change from a suited forested condition to an unsuitable/opening condition.

Existing wildlife openings that fall outside areas currently identified as old growth by the Forest Plan that are undesirable because of location or other factors (about 158 acres) would be allowed to revegetate and be reclassified to a suited forested condition. Wildlife openings that fall within areas currently identified as old growth by the Forest Plan that are undesirable because of location or other factors (about 14 acres) would be allowed to revegetate and be reclassified to another unsuited forested condition. These changes would be made due to Forest Plan direction, size/age of current vegetation, and access limitations. The suitability changes for opening creation and removal would be part of the second non-significant Forest Plan amendment (Appendix I – Forest Plan Amendments) to correct these land classification changes.

Mechanical site preparation involves the use of a skidder or dozer to expose bare mineral soil and remove competing vegetation in order to create conditions favorable for the regeneration. It may also involve removing undesirable advance regeneration while harvesting the stand. Undesirable advanced regeneration would include damaged trees, trees with poor form, diseased trees, and trees that would impede the growth of desirable trees.

Manual site preparation involves the use of chainsaws to remove undesirable advanced regeneration.

Two stands are to be planted only. One is a stand that was cut five years ago and is still understocked. The other is an opening to be converted to a forested condition.

2.2.1.2 Transportation – Proposed Action

Table 2-2 summarizes the proposed transportation management actions. These transportation actions are proposed to improve transportation system to allow the vegetative management to occur and to reduce damage from unneeded roads. See Proposed Action map in Appendix G for transportation activity locations.

Table 2-2. Proposed Transportation Management Actions

Activity	Approx. length/amount
Construct system roads	4.3 miles
Construct temporary roads	2.1 miles
Construct 2 log landings	400 feet total
Alpha numeric roads added to system	1.4 miles
Reconstruct existing system roads to access veg management	26.9 miles
Decommission roads	0.6 miles
Road closures	0.2 miles

The transportation proposed action was developed to meet the Purpose and Need described in Section 1.4.2.

System and temporary road construction, log landing construction, and existing road reconstruction would be used to access vegetation management activities. The alpha-numeric roads shown in table 2-2 are listed in the Forest database as system roads, but were originally discovered during inventory. A determiniation would be made to give them a system road number and manage them as system roads.

Road decommissioning and closure would remove or block roads to protect from further resource damage or eliminated unneeded roads.

2.2.1.3 NNIP – Proposed Action

Table 2-3 summarizes known NNIP locations that are proposed for treatment.

Table 2-3. Proposed NNIP Locations by Treatment Method

Location	NNIP Species Present	Infested Area (Roadsides)	Treatment Method
Co Rd 230	Wild parsnip, spotted knapweed, St. Johnswort, white sweet clover, Canada thistle	1 mile	Hand pull, mow, or chemical
FR 3800	St. Johnswort	<¼ mile	
FR 3320	Spotted knapweed, St. Johnswort, white sweet clover	¼ mile	
FR 3801	St. Johnswort	<¼ mile	
Co Rd 235	Leafy spurge	<¼ mile	

FR 3822	Spotted knapweed	<¼ mile	
Co Rd 230 (near I-75)	Spotted knapweed, leafy spurge, St. Johnswort	½ mile	
FR 3783	Spotted knapweed, St. Johnswort	½ mile	
FR 3521 at FH-84	Wild parsnip, St. Johnswort	½ mile	
FR 3497B	Spotted knapweed, white sweet clover	¼ mile	
FR 3511G	Bull thistle, marsh thistle	¼ mile	
FR 3371	St. Johnswort	<¼ mile	
H-40	Spotted knapweed, St. Johnswort, white sweet clover	1½ miles	
FR 3318	Spotted knapweed	<¼ mile	Hand pull or mow
Location (Compartment, Stand)	**NNIP Species Present**	**Infested Area (Acres)**	**Treatment Method**
C 98, S 12 (near Co Rd 324)	Wild parsnip, spotted knapweed	2 acres	Hand pull or chemical
C97, S43 (near FR 3744)	Marsh thistle	<1 acres	
C 28, S 12 (FR 3497 near Mackinac Trail)	Marsh thistle	8 acres	
C 130, S 1 Pipeline corridor	Reed canary grass	<1 acre	Chemical
Big Spring Gravel Pit	Spotted knapweed, Canada thistle, white sweet clover	9 acres	
H-40	Scotch pine	64 acres	Mechanical

Treat NNIP through manual, mechanical, or chemical methods at sites with known NNIP infestations and sites likely to be infested because of this project. See the Rudyard EA Proposed Action Map for NNIP activity locations (Appendix G – Maps; some NNIP locations are too small to show on map).

2.2.2 No Action Alternative

Under the No Action Alternative, current conditions would continue to guide management of the project area. Activities that would not require an environmental analysis, such as dispersed recreation use, annual road maintenance, snowmobile trail use and maintenance, and wildfire suppression would still continue.

No vegetation management, wildlife and fisheries projects, NNIP management, transportation management, or recreation projects would be proposed to accomplish the Purpose and Need for Action in chapter 1.

This alternative responds to all issues (section 1.8) because no activities would take place.

For more detailed information about the No Action Alternative, see section 2.4 Comparison of Alternatives.

The no action alternative would not meet the purpose and need for the project, but is included to show comparison between the Propose Action and alternatives and the baseline conditions.

2.2.3 Alternative 1

This alternative is designed to address the vegetation management and NNIP issues (Issues 1.8.2 and 1.8.3, respectively) while meeting the purpose and need to the extent possible.

The following activities would be reduced in acreage or eliminated under this alternative:

- Only aspen stands older than 35 years old would be harvested.
- Approximately 174 acres of lands that are classified as suited upland openings would remain suited as upland openings.
- Approximately 55 acres of lands that are classified as suitable for timber production would remain suitable for timber production.
- Tree planting would be reduced by approximately 7 acres.
- Commercial harvesting would be reduced by approximately 10 acres.
- Non-commercial harvesting would be reduced by approximately 42 acres.

The Forest Plan would not be amended.

Specific stands included in the Proposed Action that would not have any actions under this alternative can be found in Appendix I – Forest Plan Amendments.

For all stands not associated with the Forest Plan amendments, the harvest method, reforestation activities, and transportation activities are the same as the proposed action.

The reduction in acres being actively managed results in 1.8 miles less existing system roads that would need maintenance and/or reconstruction.

Alternative 1 also responds to issue 3, the spread of NNIS, by reducing the amount of acres impacted from harvesting activities.

2.2.3.1 Vegetation Management – Alternative 1

Table 2-4 summarizes the treatment types that would occur in Alternative 1. See descriptions of the actions in section 2.2.1 above.

Table 2-4. Alternative 1 Vegetation Management Actions

Activity	Approximate Acres
Commercial Thin	141

Commercial Thin/Liberation Cut	402
Coppice Cut	154
Improvement Cut	306
Single-tree Selection Cut	144
Clearcut	302
Wildlife Habitat Improvement 1. Wildlife improvement Clearcuts 2. Convert wildlife openings to forested lands 3. Convert Forested lands to wildlife openings 4. Maintain wildlife openings	 21 0 0 25
Mechanical Site Preparation	48
Mechanical or Manual Site Preparation	621
Natural Regeneration	534
Plant Trees	135

2.2.3.2 Transportation Management – Alternative 1

Table 2-5 summarizes the proposed transportation management actions. See Alternative 1 map in Appendix G for transportation activity locations.

Table 2-5. Alternative 1 Transportation Management Actions

Activity	Approx. length/amount
Construct system roads	4.3 miles
Construct temporary roads	2.1 miles
Construct 2 log landings	400 feet total
Alpha numeric roads added to system	1.4 miles
Reconstruct existing system roads to access veg management	25.1 miles
Decommission roads	0.6 miles
Road closures	0.2 miles

2.2.3.3 NNIP – Alternative 1

There are no changes in treatment of NNIP in Alternative 1 from the Proposed Action (See Table 2-3 Proposed NNIP Locations by Treatment Method).

2.3 Mitigation Measures (Design Criteria) Common to All Action Alternatives

Mitigation measures (Design Criteria) were developed to avoid or lessen some of the potential impacts the various alternatives may cause. Unless specifically listed in the description of the alternative, the following mitigation measures apply to all action alternatives. Design Criteria for site-specific activities may also be found in Appendix B – Site-specific Activities and Design Criteria.

2.3.1 Wildlife

Implement current goshawk and red-shouldered hawk conservation measures (Piehler 2006) and bald eagle management guidelines (USDI 2007) when and if necessary. Mitigation effectiveness is documented in the Project File (Huebner, 2012).

2.3.2 Soils and Hydrology

Equipment operation (except in emergency operations) would only occur when soils are capable of supporting equipment without incurring detrimental compaction, puddling, or rutting. Stand specific recommendations for preferred season of operation and application of Best Management Practices for compliance with Sustainable Soil and Water Quality Practices on Forest Land (Michigan DNR/DEQ 2009) can be found in Appendix B – Site specific Activities and Design Criteria.

2.3.3 Botany

New TES species locations that may be found during analysis or project implementation would be protected using appropriate reserve areas. Protection measures for TES plants would be reviewed on a case-by-case basis (Hiawatha Plant Protection Guidelines Memo, 2008).

Locally native plant materials would be used to the greatest extent practical for site restoration following activities such as closing roads and restoring logging landings.

In stands to be commercially thinned or selectively harvested, most trees adjacent to permanent roads would be retained unless they need to be cut for road construction, maintenance, or safety standards. Most trees along access roads to these types of harvest units would also be retained where access roads are outside of the cutting units. This would maintain shade over the road to reduce the establishment of non-native invasive plants.

Gravel, topsoil, mulch, and seed would only be obtained from a source where NNIP reduction practices are being used.

Design criteria related to mechanical and manual control activities, herbicide use, and TES plant and animals in the Non-Native Invasive Plant Control Project (Decision Notice, 2007) would be implemented for NNIP treatment activities in this project area.

2.3.4 Recreation

The following measures will be used to reduce impacts to the North Country Trail (NCT):

Post safety signs identifying harvest activity in stands the NCT passes through.

The NCT will be clearly marked by the standard trail markings before sale area preparation begins so the trail tread can be adequately protected during harvest activities, and can be located after harvest activities.

If logging equipment has to cross the NCT, the crossings would be minimized. The crossings would also be designated by the timber sale administrator. Crossings would be rehabilitated after harvest.

No log decking would occur along the NCT unless the trail is also a system road.

Timber marking prescriptions along the NCT would retain a slightly higher stocking level for 30 feet on either side to discourage the establishment of brush along the trail (brush increases maintenance and may introduce non-native invasive plants). See table B-1 in Appendix B for specific stands that NCT pass through.

For those roads slated for decommissioning that cross the NCT, the tread of the NCT should remain intact.

2.3.5 Karst Features

Protect caves and sinkholes by establishing a reserve area 200 feet from the edge of the feature in all directions. No roadwork, logging activities, or other earth disturbance would take place within the established reserve area. Reserve areas would be established prior to implementation of project activities with the assistance of the district hydrologist, geologist, or botanist. Caves and sinkholes are defined as follows.

> Cave – Any naturally occurring void, cavity, recess, or system of interconnected passages beneath the surface of the earth or within a cliff or ledge and which is large enough to permit a person to enter, whether the entrance is excavated or naturally formed. (FCRPA 1988; FSM 2880.05)
>
> Sinkhole/Sink – Depressions in the surface of a karst area created when limestone or other soluble rock is partially dissolved by groundwater. Sinkholes are often bowl-shaped and can be a few to hundreds of feet in diameter and more than 100 feet deep. Drainage into a sinkhole flows directly into the subsurface, typically an underground stream.

2.3.6 Heritage Resources

Protect and avoid all heritage resources located within 30 meters (100') of activity areas proposed for the Rudyard EA. Heritage sites will be avoided through the establishment of protection zones around individual sites, wherein no earth disturbing activities will be permitted. The implementation of such measures effectively removes the area of the heritage site from the area of potential effects.

Purpose of Mitigation Measure: To avoid, protect, and preserve the archaeological and/or architectural integrity of heritage resources located on public lands managed by the Hiawatha National Forest (see Forest Plan 2006, p. 2-7 and 2-8). Previous HNF monitoring and site evaluation reports confirm that site avoidance measures constitute an effective means for long-term protection (Forest Plan Monitoring Report 2010). The greatest threats to heritage resources are natural erosion and relict hunting or looting.

2.4 Comparison of Alternatives

Information in the following tables is focused on the activities associated with each alternative and the effects of implementing each alternative.

2.4.1 Comparison of Activities

Tables 2-6 and 2-7 provide a summary of activities by alternative

Table 2-6 Vegetation Management Comparison of Alternatives

Activity	Proposed Action Acres	Alternative 1 Acres	No Action Acres
Commercial Thin	141	141	0
Commercial Thin/Liberation Cut	409	402	0
Coppice Cut	154	154	0
Improvement Cut	309	306	0
Single-tree Selection Cut	144	144	0
Clearcut	302	302	0
Wildlife Habitat Improvement 1. Wildlife improvement Clearcuts 2 Convert wildlife openings to forested lands 3. Convert Forested lands to wildlife openings 4. Maintain wildlife openings	 63 174 55 25	 21 0 0 25	 0 0 0 0
Mechanical Site Preparation	56	48	0
Mechanical or Manual Site Preparation	667	621	0
Natural Regeneration	667	534	0
Plant Trees	142	135	0

Table 2-7 Transportation Comparison of Alternatives

Activity	Proposed Action	Alternative 1	No Action
Construct system roads	4.3 miles	4.3 miles	0 miles
Construct temporary roads	2.1 miles	2.1 miles	0 miles
Construct 2 log landings	400 feet total	400 feet total	0 miles
Alpha numeric roads added to system	1.4 miles	1.4 miles	0 miles
Existing system roads to access veg management	26.9 miles	25.1 miles	0 miles
Decommission roads	0.6 miles	0.6 miles	0 miles
Road closures	0.2 miles	0.2 miles	0 miles

2.4.2 Comparison of Effects

Resource Area	Activity or Measure	Proposed Action Effects	Alternative 1 Effects	No Action Effects
Air Quality	Harvest activities; including vehicles, equipment, chainsaws, etc.	No effect on Class I attainment area	No effect on Class I attainment area	No effect on Class I attainment area
Fire Ecology and Fuels	Canopy removal activities, including wildlife openings maintenance	Increases open, sunny conditions favorable herbaceous vegetation vs. wood vegetation. Increase ease to which wildfires are suppressed on 544 acres.	Increases open, sunny conditions favorable herbaceous vegetation vs. wood vegetation. Increase ease to which wildfires are suppressed on approximately 502 acres.	No change
Fire Ecology and Fuels	Mechanical site preparation	Rearrange fuels from greater vertical depth to less vertical depth (compacted) on 723 acres. Compacting fuels decreases receptivity to fire brands.	Rearrange fuels from greater vertical depth to less vertical depth (compacted) on 669 acres. Compacting fuels decreases receptivity to fire brands.	No change
Fire Ecology and Fuels	Road construction	No Change	No Change	No change
Fire Ecology and Fuels	Road decommissioning and closure	No Change	No Change	No change
Fire Ecology and Fuels	Construction and use of log landings or	No Change	No Change	No change

Resource Area	Activity or Measure	Proposed Action Effects	Alternative 1 Effects	No Action Effects
	back-ins			
Soils	Soil compaction and displacement from heavy equipment operations.	Some compaction and diplacement will occur on approximately 92 acres of land but will be within Soil Quality Standard (SQS).	Some compaction and diplacement will occur on approximately 87 acres of land but will be within SQS.	No soil compaction or displacement will occur.
Soils	Soils removed and/or compacted from road construction activities.	Roads will impact approximately 19 acres of land but will be within SQS.	Roads will impact approximately 19 acres of land but will be within SQS.	No new road activities are proposed.
Water Quality and Quantity	Potential stream destabilization as a result of timber harvesting and subsequent increases in peakflow.	There is not anticipated to be any stream destabilization from increased peakflows. New forest stand openings will be within the plan standards of less than 60 percent of total 6th HUC watershed combined area in stands less than 16 years old and upland openings.	There is not anticipated to be any stream destabilization from increased peakflows. New forest stand openings will be within the plan standards of less than 60 percent of total 6th HUC watershed combined area in stands less than 16 years old and upland openings.	There will be no stream destabilization from timber harvests.
Water Quality and Quantity	Potential for sediment delivery to streams.	There is a low potential and state BMPs will be used to protect stream channels from sediment delivery and	There is a low potential and state BMPs will be used to protect stream channels from sediment delivery and meet forest plan standards.	There will be no sediment delivery from activities.

Resource Area	Activity or Measure	Proposed Action Effects	Alternative 1 Effects	No Action Effects
		meet forest plan standards.		
Wetlands	Change in the amount of wetland area (ELT) as a result of road activities	Net loss of ELT wetlands on 0.9 miles (3 acres) of new roads, which still meets forest standards.	Net loss of ELT wetlands on 0.9 miles (3 acres) of new roads, which still meets forest standards.	No change in wetland area.
Wetlands	Wetland areas compacted from heavy equipment operations.	Some compaction will occur on approximately 16 acres of wetlands but will be within forest standards	Some compaction will occur on approximately 13 acres of wetlands but will be within forest standards	No soil compaction will occur.
Vegetation	Number of Aspen Stands 10-25 acres in size.	201	193	162
Vegetation	Acres of Aspen Regenerated	530	477	0
Vegetation	Percent of suitable Aspen regenerated	7%	6%	0
Vegetation	Percent of suitable Aspen stands within the desired size range	49%	47%	41%
NNIP	Canopy removal activities, including wildlife openings maintenance	Increases open, sunny conditions favorable to NNIP establishment on approximately 599 acres.	Increases open, sunny conditions favorable to NNIP establishment on approximately 502 acres.	No change
NNIP	Mechanical and	Disturbs soil and	Disturbs soil and	No change

Resource Area	Activity or Measure	Proposed Action Effects	Alternative 1 Effects	No Action Effects
	manual site preparation	creates ground for NNIP to establish in a maximum of 723 acres.	creates ground for NNIP to establish in a maximum of 669 acres.	
NNIP	Road construction	Creates approximately 6.4 miles susceptible to NNIP spread.	Creates approximately 6.4 miles susceptible to NNIP spread.	No change
NNIP	Road decommissioning and closure	Stops vehicular NNIP seed spread on approximately 0.8 miles.	Stops vehicular NNIP seed spread on approximately 0.8 miles.	No change
NNIP	Construction and use of log landings or back-ins	Creates 400 feet susceptible to NNIP introduction and spread.	Creates 400 feet susceptible to NNIP introduction and spread.	No change
NNIP	NNIP treatment by manual, mechanical, or chemical methods	Reduces NNIP seed source and spread along 6.25 roadside miles and 66 acres of other disturbed sites or forested interior.	Reduces NNIP seed source and spread along 6.25 roadside miles and 66 acres of other disturbed sites or forested interior.	NNIP seed source remains and spread continues along 6.25 roadside miles and 66 acres of disturbed or forested sites.
NNIP	Removal of non-native invasive Scotch pine from H40 roadside	Reduces seed source and Scotch pine spread from 46 acres of H40 roadside.	Reduces seed source and Scotch pine spread from 46 acres of H40 roadsides.	Growth and spread of Scotch pine along H40 continues.
TES	Canopy removal activities	Long-term changes to light and moisture conditions, alters habitat (519 acres)	Long-term changes to light and moisture conditions, alters habitat (477 acres)	No change
TES	Thinning, improvement, and	Short-term changes to light and moisture	Short-term changes to light and moisture	No change

Resource Area	Activity or Measure	Proposed Action Effects	Alternative 1 Effects	No Action Effects
	selection harvest	conditions, alters habitat (1003 acres)	conditions, alters habitat (993 acres)	
TES	Mechanical and manual site preparation	Disturbs soil, duff, and/or moss layer, disrupts mycorrhizae in soil (723 acres)	Disturbs soil, duff, and/or moss layer, disrupts mycorrhizae in soil (669 acres)	No change
TES	Wildlife openings creation and maintenance	Changes light and moisture conditions, alters habitat (80 acres)	Changes light and moisture conditions, alters habitat (25 acres)	No change
TES	Road construction	Reduces habitat, some of which may be suitable (6.4 miles)	Reduces habitat, some of which may be suitable (6.4 miles)	No change
TES	Road closure and decommissioning	Potential recovery of habitat (0.8 miles)	Potential recovery of habitat (0.8 miles)	No change
TES	Construction and use of log landings	Creates 2 areas with soil disturbance and potential reduction of habitat	Creates 2 areas with soil disturbance and potential reduction of habitat	No change
TES	Scotch pine removal	Reduces NNIP spread; improves TES plant habitat (46 acres)	Reduces NNIP spread; improves TES plant habitat (46 acres)	Spread and population growth of NNIP continues
TES	NNIP control	Reduces NNIP spread; improves TES plant habitat (6.25 roadside miles and 22 acres)	Reduces NNIP spread; improves TES plant habitat (6.25 roadside miles and 22 acres)	Spread and population growth of NNIP continues
Wildlife	Habitat availability for early successional species	Create about 600 acres of early successional habitat.	Create about 500 acres of early successional habitat.	Creation of early successional habitat would depend on natural

Resource Area	Activity or Measure	Proposed Action Effects	Alternative 1 Effects	No Action Effects
				disturbance events such as windthrow.
Wildlife	Availability of snag and woody debris habitat	Reduce snag and woody debris availability on about 1,600 acres.	Reduce snag and woody debris availability on about 1,500 acres.	More future snag and woody debris habitat would be available (no trees removed).
Wildlife	Disturbance to wildlife from road access	Increased disturbance from about 4 miles of new road construction.	Similar to the Proposed Action	No change from current condition.
Fisheries	Change in availability or quality of Brook Trout (MIS) Habitat	No Change	No Change	No Change
Recreation	Displacement during harvest related activities - Trout Brook Pond dispersed site & NCT trailhead	Displacement of recreationists for 97 days over 10 years from this project. Cumulatively, displacement of recreationists for 317 days over 10 years.	Displacement of recreationists for 97 days over 10 years from this project. Cumulatively, displacement of recreationists for 317 days over 10 years.	No Change
Recreation	Displacement during harvest related activities - NCT	Displacement of recreationists for 204 days over 10 years from this project. Cumulatively, displacement of recreationists for 568 days if travelling north of the project area and 1157 days if travelling south of the project	Displacement of recreationists for 74 days over 10 years from this project. Cumulatively, displacement of recreationists for 557 days if travelling north of the project area and 1146 days if travelling south of the project area	No Change

Resource Area	Activity or Measure	Proposed Action Effects	Alternative 1 Effects	No Action Effects
		area over 10 years.	over 10 years.	
Recreation	Changes in motorized access	No Change	No Change	No Change
Recreation	NCT	No Change	No Change	No Change
Visual Quality	VQO - Retention	Would not be met during harvest related activities along 0.3 miles of NCT, but would be met once harvest equipment is removed.	Same as Proposed Action	No Change
Visual Quality	VQO - Partial Retention	Meets VQO	Same as Proposed Action	No Change
Visual Quality	VQO - Modification	Meets VQO	Same as Proposed Action	No Change
Heritage	No. of heritage sites potentially at risk	16	7	0
Transportation	Road Density (Forest Plan maximum density for MA 1.2 = 3.0 mile/mile^2. Existing Forest-wide density for MA 1.2 = 2.5 mile/mile^2.)	MA 1.2 within Project Area: Increase from 2.1 mile/mile^2 to 2.2 mile/mile^2. No Change in Forest-wide density.	MA 1.2 within Project Area: Increase from 2.1 mile/mile^2 to 2.2 mile/mile^2. No Change in Forest-wide density.	MA 1.2 within Project Area: Remain at 2.1 mile/mile^2. No Change in Forest-wide density.
Heritage	No. of heritage sites within activity areas	16	7	0

CHAPTER 3 – ENVIRONMENTAL CONSEQUENCES

3.1 Introduction

This chapter describes aspects of the physical, biological, social, and economic environments likely to be affected by the proposed action and alternatives. It also discloses the direct, indirect, and cumulative effects that would result from implementing any of the alternatives. Together, these descriptions form the scientific and analytical basis for the comparison of effects in Chapter 2, section 2.4.2.

3.2 Past, Present, and Reasonably Foreseeable Future Actions

The Council on Environmental Quality has defined cumulative impact as "…the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions" (40 CFR 1508.7). In determining cumulative effects, the following list of past, present, and future actions were added to the direct and indirect effects of the proposed action and alternatives. These projects were identified by each resource from a master list of projects from the last 15 years found in Appendix H.

Table 3-1. Past, Present, and Reasonably Foreseeable Actions Contributing to Cumulative Effects.

Project	Road Const.	Road Oblit	Timber Harvest Acreage	Other Resource Activities	Timeframe
Merit Network Fiber Optic Cable Installation EA	None	None	None	Install underground fiber optic line in existing Rights of Way (ROW) across 23.4 miles of HNF lands to provide underserved areas with broadband services. This EA is tiered to a larger programmatic EIS.	DN signed 5/12 Being implemented
ATC 6904/6905 Powerline Rebuild EA (Line from St. Ignace to south of Rudyard)			Project includes widening the Right of Way (ROW). Woody vegetation will be removed in existing and newly widened ROW, as well as hazard trees.	Rebuild the transmission line to support existing and anticipated future power requirements for the Eastern Upper Peninsula and to operate and maintain the line in a manner consistent with present Forest Plan direction. Construct new line offset generally about 30 feet west of the existing line, except in areas of sensitive habitat where the routing would be located east of the existing line. Once new line is constructed, old poles are removed.	DN signed 4/12 Being implemented
Hiawatha Invasive Plant Control Project EA	None	None	None	A site-specific NNIP management program using a combination of control methods on approximately 5,000 acres across the entire Hiawatha National Forest.	DN signed 02/12 Being implemented
Shores Project EA	6.3 mi.	11 mi.	CC and regenerate 847 ac; two age shelterwood establishment 463 ac; seed tree 28 ac; commercial thin 40 ac; single tree selection 199 ac; scotch pine removal < 2,000 trees	Mechanical or manual site preparation and/or planting 1,537 ac; Improve wildlife habitat conditions; reduce impacts from insects and diseases	DN signed 12/11 Being Implemented
Eastside Timber Stand Improvement CE	None	None	None	White Pine pruning and crop tree release on 3,280 ac., Red Pine crop tree release on 1,237 ac. on 10-20 year old plantations.	DM signed 12/11 Being implemented

Project	Road Const.	Road Oblit	Timber Harvest Acreage	Other Resource Activities	Timeframe
Saint Ignace RD Interpretive Trail CE	None	None	None	Establish and maintain a multi-purpose, non-motorized trail network on 80 ac. parcel adjacent to Saint Ignace Ranger District Office. Trail System consists of 3 loops and is approx. 2.2 mi. total length.	DM signed 11/11 Being implemented
East Unit Spawning Habitat CE	None	None	None	Install spawning habitat in Bear Creek, biscuit Creek, and Creek Number Nine.	DM signed 08/11 Being implemented
Great Lakes Gas Transmission SUP Reissuance CE	None	None	None	Renewal of existing SUP of pipeline	DM signed 09/10 Implemented
East AOP CE	None	None	None	Replace 17 culverts throughout the Eastside of the HNF	DM signed 03/10 Being implemented
Niagara EIS	10 mi. 2 mi add to system	18 mi. decom. 2 mi. close	CC and CC – salvage 605 ac.; shelter-wood w/reserves 650 ac.; Seedtree cut w/reserves 62 ac.; Overstory removal w/reserves 219 ac.; Single-tree selection (full karst protection) 1,621 ac.; Single-tree selection cut (reduced karst protection – high shade retention) 1,790 ac.; Single-tree selection cut (Reduced Karst Protection (normal shade retention) 743 ac.; Com. Thin (Full karst protection) 23 ac.; Com thin (reduced karst protection – high shade retention) 73 ac.; Com. Thin (reduced karst protection – normal shade retention) 782 ac.;		ROD signed 12/09 Being implemented
Sand Clay Project EA	15 mi.	10 mi.	CC 609 ac; CC (w/reserve some trees); shelterwood 569 ac; Overstory removal (79 ac; Partial removal 612 ac; Selection harvest 280 ac; Thin 892 ac; Intermediate harvest WS 64 ac.	Construct non-motorized recreation trail; fisheries projects	DN signed 7/08 Being implemented

Project	Road Const.	Road Oblit	Timber Harvest Acreage	Other Resource Activities	Timeframe
Eastside Permanent Openings CE	None	None	None	Approximately 5,900 acres of existing permanent openings will be maintained by prescribed fire, mechanical opening maintenance, hand tools; and site prep and planting of native grasses and forbs. These activities These openings provide wildlife habitat and fuel breaks.	DM signed 6/08 Being Implemented
Silver Creek NCT, Trail and Bridge Reconstruction CE	None	None	None	On NCT north of FR3740 replace board walk and bridge with pressure treated lumber. Establish a small parking area near north end of the sand pit.	DM signed 7/07 Implemented
Sprinkler Project EA	3.0 mi.	25.0 mi.	Aspen salvage CC 1,066 ac; Aspen salvage shelterwood 1,161 ac; BF/aspen/PB salvage CC 1,156 ac; Cedar/aspen/PB salvage 512 ac; PB salvage 149 ac; PB CC 76 ac; BS shelterwood 59 ac; JP CC 22 ac; WS thin 27 ac; WP/hemlock thin 30 ac; WP thin 4 ac; NH thin 285 ac; NH selection 182 ac; Lowland hardwood shelterwood 122 ac; Salvage CC 45ac; Salvage shelterwood 15 ac.	Wildlife activities, fish activities	DN signed 6/07 Being Implemented
Pine River System Spawning Habitat Maintenance CE	None	None	None	Install 40 – 80 cubic yds. of gravel & cobblestone at each of 4 treatment sites and redistribute remaining rock to provide substrate, water depths, and current velocities conducive to successful spawning by steelhead and salmon.	DM signed 6/07 Implemented
Hiawatha National Forest Forest-wide Non-native Invasive Plant EA	None	None	None	A forest-wide strategic NNIP management program using a combination of control methods on roughly 130 known sites and at any new sites found through monitoring within HNF boundaries.	DN signed 6/07 Implemented
St. Ignace Gravel Pits EA	None	None	None	Expand Taylor Creek Gravel Pit and the Bissel Road Sand Pit, & develop the Barrett Road Gravel Pit and the Akrigg West Pit	DN signed 10/06 Being implemented

Project	Road Const.	Road Oblit	Timber Harvest Acreage	Other Resource Activities	Timeframe
Brevoort Lake Log Cribs CE	None	None	None	Install 150 log cribs (8 ft. x 8 ft. x 5 ft) in Brevoort Lake to improve fish habitat.	DM signed 2/06 Implemented
East Red Pine 2 EA	2.0 mi.	5.0 mi.	Thin 4,594 ac. of red pine.	Maintain wildlife openings.	DN signed 1/05 Being implemented
Walker Access Road CE			None	Access to private land at the end of the North Service Road across National Forest land for ½ mi.	DM signed 9/04 Implemented
Edison Opening Maintenance Project CE	None	None	None	Maintain 20 ac. of 3 existing wildlife openings	DM signed 9/04 Implemented
Raco Plains Ecosystem Management EA	0.7 mi.	22.3 mi.	Jack Pine (JP) Salvage CC 6,257 ac; JP Seed tree/burn for JP 145 ac;JP Salvage/underplant White Pine (WP) 101 ac; JP removal 444 ac; Create savanna from JP 366 ac; Red Pine (RP) CC 120 ac; RP shelterwood 89 ac; RP seedtree 39 ac; RP thinning 797 ac; Create upland opening in JP 23 ac	Site preparation and/or planting for various treatments, prescribed burning, maintain wildlife openings, NNIP removal.	DN signed 9/04
Cloverland Electric East Lake Distribution Line CE	None	None	None	1.4 miles of new line overhead/underground	DM signed 10/03 Implemented
Relocation of the Red Creek Snowmobile Trail EA	None	None	None	Relocate approx. 3 mi. of snowmobile trail, construct trail bridge across I-75, & 1.7 mi. of old rd. designated mountain bike trail.	DN signed 8/03 Implemented
Interior Wetlands Project EIS	4.3 mi.	17.0 mi.	JP cc 233 ac; salvage 1,516 ac; removal 6 ac; Aspen CC49 ac; salvage 65 ac; removal 104 ac; BF/aspen/PB CC 139 ac; removal 16 ac; NH/PB CC 13 ac; removal 25 ac; improvement 55 ac; thin 37 ac; BS CC 52 ac; Cedar removal 34 ac.	Wildlife management, fisheries management	Record of Decision (ROD) signed 7/03 Being implemented
Rudyard Project EA	5.5 mi.		Aspen/BF Salvage 2,652 ac; Aspen/PB/RM/BF CC 101 ac;	Wildlife/Fish/Recreation management	DN signed 1/02 Being implemented

Project	Road Const.	Road Oblit	Timber Harvest Acreage	Other Resource Activities	Timeframe
East Lake Access Road CE	None	None	None	Provide access to Secluded Land Company private land inholding within the boundaries of HNF using existing FS road.	DM signed 2/01
Biscuit Creek Log Bank Cover	None	None		Install 19 log bank covers along approx. 0.5 miles of Biscuit Creek to enhance habitat for Brook Trout	DM signed 7/00 Implemented
5 Year Red Pine Thinning EA	2.2 mi.	None	RP thin 1,864 ac.	Fisheries projects	DN signed 6/00 Being implemented
Lamprey Weir Site Rehabilitation CE	None	200 ft.	None	Remove weir. Remove road, parking lot, abutments, railroad ties, junction boxes, fences, posts, and logs from site. Retain or place rock rip rap along approx. 160 ft. of stream banks to stabilize them. Recontour the stream banks above the rip rap. Stabilize and revegetate disturbed areas.	DM signed 5/00 Implemented
Great Lakes Gas Transmission Limited Partnership Sault Looping Project EA	None		None	SUP for 11.3 mi. of pipeline loop on HNF.	DN signed 4/00 Implemented
Nunn's Creek Snowmobile Bridge CE	None	None	None	Replace snowmobile bridge to meet Forest Service and State of Michigan standards.	DM signed 8/99 Implemented
Stream Sediment Basin Maintenance CE	None	None	None		DM signed 3/99 Implemented
Carp National Wild and Scenic River EA	None	None	None	A Plan in place with standards and guides to protect/manage the W & S river.	DN signed 2/98 Implemented
Current Proposed Projects being Analyzed					
None					

3.3 Air Quality

3.3.1 Summary of Effects

Table 3-2 Summary of Air Quality Effects

Activity or Measure	Proposed Action Effects	Alternative 1 Effects	No Action Effects
Harvest and transportation management activities; including vehicles, equipment, chainsaws, etc.	No effect on Class I attainment area	No effect on Class I attainment area	No effect on Class I attainment area

3.3.2 Introduction

The effects of this resource have already been disclosed in the FP FEIS (pp. 3-80 to 3-81).

Air quality monitoring is coordinated and the results are disseminated by the Michigan Department of Environmental Quality (MDEQ 2011). Monitoring stations are located 67 miles to the west of the project area in Seney National Wildlife Refuge (Seney NWR) and 30 miles to the northeast of the project area in Sault Ste. Marie, MI.

3.3.3 Analysis Methods

The Analysis of the project area's air quality is based on the MDEQ's annual air quality report for the state of Michigan (MDEQ 2011).

3.3.4 Analysis Area

The spatial boundary for this effects analysis is the Upper Peninsula District as that is the reporting unit designated by MDEQ[2]. The temporal boundary is one day after each activity day because this is the typical MDEQ air quality standards data unit of measure.

The wilderness area within Seney National Wildlife Refuge is the closest Class I airshed which is approximately 62 miles to the west of the project area. The prevailing winds are from the west. The Midwest Regional Planning Organization in cooperation with the Air

[2] http://www.michigan.gov/documents/deq/deq-aqd-air-admin-District-map_258279_7.pdf

Quality Division of the MDEQ has been monitoring and studying acid deposition, mercury, ozone, and visibility levels at Seney NWR.

The analysis area is more precisely defined as anything that could affect the Class 1 area at Seney NWR.

3.3.5 Affected Environment

Geographic regions of the country are given air quality classifications that designate the level of protection areas receive. The classification indicates the level of air quality deterioration that would be regarded as significant and considered as unacceptable. Class I airsheds tend to prohibit actions that deteriorate air quality in the short and long term. Class II is much less restrictive than Class I (Sams 2002).

The HNF (including the Rudyard Project Area) is considered by the state of Michigan to be a Class II airshed under the Clean Air Act (PL88206) as amended (Forest Plan 2006).

The project area is currently subject to air pollutants from mobile sources such as vehicles, equipment, snowmobiles, and chainsaws. Due to dissipation by wind, pollutants from these sources do not attain high enough concentrations to warrant measurement or to result in degradation to sensitive resources. Wildland fires occur in the area, but are usually contained when they are only a few acres in size. On average, once a decade, a large wildfire (1,000 acres or more) occurs in the Eastern UP (see Fire Effects, section 3.4). These occasional large wildfires significantly impact the air quality for a short duration of time (typically less than 1 week), but it is impossible to predict when and where they will occur. In addition to wildfires, farmers and private landowners occasionally burn brush piles and fallow fields.

3.3.6 Proposed Action & Alternative 1

3.3.6.1 Direct and Indirect Effects

There would be effects to air quality from the harvest activities and log hauling which would temporarily produce emissions of hydrocarbon, carbon monoxide, nitrogen oxides, sulfur oxides, and particulate matter. However, it is not anticipated that these emissions would be in high enough concentrations to show an increase in any of these pollutants at either of the two air quality monitoring stations (MDEQ 2011). Prescribed burning is not part of the proposed action. Therefore there are no effects to the Class 1 airshed at Seney NWR.

3.3.6.2 Cumulative Effects

Since there are no direct or indirect effects to the Class 1 airshed at Seney NWR, there would be no cumulative effects to air quality by these proposed activities.

3.3.7 No Action

3.3.7.1 Direct and Indirect Effects

Under the No Action, there would be no new activities, so there would be no direct or indirect effects on air quality.

3.3.7.2 Cumulative Effects

Since there are no direct or indirect effects under the No Action, there are no cumulative effects.

3.4 Fire Ecology and Fuels

Table 3-3 Summary of Fire Ecology and Fuels Effects

Activity or Measure	Proposed Action Effects	Alternative 1 Effects	No Action Effects
Canopy removal activities, including wildlife openings maintenance	Increases open, sunny conditions favorable herbaceous vegetation vs. wood vegetation. Increase ease to which wildfires are suppressed on 544 acres.	Increases open, sunny conditions favorable herbaceous vegetation vs. wood vegetation. Increase ease to which wildfires are suppressed on approximately 502 acres.	No change
Mechanical site preparation	Rearrange fuels from greater vertical depth to less vertical depth (compacted) on 723 acres. Compacting fuels decreases receptivity to fire brands.	Rearrange fuels from greater vertical depth to less vertical depth (compacted) on 669 acres. Compacting fuels decreases receptivity to fire brands.	No change
Fire Regime Condition Class	Thinning red pine and removing Scotch pine results in the improvement of FRCC toward desired conditions	Same as Proposed Action	No change

3.4.1 Introduction

Within the project boundary, there has been one reported wildfire on USFS lands which occurred in 1983, caused by lightning and was 1/10 of an acre in size. Historically, fire records for this portion of the HNF (summarized since the mid-1930s) indicate that the

majority of the fires were very small and that they tended to occur around occupied areas. The topography, access, and vegetative composition of Lake States aspen forests generally result in low frequency/low intensity fires (USDA, 2002). Ironically, these same aspen dominated stands were created by forest fires that occurred as a result of timber harvest techniques followed up by slash burning in the late 19th century. Aspen forests typically are one of the early pioneers of sites disturbed by natural events such as windstorms or forest fires.

Today, the primary causes of forest fires in the Upper Peninsula are human activities including debris burning, operating equipment, campfires, and incendiary action. Forest fires on HNF lands in the last five years have occurred most commonly in vegetative openings. Fires in pine forest types are the next most common followed by fires in hardwoods and swamp forest types (USDA, 2002).

3.4.2 Analysis Methods

A natural fire regime is a general classification of the role fire would play across a landscape in the absence of modern human mechanical intervention, but including the influence of aboriginal burning (Agee 1993, Brown 1995). The fire regimes are numerically classified based on average number of years between fires (fire frequency).The majority of the project area is characterized as FR3, FR3W, FR4 and FR4W (see Fire Regime Map in Project Record and Glossary). These fire regimes typically experience infrequent to very infrequent stand replacing fires on a return interval ranging from 100 years on the drier sites and up to 1700 years on the wetter sites. These forest types are long-lived and are fire intolerant when fire does occur resulting in a stand replacement and a total successional change (Cleland 2004).

The Fire Regime Condition Class (FRCC) is a classification system of the amount of departure from the Historical Range of Variability or reference condition (Hann, 2001). They include three condition classes for each fire regime. The classification is based on the relative measure describing the degree of departure from the historical natural fire regime. This departure results in changes to one (or more) of the following ecological components: vegetation characteristics (species composition, structure stages, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, sseverity, and pattern; and other associated disturbances (i.e. insect and disease mortality, grazing, and drought). Fire Regime Condition Classes include:

- *Condition Class 1* – Within the natural (historical) range of variability of vegetation characteristics; fuel composition; fire frequency, severity, and pattern; and other associated disturbances.
- *Condition Class 2* – Moderate departure from the natural (historical) range of variability of vegetation characteristics; fuel composition; fire frequency, severity, and pattern; and other associated disturbances.
- *Condition Class 3* – High departure from the natural (historical) range of variability of vegetation characteristics; fuel composition; fire frequency, severity, and pattern; and other associated disturbances.

Table 3-4 Existing Forest-wide and Rudyard Project Area FRCC by ELT (Rudyard Miscale Analysis, 2010, project record, Spectrum FRCC)

ELT	Current FRCC Forest-wide	Current FRCC Rudyard Project area
10,20	2	3
30	2	3
40,50,90	1	2
60	2	2
70	1 & 2	2
80B	1	1 & 2

Table 3-4 displays the current FRCC within the Rudyard project area at the time of the Rudyard Midscale analysis (2010). Fire Ecology analysis within the Forest Plan focus primarily on fire-dependent ELTs. Mid-seral (balsam fir, black spruce, cedar and white pine) and late-seral (black spruce, cedar, white pine, hemlock) are usually influenced more by surrounding vegetation types than by fires. For example, those surrounded by hardwoods are essentially a non-fire system; but those surrounded by fire-prone vegetation (specifically jack pine and red pine) are fire dependent and essential to this discussion (see ELT map in Project Record).

Fire prone stands in the project area are limited to red pine plantations and Scotch pine in the northwest portion of the project area.

Achieving the desired condition of the forest described by the Forest Plan will not return the forest to the reference condition, although many similarities exist between the desired condition and reference condition.

3.4.3 Analysis Areas

Fire prone stands makes up approximately 1% of vegetation within or adjacent to the project boundary, therefore, the spatial boundary will utilize the project boundary for direct, indirect and cumulative effects. The ten year temporal boundary for this section will be consistent with the temporal boundary that was used for the vegetation analysis.

The geographical and temporal boundary for cumulative effects is the same as those used to evaluate vegetation composition goals (see 3.3.3 Analysis Areas)

3.4.4 Affected Environment

Aspen, balsam fir, and black spruce are also disturbance-related species and are the fuels of any concern in the project area. Fire, along with wind, insects and ice are the disturbance factors that may increase natural fuels. Typically these site conditions reduce the frequency of fires, but during drought conditions they can burn with high enough intensity to regenerate the area. Fire return intervals in these wet sites have been determined to be about 170 years (Cleland 2004). The Forest Plan has identified these species as non-fire ecosystems when surrounded by hardwoods which is consistent with the vegetation within the project boundary.

Mature red pine is fire resistant. Mature trees survive fire because they have think bark, branch-free boles, moderately deep rooting habitat, and ofter occur in moderately open stands (Brown 1973). Once the canopy closes, the lower branches die, and a large gap develops between the ground and the crown. The natural fire regime in red pine forests is characterized by alternating stand-replacing fires and non-lethal fires. Low and moderate intensity fires occur at 20-40 year intervals and high severity fires occu at 150-200 year intervals. Most low to moderate severity fires do not kill canopy trees but do remove understory vegetation thus reducing ladder fuels and reducing the probability of a stand replacing fire. The high severity fires kill trees and thus create openings in the stand, ideal for red pine recruitment (Carey 1993). Thus, thinning red pine plantations somewhat mimics the natural function of fire by eliminating some trees and reducing the amount of understory vegetation.

Adequate transportation to access the area for fire suppression needs is currently present.

3.4.5 Proposed Action and Alternative 1

3.4.5.1 Direct and Indirect Effects

The treatments under the Proposed Action and Alternative 1 would provide a short-term increase in ground fuels from slash debris. Canopy removal activities, including wildlife openings maintenance, increases open, sunny conditions favorable herbaceous vegetation vs. wood vegetation. An indirect effect is increased ease of suppressing wildfires. Over the long-term, clearcutting resembles a stand replacement fire event and reduces the amount of available fuels for wildfire and reforestation activities produce a new age class. Relying on the writer's personal experience, these changes mimic those associated with wildfire by producing temporary openings and fuel breaks and developing a new age class.

Mechanical site preparation of soils and opening creation would compact or remove this remaining slash debris. Mechanical site preparation rearranges fuels from greater vertical depth to less vertical depth. Compacting fuels decreases receptivity to fire brands

Thinning all the red pine plantations within the project area (319 acres), primarily on ELTs 30 and 40/50/90,mimics the effects of low to moderate intensity understory burning by removing scattered overstory trees, reducing understory (ladder fuel) vegetation and preparing a seedbed for regeneration. Scotch pine removal (64 ac) mimics the effects of burning and reduces understory (ladder fuel) vegetation. Both of these treatments result in improved FRCC.

Neither of the action alternatives are expected to move the condition class for the area full steps in the FRCC classification but would show a trend towards a new FRCC level (Table 3-5). Individual stands may show full step changes.

Table 3-5 Vegetation Management by ELT in Rudyard Project

ELT	Proposed Action (Acres Treated)	Alternative 1 (Acres Treated)	No Action (Acres Treated)
10,20	1	1	0
30	143	131	0
40,50,90	564	544	0
60	774	728	0
70	201	173	0
80B	38	33	0

3.4.5.2 Cumulative Effects

Past actions such as thinning, understory brush management and wildlife opening construction and maintenance have contributed to reducing the potential of large, intense wildland fires by reducing available fuels and providing breaks in fuel continuity. In addition, age class and species diversity contributes to providing a forest condition which mimics the results of wildfire activity. The Proposed Action and Alternative 1 would continue these efforts in reducing the wildfire potential and restoring components of the natural/historic role of fire in this ecosystem. Review of the vegetation cumulative effects (3.3.5.2 Cumulative effects) indicates there are no foreseeable new vegetation projects within MA 1.2. It also demonstrates a trend of moving seral and size classes toward the Forest-wide vegetation composition goals. Cumulatively, these actions would move the area towards the Forest Plan desired fire regime condition class.

3.4.6 No Action

3.4.6.1 Direct and Indirect Effects

Natural processes such as insect, wind and wildfire would be the only disturbance within the project area under this alternative. Ecosystem restoration and reduction of hazardous fuels would not occur in a controlled condition, although it may occur through wildfire at the risk of public and fire fighter health and safety. Wildfire suppression efforts would still occur under the No Action in accordance with Forest Plan direction (Forest Plan 2006, p. 2-23). The US Forest Service, the Michigan DNR and the local volunteer fire departments have effectively suppressed most unwanted wildfires in the Eastern UP with an exception of a few fires that grew to be considered large in size.

3.4.6.2 Cumulative Effects

No management activities to reduce available fuels would be made under this alternative. Ecosystem restoration and reduction of the fire regime condition class would not occur in a controlled condition.

3.5 Soils

3.5.1 Introduction

Table 3-6 Summary of Soils Effects

Activity or Measure	Proposed Action Effects	Alternative 1 Effects	No Action Effects
Soil compaction and displacement from heavy equipment operations.	Some compaction and displacement will occur on approximately 92 acres of land but will be within SQS.	Some compaction and displacement will occur on approximately 87 acres of land but will be within SQS.	No soil compaction or displacement will occur.
Soils removed and/or compacted from road construction activities.	Roads will impact approximately 19 acres of land but will be within SQS.	Roads will impact approximately 19 acres of land but will be within SQS.	No new road activities are proposed.

Regional soil quality standards require project specific standards with a site specific assessment to assure that vulnerable soil properties are not affected so as to create a negative ecological response (R9 RO 2550-2012-1, 2012). Generally speaking, soil properties may be impacted by compaction, rutting, displacement, erosion, mass movement, detrimental burning, or detrimental loss of ground cover. Forest monitoring has shown that rutting should be prevented and should be confined to less than 5% of the activity area. Hiawatha National Forest monitoring has shown that when design criteria are implemented, vulnerable soil properties and hence R9 soil quality standards are met or exceeded (Corner and Gries 2007, Trudell 2005, Landwehr 2005). For more detailed analysis, soils information, Best Management Practices (BMPs) and references see the watershed specialist report in the project record.

3.5.2 Analysis Methods

The Forest Service Soil Disturbance Monitoring Protocol (Page-Dumroese et al. 2009) was used to determine soil detrimental disturbance in proposed treatment units. Units were traversed along randomly chosen transects to cover as much of the units as possible. Paced transects were used to measure ground cover, slopes, detrimental soil conditions, and any other pertinent soil observations. Additionally, soil mapping units were verified at randomly selected locations using published soil survey information (Whitney, 1992).

Thirty-four treatment units were surveyed for this project during August of 2012. Other data reviewed included landform mapping, ecological classification (landtype association (LTA) and Ecological Land Type (ELT)), and regional landscape classification.

Research in the lake states has identified loss of soil macroporosity and site organic matter as two factors common to sites where soil productivity has declined (Powers et al. 1990 and Stone et al. 1998). The most likely cause of disturbance from harvest in this assessment is rutting in wet areas.

3.5.3 Analysis Areas

The spatial boundary for all soils effects analysis (including cumulative effects) is 100 feet beyond the boundary of all treatment stands. Soil impacts occur over a limited spatial extent, typically at the point beneath a ground disturbing activity. Examples of these impacts include compaction, rutting, displacement, loss of ground cover, and decreased site productivity, all from mechanical disturbances. This makes the 100 foot distance adequate for two reasons: 1) it is unlikely mechanical disturbances will occur beyond this distance from a treatment stand and 2) this is larger than the anticipated distance erosion and sedimentation travel in vegetated areas.

The temporal boundary used for direct and indirect effects is 2 years, and for cumulative effects analysis it is 20 years following implementation of proposed ground disturbing activities. These are the temporal boundaries because these are roughly the timeframes it takes for soils to revegetate (2 years) and stabilize (20 years).

3.5.4 Affected Environment

The project area is primarily management area 1.2 (HNF plan, page 3-5). The emphasis summary for this management area is as follows: *"Aspen management for fiber production and deer and grouse habitat. Dispersed recreation."* The project area includes ten landtype associations listed in Table 3-7. The vast majority of the project area is the Pine River patterned wetland landtype (Hj06).

Table 3-7 Landtype Associations in the Rudyard project area.

Land Type Association	Name	Acres
Hj11	Niagara escarpment 1	798
Hj04	Huron patterned outcrop	259
Hj11	Niagara escarpment 3	276
Hj11	Niagara escarpment 2	452
Hj13	Lower Carp River complex	767
Hj07	St. Martin Bay wetlands	575
Hj05	Huron outcrop	225
Hh29	Sand/clay transition south	78
Hk03	Rudyard clay plain	885
Hj06	Pine River patterned wetland	29,972

All ecological landtypes (ELT) occur within the project area. For a detailed description of these landtypes, see Appendix I of the Hiawatha Forest Plan FEIS. Table 3-8 below shows all ELT acreage for the project area. Organic wetlands occupy 8.9% of the project area occurring on swales, drainageways and depressions (ELT 80). Mineral soil wetlands (ELT 70) occupy 43.7% of the project area. Sandy outwash plains (ELT groups 10, 20 and 30) occupy 2% of the project area. Glacial moraines and bedrock controlled features (ELT 40,50,90) occur on 10.4 percent of the project area. Transition zones between wetlands and dry uplands occur on 34.4% of the project area (ELT 60).

Table 3-8 Ecological Land Types in the Rudyard project area.

ELT Group	Acres	Percent of Area	Description
10,20	42	0.1	Sandy outwash plains; xeric ecosystems
30	654	1.9	Sandy outwash plains and morainal areas with a slightly higher productivity than ELT 10, 20
40,50,90	3,566	10.4	Glacial moraines, pitted outwash, bedrock controlled moraines and areas where bedrock is close to the surface
60	11,798	34.4	A transition zone between dry uplands to true wetlands, often occurs at the edge of the outwash plains, but includes the somewhat poorly drained soils on the clay plain landform. Vegetation is highly variable.
70A	894	2.6	Mineral soil wetlands.
70B	14,110	41.1	Mineral soil wetlands supporting vegetation indicative of higher pH (>5.5) or basic soil conditions.
80A	73	0.2	Organic soil wetlands with more than 12 inches of wet, acidic (pH<5.5) soil.
80B	2,992	8.7	Organic soil wetlands with more than 12 inches of wet, basic (pH > 5.5) soil.
Pit	117	0.3	Pits
Water	44	0.1	Lakes and Streams

For the proposed action, there are 38 soil map units (SMU) and for Alternative 1 there are 36 SMUs. Table 3-9 below contains SMU, SMU description, the preferred operating season, and acreage by alternative for soils in the project area. The unit with the most acreage is 25B, the Gaurdlake loam, 0 to 6 percent slopes. Field surveys found that there were no areas within units that were over 5% slope. It should be noted that for this and all other summaries of proposed action acreage will be for activities that produce ground disturbance only, and not activities that are to change the classification of stands.

Table 3-9 Soil mapping units and operating restrictions by alternative treatment acres.

Soil Map Unit	Soil Map Unit Description	Preferred Operating Season	Acres	
			Proposed Action	Alternative 1
112	Soo silty clay loam	Summer, winter	41	35
11A	Rudyard silty clay loam, 0 to 3 percent slopes	Summer, winter	172	164
12	Pickford silty clay loam	Summer, winter	703	81
13B	Alcona loamy very fine sand, 0 to 6 percent slopes	Summer, fall, winter	162	149
146A	Allendale-Fibre complex, 0 to 3 percent slopes	Summer, winter	5	
14A	Gaastra silt loam, 0 to 3 percent slopes	Summer, winter	64	64
150	Fibre muck	Summer, winter	9	9

15B	Rousseau fine sand, dark subsoil, 0 to 6 percent slopes	Year round	79	69
164A	Moltke loam, 0 to 3 percent slopes	Summer, winter	102	102
18B	Rubicon sand, 0 to 6 percent slopes	Spring, fall, winter	0	0
18D	Rubicon sand, 6 to 15 percent slopes	Spring, fall, winter	3	3
19B	Kalkaska sand, 0 to 6 percent slopes	Year round	42	32
20A	Croswell sand, 0 to 3 percent slopes	Year round	1	1
20B	Croswell sand, 0 to 6 percent slopes	Spring, fall, winter	20	20
21A	Finch sand, 0 to 3 percent slopes	Summer, winter	13	14
22	Kinross muck	Summer, winter	1	1
25B	Guardlake loam, 0 to 6 percent slopes	Summer, fall, winter	284	286
27B	Greylock fine sandy loam, 1 to 6 percent slopes	Year round	15	15
28B	Longrie sandy loam, 1 to 6 percent slopes, rocky	Summer, fall, winter	0	1
29A	Solona loam, 0 to 3 percent slopes	Summer, winter	72	61
32A	Allendale fine sand, 0 to 3 percent slopes	Summer, winter	172	161
33	Pits, sand and gravel	Not rated	1	1
34	Entisols, flooded	Not rated	14	14
35	Histosols and Aquents, ponded	Not rated	1	1
36	Markey and Carbondale mucks	Winter	40	35
43	Angelica muck	Summer, winter	9	
44B	Battydoe fine sandy loam, 1 to 6 percent slopes, stony	Year round	19	19
48E	Wainola-Kinross-Rousseau complex, 0 to 35 percent slopes	Summer, winter	46	45
49A	Wainola fine sand, 0 to 3 percent slopes	Summer, winter	30	30
52A	Ingalls fine sand, 0 to 3 percent slopes	Summer, winter	76	76
53B	Menominee loamy sand, 0 to 6 percent slopes	Year round	2	2
57B	Amadon-Longrie sandy loams, 1 to 6 percent slopes, rocky	Summer, fall, winter	15	15
61A	Halfaday sand, 0 to 3 percent slopes	Spring, fall, winter	0	1
62A	Iosco sand, 0 to 3 percent slopes	Summer, winter	1	1
68	Wakeley muck	Summer, winter	11	11
79B	Kalkaska-Manistee sands, 0 to 6 percent slopes	Year round	25	25
85B	Kalkaska-Ocqueoc complex, 0 to 6 percent slopes	Year round	47	47
89A	Spot-Finch complex, 0 to 3 percent slopes	Summer, winter	24	24

All of the soils within units are rated as having a slight erosion hazard. Field surveys verify this as there was found to be no steep areas (all <5%) within the treatment units and ground cover was at 100%. Table 3-10 below contains ELT treatment acreage by alternative. Also in Table 3-10 are the soil textures with relation to drainage class. Drainage class is an important soil characteristic as it determines many of the sensitivity characteristics in soils of the project area. The more poorly drained soils are more

sensitive to management. This is primarily because soils with higher moisture content have less weight bearing capacity.

Table 3-10 ELT soil drainage and vegetation descriptions for the Rudyard project.

ELT Group	General Description	Vegetation	Acres	
			Proposed Action	Alt 1
10,20	Weakly developed, and poorly developed nutrient poor soils; upland.	Poor, mostly pine with scattered hardwoods, sparse herbs. Poor, mostly pine with some hardwoods, sparse herbs	1	1
30	Moderately rich sites, moderately developed soils; upland.	Moderately rich, mixed conifer and hardwood with woodsfern	143	131
40,50, 90	This group includes productive sites and well developed soils, and areas sandstone bedrock within 80 inches; and areas with limestone bedrock within 80 inches; upland.	Rich, northern hardwoods with woodsfern. And rich, hardwood or aspen-conifer, moderately rich herbs	564	544
60	Water table is 12 to 40 inches below surface transition between upland and lowland.	Variable, transition between upland and wetland	774	728
70	Water table less than 12 inches and less than 12 inches of organic matter (peat or muck)	Cedar, mixed swamp conifers, tamarack and balsam fir are typical of the vegetation on this land-type.	201	173
80B	Water table less than 12 inches and more than 12 inches of organic matter.	ELT typically supports northern white cedar stands, mixed swamp conifer stands and to a lesser extent tamarack and black ash stands.	38	33

Field reconnaissance for soil conditions of the proposed treatment units generally found resilient and stable soil conditions. There were no signs of erosion and, as mentioned above, ground cover was 100% across all sites with that being mostly organic (coarse woody debris, litter, and vegetation) with few rocks or boulders exposed (Issue 2 in section 1.8.2).

Although GIS maps showed some units with inclusions of steeper ground (>15%) and more sensitive wetland areas (such as SMU 36 from Table 3-8 above), field surveys found that several of these were mapping errors and did not occur within the units. It is therefore crucial that soil sensitivities are taken into account during project layout and implementation.

There was found to be no signs of current soil detrimental conditions. There were very few signs of rutting, displacement, or residual compaction from past logging activities. There were multiple units that were within old plantation stands. These units all showed signs of deep furrows from plantation establishment, which is a consistent determinant of soil detrimental conditions using visual cues (Page-Dumroese et al. 2009). However, upon closer examination, it was determined that the furrows were fully recovered without any noticeable decline in productivity.

3.5.5 Proposed Action & Alternative 1

3.5.5.1 Direct and indirect effects

Long-term direct or indirect effects to soil productivity due to compaction and disturbance beyond Soil Quality Standards (SQS) would not occur with either action alternative. Monitoring on the HNF has shown that the forest is in compliance with required Best Management Practices (BMPs) and BMPs effectively protect soil and water quality (Trudell 2005, Corner and Gries 2007, Range and Corner 2009). Disturbance monitoring for similar projects (Corner and Gries, 2007) found detrimental disturbance to be close to 5% of project areas. This is anticipated to be the case for the proposed treatment units.

3.5.5.1.1 Soil Compaction Calculation

Soil compaction calculations are classified by texture to analyze impacts. The information provided in Landwehr's 2005 monitoring report is used to extrapolate to the project area to estimate the total acres of compaction due to the proposal. Table 3-11 contains the calculations for acreage expected to exceed NSSH root restriction standards by alternative. On a percentage basis, the proposed action would have 6.8% of the total treatment acres severely compacted and Alternative 1 would have 6.7% of the total treatment acres.

Table 3-11 Calculated acres of soil compaction that exceeds NSSH root restriction standards.

Soil Textural Group	Acres Treated		Skid Trail Density	Expected Exceedence	Acres of compaction exceedence	
	Proposed Action	Alternative 1			Proposed Action	Alternative 1
Medium and fine sands, loamy sands	799	757	0.21	1.8%	3	3
Organic Soils	77	56	0.21	5.5%	1	1
Silty clay loams and clays	832	784	0.21	52.50%	92	87
Road Acres (Temporary and Permanent) assuming a 20 foot road width					**19**	**19**
Total acres compacted beyond NSSH root restriction standards					**115**	**110**

3.5.5.2 Cumulative effects

There are no cumulative effects anticipated from implementing the proposed action or Alternative 1. The direct and indirect effects of the project would not result in additional incremental impact when added to effects of past, present, and reasonably foreseeable future actions shown in Appendix H. Field surveys of proposed treatment stands confirmed that past activities have fully recovered and therefore will not contribute to cumulative effects. There is some thinning and road obliteration planned within the cumulative effects boundary as part of the East Red Pine II NEPA project. There are a total of 12 proposed treatment acres from the East Red Pine II NEPA project that will not contribute to future cumulative effects.

3.5.6 No Action

3.5.6.1 Direct and Indirect Effects

The No Action would have no direct or indirect effects on soil resources from soil compaction or rutting.

Proposed road improvement and decommissioning activities would not be accomplished with the No Action alternative. This has the potential to create some indirect effects as any road erosion problems are not addressed on upgraded or decommissioned roads. Decommissioned roads in particular will still be available for illegal ATV activities, potentially causing erosion.

3.5.6.2 Cumulative Effects

There would be no cumulative effects to the soils resource since there are no direct or indirect effects. The possible indirect effects described in the previous section will be minor and not contribute to cumulative effects.

3.6 Water Quality and Quantity

3.6.1 Introduction

Table 3-12 Summary of Water Quality and Quantity Effects

Activity or Measure	Proposed Action Effects	Alternative 1 Effects	No Action Effects
Potential stream destabilization as a result of timber harvesting and subsequent increases in peakflow.	There is not anticipated to be any stream destabilization from increased peakflows. New forest stand openings will be within plan standards.	There is not anticipated to be any stream destabilization from increased peakflows. New forest stand openings will be within plan standards.	There will be no stream destabilization from timber harvests.
Potential for sediment delivery to streams.	There is a low potential and state BMPs will be used to protect stream channels from sediment delivery and meet forest plan standards.	There is a low potential and state BMPs will be used to protect stream channels from sediment delivery and meet forest plan standards.	There will be no sediment delivery from activities.

Primary potential impacts to water quality and quantity from the proposed activities include a loss of stream channel stability and sedimentation into stream channels. It is not anticipated that the proposed activities will have these effects as long as state BMPs are adhered to as well as other mitigation measures, as outlined in the watershed resource report in the project record.

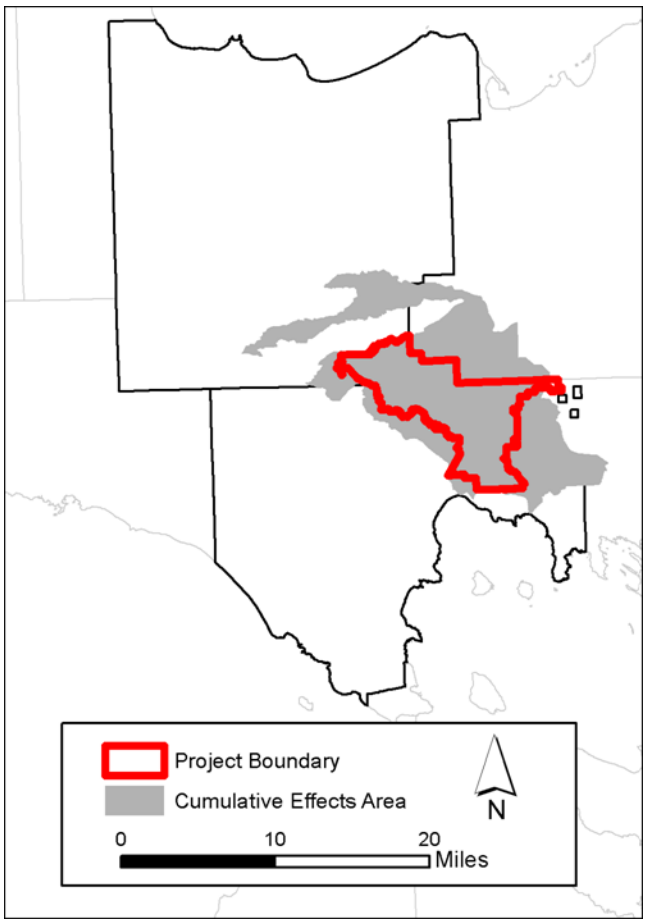
3.6.2 Analysis Methods

Published state water quality reports and internal monitoring and inventory reports were used to determine existing water quality and watershed conditions. Past monitoring and existing GIS information and additional information gathered during field review were used to develop design criteria and determine impacts.

3.6.3 Analysis Areas

The spatial and temporal boundaries for direct and indirect effects are streams adjacent to the project activity areas and ¼ mile downstream with duration of 5 years after completion of an activity. This is a reasonable area to expect that sediment could be delivered and the time for disturbed areas to re-stabilize (Ohmann, et al 1978).

Figure 3-1 Water Quality & Quantity Cumulative Effects Area



The spatial boundary for cumulative effects is the six (6) - sixth level HUC watersheds (see watersheds map in Appendix G – Maps) where proposed activities are planned. The timeframe for cumulative effects is 15 years after implementation of this project based on aspen regeneration. This 15 year timeframe is consistent with water yield recovery for the Lake States as determined by Verry (1986). Fifteen years to the future also includes the next entry of timber management. This area represents a natural boundary where effects may occur. Activities that have and will occur within the watershed cumulative effects analysis area include road maintenance, decommissioning, and construction on federal and private lands; timber harvest and planting; and wildlife projects including maintenance of open areas.

3.6.4 Affected Environment

3.6.4.1 Watersheds

There are six (6) sixth Hydrologic Unit Code (HUC) watersheds, as defined by the United States Geological Survey (Seaber et al, 1987) within the project area. Of these, five have activities proposed within their boundaries for the proposed action and four have activities proposed for Alternative 1. Table 3-13 below shows total watershed acreage, acreage within the project area, and acreage for both alternatives. The value in parenthesis represents the aerial extent or percentage of the watershed that the acreage occupies.

Table 3-13 Watershed acreage and aerial extent of project area and alternatives.

Sixth HUC Name	Total Acres	Project Area Acres	Proposed Action Acres	Alternative 1 Acres
Pine River	14,116	8,389 (59%)	122 (0.8%)	113 (0.8%)
Nunns Creek at mouth	13,145	766 (6%)	22 (0.2%)	0
Bear Creek	14,436	6,599 (46%)	800 (5.5%)	749 (5.2%)
Trout Lake-Pine River	24,652	1,418 (6%)	0	0
Elmhirst Creek-Pine River	14,024	10,368 (74%)	402 (2.9%)	395 (2.8%)
Chub Creek	13,694	6,750 (48%)	366 (2.7%)	345 (2.5%)

Major Streams and rivers within the project area include Pine River, Elmhirst Creek, Chub Creek, Little Bear Creek, and Bear Creek. Streams on the Hiawatha National Forest have been classified by temperature. Table 3-14 below lists the total length of streams within the project area by watershed and temperature class. There are no GIS mapped lakes within the project area.

Table 3-14 Stream mileage by watershed and temperature class for the project area.

6th HUC Watershed	Temperature Class Miles		Total
	Cold	Cool	
Bear Creek	18	2	20
Chub Creek		20	20
Elmhirst Creek-Pine River	12	15	27
Pine River	6	15	20
Trout Lake-Pine River		3	3
Grand Total	**36**	**54**	**90**

3.6.4.2 Streams and Water Quality

Riparian zones occupy a small percentage of the landscape but play vital roles in influencing and maintaining water quality and healthy aquatic conditions. The riparian zones in the project area are still showing effects from logging activities in the 19th century. Most of this riparian logging converted climax tree species such as white pine and hemlock into early successional species such as aspen and paper-birch.

Although the riparian zones have had a long period of time to recover, with the average stand age in the project area being 60 years old, the vegetative conversion is still persistent and has created an herbaceous and leaf material input of nutrients into stream channels instead of a pine needle input. Field surveys found that riparian corridors were all well vegetated, providing stream shade, but lacking white pine and hemlock climax species. It was also found that Large Woody Debris (LWD) was not as abundant as would be expected but stream channels all show signs of stability.

Table 3-15 below includes water quality impaired streams, as compiled by the Michigan Department of Environmental Quality (MDEQ) and included on the state's 303(d) list. The primary source of water quality impairment in the project area is Polychlorinated Biphenyls (PCBs) and mercury found in the water column of several streams. Although banned in 1979, PCBs can remain for a long period of time in the environment, cycling between land, air, and water. Standard forest management activities do not affect PCB and mercury levels in streams. The MDEQ's 2010 303(d) list has several streams within the larger watersheds as impaired. Table 3-15 only includes those that lie within the project area.

Table 3-15 Water quality impaired streams in the Rudyard project area watersheds

Sixth HUC Watershed	Stream	Impaired Uses	Probable Cause
Bear Creek	Bear Creek and Little Bear Creek	Fish Consumption, Other indigenous aquatic life and wildlife	Mercury and PCB in water column
Chub Creek	Chub Creek	Fish Consumption	PCB in water column
Trout Lake-Pine River	Pine River	Fish Consumption	PCB in water column
Elmhirst Creek-Pine River	Elmhirst Creek, Pine River	Fish Consumption	PCB in water column
Pine River	Pine River	Fish Consumption, Other indigenous aquatic life and wildlife	Mercury and PCB in water column

Other than the Mercury and PCB mentioned above, water quality within the project area is good. There are likely isolated sources of sediment within and upstream of the project area including stream banks, soil erosion from roads and ditches, and natural erosion from geologic sources. However, none were found during field surveys. The fact that none of the streams are listed for sedimentation indicates that traditional forest management practices (skid trails, roads, logging operations) are not causing excessive sedimentation into streams.

3.6.5 Proposed Action & Alternative 1

3.6.5.1 Direct and Indirect Effects

Timber harvest activities have the potential for elevated short-term erosion rates with localized effects. Where harvest is in close proximity to stream channels harvest design would incorporate state of Michigan BMPs (State of Michigan, 2009). All mapped streams currently have a 100-foot buffer with harvest limitations. This buffer contains harvest limitations to maintain water quality (State of Michigan, 2009). Any additional streams found during sale layout would be prescribed the same buffer. This minimizes any sediment delivered to stream channels. Potential harvest impacts are minor and

short-term in nature. Best Management Practices (BMPs) are prescribed on the HNF to help maintain water quality during management activities. Monitoring of BMPs on the HNF has shown that they are effective in protecting soil and water quality (Trudell 2005, Corner and Gries 2007, Range and Corner 2009).

Some additional delivery of sediment to stream systems would be expected in the short-term at road-stream crossings due to increased hauling and necessary maintenance activity for timber sales. Best Management Practice standards at stream crossings can help reduce this potential sedimentation. Winter operations will also decrease any potential stream sedimentation from road crossings.

In terms of the water quality listed streams contained in Table 3-14 above, it is not anticipated that either the proposed action or Alternative 1 will have impacts to these streams that further limit water quality. Streams are listed for PCB and mercury content, which the forestry practices proposed in this project have no effects on. None of the streams are listed as impaired for sedimentation, which is the primary anticipated short-term effect from the activities proposed. It is not anticipated that the small amount of potential sediment entering the streams will cause them to be impaired either (Issue 5 in section 1.8.5).

3.6.5.2 Cumulative Effects

The Rudyard project area watersheds have been affected by past timber management activities. Table 3-16 below shows the percentage of upland young forest (younger than 16 years) and upland openings in each of the 6th HUC watersheds. Field reviews show each of the proposed treatment units has fully recovered hydrologically as well as the majority of the road system. The Hiawatha National Forest plan watershed standard #1 states “management actions on National Forest System land will not increase the total combined acreage of upland young forests (younger than 16 years) and upland openings to exceed 60 percent of the total area (all ownership) of any sixth-level HUC watershed” (p.2-29). This watershed cumulative effects threshold is not anticipated to be met with either action alternatives. Standardized Hiawatha National Forest protocol was used to calculate forest openings. State of Michigan land cover geographic data was used to determine land cover on private land.

Table 3-16 Current and anticipated openings for the Rudyard watersheds.

		New Open Acres		**New Open Percentage**		**Percentage After Treatment**		
Sixth HUC Watershed	**Percentage Currently Open**	Proposed Action	Alt 1	Proposed Action	Alt 1	Proposed Action	Alt 1	**Watershed Acres**
Bear Creek	22	125	81	2	1	24	23	6,116
Chub Creek	19	74	64	1	1	20	20	6,750
Elmhirst Creek-Pine River	19	336	330	3	3	22	22	10,368

Nunns Creek at mouth	1	22	0	3	0	4	1	766
Pine River	18	39	30	0	0	18	18	8,389
Trout Lake-Pine River	25	0	0	0	0	25	25	1,418

Future activities within the 6th HUC watershed would include more timber harvesting and road construction on forest service land as well as land clearing and development on private land. Appendix H of this document contains a list of projects that overlap the cumulative effects boundaries in both space and time. Past projects were used for calculations in the table above. Reasonably foreseeable future actions are not anticipated to cause watersheds to cross threshold levels in the timeframe of analysis (15 years).

3.6.6 No Action

3.6.6.1 Direct and Indirect Effects

The No Action would have no direct effects on water quality resources. With the no action alternative, there would be a missed opportunity to fix any existing road-related watershed issues. Although none were found during field surveys, there is the possibility that some exist. The proposed road decommissioning also would not take place. Not decommissioning roads increases the possibility of illegal ATV use and associated watershed damage. These are all potential indirect effects.

3.6.6.2 Cumulative Effects

There would be no cumulative effects to the water quality resource. The direct and indirect effects mentioned above are not anticipated to contribute to cumulative effects.

3.7 Wetlands

3.7.1 Introduction

Table 3-17 Summary of Wetlands Effects

Activity or Measure	Proposed Action Effects	Alternative 1 Effects	No Action Effects

Change in the amount of wetland area (ELT) as a result of road activities	Net loss of ELT wetlands on 0.9 miles (3 acres) of new roads, which still meets forest standards.	Net loss of ELT wetlands on 0.9 miles (3 acres) of new roads, which still meets forest standards.	No change in wetland area.
Wetland areas compacted from heavy equipment operations.	Some compaction will occur on approximately 16 acres of wetlands but will be within forest standards	Some compaction will occur on approximately 13 acres of wetlands but will be within forest standards	No soil compaction will occur.

Wetlands are defined as "those areas that are inundated or saturated by surface water or ground water with a duration sufficient to support, and under normal circumstances, do support a prevalence of vegetation typically adapted to life in saturated soil conditions." (40 CFR 230.41 (a)(1)). Wetlands have been recognized as important ecosystem components for their functions as filters for sediment and pollutants, nutrient cycling, water storage, flood control, and wildlife habitat.

Under Section 404 of the Federal Water Pollution Control Act of 1972 (also known as the Clean Water Act), the U.S. Army Corps of Engineers has been given responsibility to regulate the discharge of dredged and fill material into waters of the United States, including wetlands (33 CFR 323.3). Normal silvicultural activities, including harvesting for the production of forest products or upland soil and water conservation practices, are exempt from Section 404 permits (33 CFR 323.4). Construction and maintenance of forest roads for normal silviculture are also exempt provided BMPs are applied (33 CFR 323.4; Michigan's Water Quality Management Practices on Forest Land). Where a Section 404 permit is required, a Section 401 water quality certification from the State of Michigan may be required (33 CFR 325.2; NR 103 Water Quality Standards for Wetlands). Appropriate federal and state permits would be obtained prior to implementation of projects involving wetlands.

3.7.2 Analysis Methods

Datasets were reviewed for the presence of wetlands within the project area of the proposed treatment stands. The datasets include stand vegetation data, soil survey data (hydric soil list), U.S. Fish and Wildlife Service National Wetland Inventory (NWI) maps, and ELT mapping. Additionally, field survey information was used to verify the general accuracy of the published data. Thirty-four proposed treatment stands were visited and documented in the Project Record.

Harvest compaction analysis on wetlands was done using ELT mapping data as a delineator of wetlands. Ecological landtype data is correlated to soils survey information and groups wetland soils by the type of soil - mineral or organic, and the depth of the organic layer (Table 3-8 in the soils section). The ELT mapping is therefore more appropriate for this level of analysis. Soil textures within these wetland ELTs were used

to estimate the extent of compaction using Landwehr's monitoring results. For complete analysis and assumptions, see the watershed specialist report in the project record.

3.7.3. Analysis Areas

3.7.3.1 Direct and Indirect Effects Boundaries

The spatial effects boundary is a 100 foot buffer on all treatment stands. The temporal boundary for direct and indirect effects is 2 years after completion of an activity. This is a reasonable area to expect any direct impacts will occur from stand treatments and the time for disturbed areas to re-vegetate and re-stabilize.

3.7.3.2 Cumulative Effects Boundary

The timeframe for cumulative effects is twenty years after project implementation. Twenty years is roughly the time required for any detectable physical and chemical changes to be seen in the wetland soils and also the stand re-entry timeframe. The spatial boundary is 100 feet from the edge of treatment stands. This area represents a natural boundary where effects may contribute to wetland cumulative effects beyond which wetland effects are diluted to the point of not reasonably detectable. Activities which have and will occur within the wetland cumulative effects analysis area include road maintenance, decommission, and construction on federal and private lands, timber harvest and planting, wildlife projects including maintenance of open areas.

3.7.4 Affected Environment

NWI mapped wetlands occupy about 33 percent the project area. Table 3-18 below summarizes wetland acreage by alternative and NWI type within the project area. As can be seen, and is expected, the most common type of wetland is the freshwater forested/shrub wetland throughout the project area and in both alternatives.

Table 3-18 Acres of NWI wetland type by total project area and alternatives for the Rudyard project.

NWI Wetland Type	Project Area	Proposed Action	Alternative 1
Freshwater Emergent Wetland	556	7	7
Freshwater Forested/Shrub Wetland	10,775	235	196
Freshwater Pond	186	2	2
Riverine	32		
Total	**11,549**	**244**	**205**

Natural disturbance events in wetlands include flooding, wildfire, windthrow and beaver activity in adjacent streams. Of these events, beaver ponding probably has the most noticeable effect on wetland hydrology and the extent of wetlands on the Forest. The numbers of beaver on the forest are increasing due to decreased trapping and abundant habitat opportunities. As a consequence, the acres of beaver ponds and wetlands are increasing and the type of wetland is changing. After beaver abandon their ponds, the

impounded area remains an open water, sedge or shrub wetland due to the remaining silty deposits of poorly drained soil with high water holding capacity.

Roads and railroad grades traverse wetlands and have led to changes in wetland hydrology and ponding and limit surface water and shallow groundwater movement in some wetlands (USDA Forest Service 2006b). GIS mapping indicates that there are about 28.5 miles of roads through wetlands within the project boundary (NWI and travel route GIS data). Table 3-19 below shows mileage of roads through wetlands by watershed in the project area. Where harvest is planned on wetland soil types, mitigations have been prescribed to minimize potential impacts due to compaction, rutting, and displacement (MDEQ/MDNR 2009).

Table 3-19 Mileage of existing road through wetlands by watershed in the Rudyard project.

Sixth HUC Watershed	NWI Wetland Type			Total
	Freshwater Emergent Wetland	Freshwater Forested/Shrub Wetland	Freshwater Pond	
Bear Creek	0.3	6	0.2	6.5
Chub Creek	0.6	3.5		4.1
Elmhirst Creek-Pine River	0.2	4.1	0.1	4.4
Nunns Creek at mouth		1.4		1.4
Pine River	0.4	9.9	0.3	10.6
Trout Lake-Pine River	0.1	1.4	0.1	1.6
Total	**1.6**	**26.3**	**0.7**	**28.6**

3.7.5 Proposed Action & Alternative 1

3.7.5.1 Direct and Indirect Effects

Table 3-20 below shows the harvest acres by alternative for wetland ELTs in the Rudyard project area. Ecological Land Types 70A and 70B consist of forested wetlands with less than 12 inches of organic soil while ELT 80B consists of forested wetlands with more than 12 inches of wet, organic soil.

Table 3-20 Harvest acres on wetland ELTs.

Ecological Land Type	Proposed Action	Alternative 1
70A	11	10
70B	190	163
80B	38	33
Total	**239**	**206**

3.7.5.1.1 Wetland Compaction and Rutting

Compaction monitoring (Landwehr, 2005) and subsequent calculations estimate that approximately 16 acres for the proposed action and 13 acres for Alternative 1 would exceed compaction standards for ELT wetland harvest. These results are shown in Table 3-21 below. The total wetland acres anticipated to exceed NSSH root restriction standards is 8% of the wetland treatment area for both alternatives.

Monitoring on the HNF suggests that rutting and displacement are bigger issues on organic soils than compaction (Range, 2007). Displacement from rutting can result in a diversion of subsurface flow. This may result in some drainage of upland wetland areas due to a lowered resistance to flow during high water periods. The precise impact of this is difficult to assess, but would generally be when water tables are high, since the flow would decrease as the water level decreases. Any anticipated rutting would be closely associated with the compaction acreage in table 3-21 below as this assesses the total acreage heavily impacted from stand treatments.

Approximately 3.2 acres of new and temporary roads would be built on wetlands. This is somewhat offset by the 1.2 acres of road decommissioning that will occur in ELT wetlands. Within the short term (2-3 years) following harvest activities, vegetation will be re-established and soils will recover in both the decommissioned road areas and secondary skid trails.

Table 3-21 Total acres anticipated to exceed NSSH root restriction standard for compaction on ELT wetland soils.

Soil Textural Group	Proposed Harvest Acres		Anticipated Compaction Acres	
	Proposed Action	Alternative 1	Proposed Action	Alternative 1
Medium and fine sands, loamy sands	23	23	0.1	0.1
Organic Soils	73	67	0.8	0.8
Silty clay loams and clays	143	116	15.8	12.8
Total acres compacted by harvest activities	**239**	**206**	**16.7**	**13.7**
Total acres compacted by road activities			**3.2**	**3.2**

Table 3-22 below contains a summary of harvest acres by Alternative on ELT wetland soils. Almost all of the wetland soil units have preferred logging during the winter season. Although not all classified as organic soils, most of the wetland soils will have strong organic component. Therefore if rutting occurs operations are shut down until measures are taken to prevent rutting or conditions will enable logging without rutting (Soils Guideline #1, HNF Plan, Appendix A). Where rutting has occurred on deep peat soils productivity impacts are limited to the impact areas (Groot 1998).

Table 3-22 Soil characteristics and operating season for ELT wetland soils.

Map Unit Symbol	Map Unit Description	Textural Class	Preferred Operating Season	Proposed Action	Alternative 1
12	Pickford silty clay loam	SCL	Summer, winter	101.6	80.7
22	Kinross muck	O	Summer, winter	1.4	0.6
34	Entisols, flooded	O	Winter	13.5	13.5
35	Histosols and Aquents, ponded	O	Winter	0.2	0.2
36	Markey and Carbondale mucks	O	Winter	37.9	32.6
68	Wakeley muck	O	Summer, winter	10.6	10.6
112	Soo silty clay loam	SCL	Summer, winter	40.6	34.8
150	Fibre muck	O	Summer, winter	9.3	9.3
11A	Rudyard silty clay loam, 0 to 3 percent slopes	SCL	Summer, winter	0.3	
164A	Moltke loam, 0 to 3 percent	SCL	Summer, winter	0.1	0.1

	slopes				
18D	Rubicon sand, 6 to 15 percent slopes	MS	Spring, fall, winter	1.3	1.3
20B	Croswell sand, 0 to 6 percent slopes	MS	Spring, fall, winter	1.5	1.5
29A	Solona loam, 0 to 3 percent slopes	SCL	Summer, winter	0.5	0.5
32A	Allendale fine sand, 0 to 3 percent slopes	MS	Summer, winter	2.5	2.5
44B	Battydoe fine sandy loam, 1 to 6 percent slopes, stony	MS	Year round	0.8	0.8
49A	Wainola fine sand, 0 to 3 percent slopes	MS	Summer, winter	16.4	16.4
89A	Spot-Finch complex, 0 to 3 percent slopes	MS	Summer, winter	0.5	0.5
				239.2	**206.1**

O=Organics, **SCL**=Silt Clay Loams and Clays, **MS**=Medium and Fine Sands, Loamy Sands

3.7.5.1.2 Road Activities on Wetlands

Roads used for winter logging only are not constructed using road base fill or gravel for hardening. This decreases the long term wetland impacts. On HNF roads avoid wetland crossing during sale layout, further reducing wetland impacts (Range 2005). Road fill is added only when necessary to cross wet areas that will not freeze adequately to support equipment. Where cross flow may be affected by compaction and rutting, rubber mats are used to aide in freeze-down. Where this method does not work a culvert may be installed. When it is necessary to install a culvert, fill would be used to cover the culvert. Following harvest, culverts and mats are removed, and the crossing is restored to its original dimensions. These measures ensure that road management impacts to wetlands are minimized. Temporary roads are obliterated following timber sales and site preparations.

3.7.5.1.3 Water Table Changes

Following harvest, a rise in the local water table would be expected and water table fluctuations would be less moderated following rainfall events (Verry 1997). This results from reduced evapotranspiration and altered surface soil properties from traffic after vegetation removal. This effect is most pronounced during the growing season and generally returns to baseline conditions within several years. The ‘wetting up’ of a site is recognized as a transient effect, although full recovery to pre-harvest conditions may take many years. Re-establishment of the forest stand is the main driver that restores hydric balance (Dube et al. 1995, Verry 1986).

3.7.5.2 Cumulative Effects

Within the project area wetlands have been impacted primarily by loss of wetlands due to road construction and private land development. Private land development will continue in the project area watersheds. However, neither the proposed action nor Alternative 1 direct or indirect effects would contribute to cumulative effects to wetlands.

Within the project area watersheds it is estimated that 28.5 miles of roads go through wetlands, impacting 69.2 acres. An additional 3.2 acres will be impacted from road

construction while 1.2 acres will be restored with both action alternatives. The direct and indirect effects of the project would not result in additional incremental impact when added to effects of past, present, and reasonably foreseeable future actions shown in Appendix H. Field surveys of proposed treatment stands confirmed that wetlands have fully recovered from past activities and therefore will not contribute to cumulative effects. There is some thinning and road obliteration planned within the cumulative effects boundary as part of the East Red Pine NEPA project. There are a total of 12 proposed treatment acres from the East Pine NEPA project that will not contribute to future cumulative effects.

3.7.6 No Action

3.7.6.1 Direct and Indirect Effects

The No Action would have no direct or indirect effects on the wetland resources.

Proposed road improvement and decommissioning activities would not be accomplished with the No Action alternative. This has the potential to create some indirect effects as decommissioned roads will still be available for illegal ATV activities, potentially causing damage to wetlands.

3.7.6.2 Cumulative Effects

There would be no cumulative effects to the wetlands. The potential indirect effects described above are not anticipated to contribute to cumulative effects.

3.8 Vegetation

3.8.1 Introduction

Table 3-23 Summary of Vegetation Effects

Activity or Measure	Proposed Action Effects	Alternative 1 Effects	No Action Effects
Acres of Mid Seral moved to Aspen	346	346	0
Acres of A3 or A4 to A1	287	287	0
Acres of L3 or L4 to L5	121	121	0
Number of Aspen Stands 10-25 acres in size.	201	193	162

Acres of Aspen Regenerated	530	477	0

This section refers to the forest stands that make up the Rudyard project area. The analysis will discuss how silvicultural treatments would affect the forest health or stands proposed for treatment. The analysis will also discuss how treatments would affect vegetation composition regarding the Forest Plan's desired conditions. The HNF received the following comments in response to the project scoping process regarding impacts to the vegetation resources.

1. The amendment of the Forest Plan may lead to a Forest-wide cutting before rotation age and does not represent the management of those stands for the best value if it produces low-value biomass now instead of high-value pulpwood later.

2. The amendment of the Forest Plan to allow some of the wildlife openings to become reforested may lead to the cutting of trees in other areas to create new wildlife openings in order to provide more biomass.

3. Removal of trees that results in an increase in distance between trees may result in drier conditions due to increased sunlight and there may be a significant reduction in growth of trees and ground cover.

Needs identified in chapter 1 that relate to vegetation include the following:

1. Moving the current vegetation composition in Management Area 1.2 closer to the desired range in the Forest Plan.

2. Improve growth and vigor of individual trees.

3. Reduce the risk of future insect and disease outbreaks.

4. Create a balanced aspen age class structure.

3.8.2 Analysis Methods

The Forest plan Implementation Simulation Tool (ForIST) breaks the HNF down by suitability, ecological land type (ELT) and Management Area (MA). It then classifies stands by seral class and by size class. The tool then compares the current condition of stands in the Management Area to FP desired condition (DC) for vegetation composition. This helps drive the purpose and need, by highlighting where vegetation composition is outside of the DC. This model also creates an ArcGIS layer that assigns seral and size class to each polygon. It was then predicted what seral class and size class each proposed activity would result in for every activity proposed in Management Area 1.2. These predictions were based on experience and the following research: Manager's handbook for Aspen in the North Central States (Perala, 1977), Stand development and overstory-understory interaction in an aspen-northern hardwoods stand (Roberts, 1992), A revised Managers Handbook for Red Pine in the North Central Region (Skally & Blinn, 2002) and Managers Handbook for Northern Hardwoods in the North Central States (Tubbs, 1977).

Analysis of forest vegetation requires data analysis, followed by on the ground confirmation. Data used for this analysis is from HNF FSVeg database, and walk-through exams. FsVeg stores data that has been collected through field examination of individual stands. Within Rudyard EA project area approximately 74% of the stands were inventoried using a quick plot examination method between 2007 and 2012. A determined number of plots were taken for each stand. Species, diameters at breast height (DBH), and number of trees were recorded for each plot, along with field observations such as stand health. The data was summarized by stand and an initial list of potential stands was drafted. Stands where vegetative management is not permitted under Hiawatha National Forest Plan (FP) were not included on the list. Also, young stands and poorly stocked stands were not included on this list. Further analysis of the area showed a need to treat some young and poorly stocked aspen stands in order to create habitat for early successional species.

The stands on the initial list then received walk-through exams in 2011. This type of examination relies on field observations of the viability of harvesting, special management concerns, and possible treatments. Based on the walk-through observations and the purpose and need of Management Area 1.2, a finial list of stands and proposed treatments were created, and can be found in Appendix C – Silviculture and Transportation.

As the list for proposed silvicultural activities was being developed, Interdisciplinary Team members provided input regarding other resources within or near the stands. This resulted in some stands being dropped as well as some stands being broken up to provide small stands of young aspen.

3.8.3 Analysis Areas

The defined spatial boundary for direct and indirect effects is the Rudyard project area. The rationale is because vegetation management activities only affect vegetation within the treatment units within the project area boundary.

The defined spatial boundary for insect and disease direct, indirect and cumulative effects is Mackinac and Chippewa counties. The rationale is based on the existence of Emerald Ash Borer (EAB), spruce budworm, and beech bark disease (BBD). There is potential for all three of these to spread as their hosts are scattered throughout the project area.

The temporal boundary for other vegetation direct, indirect and cumulative effects analysis is estimated at 1992-2022. 1992 is when the last two EA's within this project area started, and 2022 is approximately the length of time new even-aged regeneration cuts would be temporary openings, and the approximate time when the project area would be ready for future harvest.

The defined spatial boundary for cumulative effects analysis for Forest Plan vegetation composition goals is the HNF boundaries for MA 1.2. The rationale is based on FP direction that vegetation composition goals are forest wide. There are no vegetation composition goals for lands other than HNF. Even though the Proposed Action includes red pine commercial thinning of 372 acres in MA 2.3, this EA will not discuss how treating these acres would affect the Forest vegetation composition goals for MA 2.3, because commercial thinning of red pine will not change either the seral class or size class of these stands. Thus it would not have an effect on the vegetation composition goals.

The temporal boundary for FP vegetation composition goals is from when the FP was initiated until the present. Therefore, cumulative effects for vegetation composition goals will only be on HNF System lands from March 29, 2006 to implementation of harvest treatments.

3.8.4 Affected Environment

Approximately 78% (18,184 acres) of the Rudyard project area is considered suitable for timber production. Approximately 92% (16,712 acres) of the suited acres are in MA 1.2.

The existing conditions used in describing the affected environment for Rudyard project area were obtained from the Rudyard Mid-Scale Assessment (April, 2010). Figure 3-1 shows the existing seral class percentages in MA 1.2 for suited land.

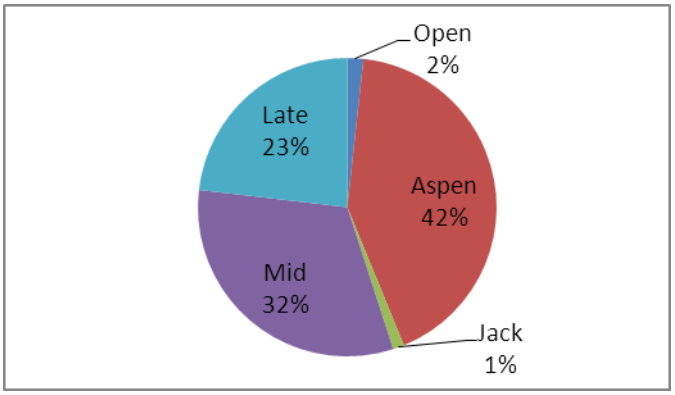


Figure 3-1 Summary of Existing Seral Classes for Suited Land MA 1.2

Aspen Seral

The aspen seral class accounts for approximately 42% of suited acres in MA 1.2 across the HNF and 51% of the suited acres in Rudyard project area. The aspen seral class is comprised of the following forest types: quaking aspen, paper birch, bigtooth aspen and balsam poplar. Aspen/white spruce/balsam fir is in the aspen seral class for ELTs 10/20, 30 and 40/50/90, and mid seral for all other ELTs. In general the HNF has too many acres in size class 4 and not enough in size class 1. Within the Rudyard project area stand exam data shows about 17% of the aspen is in size class 1 and 32% in size class 2. However, walk-through exams found that most of the size class 1 has grown into size 2; resulting in about 49% of the aspen being size class 2, and about 1% in size class 1.

Of aspen seral class on suited lands within the Rudyard project area, approximately 57% (4,374 acres) of it is younger than the minimum timber rotation age of 35 years. Since an even-aged harvest cannot be prescribed to a stand adjacent to a temporary opening, only about 35% of the aspen seral class is currently suitable for regeneration harvests to be chosen from. A temporary opening is a regenerating stand in which the trees are still less than 20 percent of the height of the surrounding trees (FP 2006 2-12). In the Rudyard project area approximately 22% of the aspen seral class is still too short for an adjacent stand to be clearcut. In Management Area 1.2 the desired aspen stand size is 10 to 25 acres. Approximately 41% of the aspen seral class stands are of the desired acre range of 10 to 25 acres.

Mid Seral

The mid seral class accounts for approximately 31% of the suited acres in MA 1.2 across the HNF and 30% of the suited acres in Rudyard project area. The mid seral class is comprised of a variety of forest types ranging from spruce/fir to red pine to mixed swamp conifer. In general the HNF has too many acres in size class 4 and not enough in size class 1, 2 and 3. In general the Rudyard project area does not have enough in size class 1 and 2.

Late Seral

The late seral class accounts for approximately 23% of the suited lands in MA 1.2 across the HNF and about 15% of the land in the suited acres in Rudyard project area. The late seral class accounts for approximately 46% of the suited lands in MA 6.4. The seral class is comprised of long-lived species such as white pine, hemlock, lowland hardwoods, and northern hardwoods. In general there is a need to increase the number of acres in size class 2, 3 and 5. This is true for the Rudyard project area also.

Red Pine

There are 5 red pine stands in MA 2.3, approximately 319 acres. They were planted with red pine in the 1930s. After being row thinned in the 1970s and 1980s, some of the rows were planted with various tree species including white pine, yellow birch, paper birch and white spruce.

3.8.5 Proposed Action

3.8.5.1 Direct and Indirect Effects

Almost all of the stand boundaries proposed for harvest were redrawn for several reasons, and may be slightly adjusted during implementation for the same reasons. The old stand boundary did not reflect current natural stand boundaries. Forests are dynamic and stand boundaries can change due to natural or human disturbances. Some of the stands could not be treated in their entirety due to them being larger than the desired temporary opening size of 10 to 25 acres (Forest Plan, 2006 p.3-5).

The effects of the coppice cutting and wildlife habitat improvement cutting in stands younger than 35 years would include improving the stocking of under stocked areas within larger stands (USDA 1977). Single tree selection, improvement cut and commercial thin harvests would result in improved stand quality and tree vigor, allowing residual trees to increase in size and value due to increase availability of soil nutrients, moisture and sunlight (Gilmore 2005, Smith 1962). Liberation harvest would also allow trees in the strips within the red pine stands to increase in size. This would promote species diversity within the red pine stands. Clearcut, coppice cut and wildlife habitat improvement cut would result in ideal growing conditions for aspen. Planting would promote species diversity and ensure National Forest Management Act (NFMA) requirements are met.

Harvest would provide usable wood products to local markets. It would also result in the accumulation of slash (tree tops and branches) on the forest floor. The amount of slash in a stand would vary depending on the number of trees removed and type of harvest.

Slash would be visible in the understory of the stands for 3-5 years after harvesting until it is decomposed enough to lay flat on the forest floor.

Most of the snags and den trees would be retained as described in the Forest Plan pp. 2-16 and 2-17. Either reserve islands or scattered trees would be retained in all stands to receive even-aged regeneration cuts see table C-1 in Appendix C – Silviculture and Transportation for details. These reserve islands would provide a future source of dead and down coarse woody debris, snags and den trees. If possible, reserve areas would be associated with long lived conifer species. Retaining individual trees and reserve islands as described above would provide visual and ecological diversity, as well as providing habitat for raptors and other wildlife.

To protect riparian and aquatic habitat, Michigan state best management practices will be followed (FP 2006, p. 2-14).

Proactive treatment of hardwood stands that include ash could minimize damaging effects of EAB on the stand as a whole. Treatments designed to improve the growth or regenerate non-ash species could decrease the impact of EAB. In wetter stands with a high percentage of ash that die all at once, it could raise the water table to such an extent that regeneration is no longer possible. In drier stands with a high percentage of ash that die all at once, the effect would be similar to over harvesting a hardwood stand in that raspberries and other shrubs impede regeneration (Berrang 2009). Removal of beech trees in hardwood stands could provide growing space for other more desirable tree species such as hemlock, yellow birch, and red oak.

Trees grow in two ways. The first way is in height and is determined by the site quality. The second way is in diameter, and is determined by density. Density is usually measured as trees per acre or square feet of basal area. If the entire area is already occupied then there is no room for continued diameter growth. Eventually a stand can start to self-thin, in which the trees with the smallest crowns will die. If all the trees in the stand have similar amount of crowns the stand may not self-thin; instead the stand will stagnate and there will be neither mortality nor diameter growth. If the density is too low then individual tree diameter growth is optimized, but not stand growth. Tree density management guides have been developed through years of research to optimize a variety of outputs, including both stand growth and individual tree growth (Smith 1962). There are density guides for a variety of species as how much growing space is occupied by a ten inch DBH. Red pine is different than how much growing space is occupied by a ten inch DBH sugar maple. Those stands proposed to be thinned would be thinned so as to balance stand growth and individual tree growth in order to maximize timber production and reduce tree mortality.

Aspen site preparation would remove cull trees to promote aspen sprouting. The less shaded the soil is, the warmer it will be, which then causes the aspen roots to send up new stems. The same result would be achieved whether it is accomplished by the logger while the unit is being harvested or by hand crews afterwards. Slightly better results would be achieved with the logger performing the task, as there would be no lag time between harvest and site preparation. Also the most successful site preparation is achieved when the soils are frozen (USDA 1977). Mechanical site preparation would reduce vegetation competition and create mineral seedbeds for hand planting (Smith 1962).

Aspen Seral Class

Even-aged regeneration cuts would regenerate stands to healthy vigorous young stands. It would also break up aspen stands greater than the 25 acres desired size into 10 to 25 acres stands. Approximately 49% of the aspen seral class stands would be of the desired acre range of 10 to 25 acres. In order to meet the FP vegetation composition goals and stand size desired condition about 7%-12% of the suitable aspen within Rudyard would need to be regenerated every 5 years. The proposed action regenerates 7% of the suitable aspen. This would lead to a more balanced age class structure (Issue 2 in section 1.8.2).

Approximately 530 acres of aspen less than 4.5 feet tall (size class 1) would be created.

Approximately 170 acres of aspen would be treated with intermediate harvests in order to improve the growth of individual trees, salvage aspen and to shift species composition to midseral.

Mid Seral Class

Approximately 156 acres would be clearcut to be converted into aspen stands, size class 1. Approximately 150 acres would receive improvement cuts, (most of the dying trees removed and the rest of the stand thinned). This will result in about 125 acres of aspen size classes 2 and 3. It would also result in 24 acres mid seral size classes 2 and 3. Approximately 48 acres would be commercially thinned, resulting in improved individual tree growth and overall stand value. In general, the mid seral class in MA 1.2 would not be affected. Only the percentage of size class 3 changes (11% to 12%).

Late Seral Class

One stand (about 14 acres) would be clearcut to create aspen size class 1. Approximately an additional 86 acres would be single-tree selection cut to introduce a new age class into the stand in order to move it towards an all age stand. Approximately 139 acres would be treated with intermediate harvests in order to improve the growth of individual trees, and to salvage aspen.

3.8.5.2 Cumulative Effects

Table H-1 of Appendix H lists past and current projects that have occurred, are occurring or soon to occur on Forest Service land within Rudyard project area and MA 1.2. Sprinkler EA is the only current vegetation project in MA 1.2 that tiers to the FP. The cumulative effect of these vegetation treatments along with the Proposed Action would be movement towards the FP vegetation composition goals. There are no foreseeable new vegetation projects within MA 1.2.

Table 3-24 shows the forest wide effect of the Proposed Action and the Sprinkler EA on the FP vegetation composition goals. The primary way to increase percentages in size classes 2-5 is to allow stands to grow into them. Thinning and other intermediate harvests can increase diameter growth rates. If they remove small diameter trees and leave the largest diameter trees they can also cause an increase in stand size class.

Table 3-24 Change in Size Class and Seral Class by ELT from Sprinkler and Rudyard PA

ELT	Size Class	Aspen		Late Seral		Mid Seral	
		FW % Before/ After	FP Goals Min/Max %	FW % Before/ After	FP Goals Min/Max %	FW % Before/ After	FP Goals Min/Max %
10/20	1	0/1	2/6	0/0	1/4	0/2	0/3
	2	1/4	8/18	1/1	3/12	0/2	1/3
	3	23/11	10/18	12/23	3/12	5/20	2/4
	4	13/15	0/3	11/25	8/20	7/22	None
	5	0/6	None	2/5	None	0/0	None
30	1	0/2	4/10	0/0	None	0/1	2/10
	2	3/5	14/25	0/2	None	2/4	6/15
	3	29/18	17/30	4/8	4/12	8/15	7/15
	4	13/13	0/5	14/26	5/13	22/39	8/20
	5	0/8	None	0/0	3/12	0/5	2/10
40/50/90	1	1/5	4/10	0/3	None	0/7	1/5
	2	9/10	10/20	0/0	5/10	0/4	2/8
	3	15/5	17/25	2/4	10/20	7/3	3/10
	4	13/13	4/10	39/57	6/16	11/17	6/10
	5	1/4	None	0/2	3/13	0/0	None
60	1	0/6	5/10	1/6	None	0/2	1/10
	2	23/9	25/35	0/0	1/5	1/5	2/15
	3	12/10	30/40	8/12	5/15	9/25	3/18
	4	19/7	0/5	9/16	4/15	14/28	5/20
	5	0/9	None	1/2	2/12	1/2	1/12

***The highlighted cells are where a particular seral class and size class moved closer to the forest wide vegetation composition goals.**

When Rudyard proposed harvests and harvests scheduled under the Sprinkler EA are cut, aspen size class 1 would be within the Forest Plan vegetation composition goals for ELTs 40 and 60. Overall size class 1 is increased from approximately 1% of MA 1.2 to 4% of MA 1.2. Overall aspen size class 2, 3 and 4 acres are reduced. Many of the proposed harvests in Sprinkler move aspen stands into the mid seral groups. Also, most of the aspen acres across MA 1.2 would not be treated allowing them to either grow into the next larger size class, or to convert into mid seral stands as the aspen dies out of them.

The Sprinkler EA does not treat any late seral stands. However, it does convert approximately 337 acres of mid seral stands to late seral size class 1. This combined with the Rudyard EA proposed harvests account for the increase in size class 1 in ELTs 40 and 60 and some of the increase in size class 4 in ELT 40. The rest of the changes are due to the stand average diameter growing into the next size class.

Most of the changes in the mid seral class are either stands being converted into aspen or late seral stands, or aspen stands naturally converting into mid seral stands. The Sprinkler EA does regenerate about 127 acres of over mature mid seral stands. The rest of the changes are due to the stands growing into the next size class.

Proposed clearcuts are arranged in such a manner that not only is there 10 acres between them, but also to facilitate future harvesting. In the case of stands being harvested before rotation age there would be an age difference of about 10 years between the newly created stands, and the untreated stands. If the untreated stands are grown until they are 40 years old, the newly created stands would be at least 20 percent of the height of the surrounding trees. The rest of the clearcuts are arranged in such a way that there would be an operable future harvest unit between them.

Michigan Department Natural Resources has an active timber program for the Sault Ste. Marie and Newberry Forest Management Units in Chippewa and Mackinac counties (MDNR). These harvest activities include clearcuts, clearcuts with reserve trees, shelterwood cuts, thinning, and selection cuts in all Lake States forest types (Michigan DNR Sault Ste. Marie webpage 2012).

Industrial forested lands in Mackinac and Chippewa counties are dominated by Plum Creek and Forest Land Group. Several of these stands are managed predominately for red pine pulpwood. Many of their northern hardwood stands are dominated by beech that is heavily infested with BBD. Plum Creek salvaged most of these stands in the past seven years. This management direction on private and industrial forested lands will most likely continue in the future.

Thinning and selection cuts on all lands containing ash species would reduce the impact of EAB infestations by reducing the ash population. This gives the stands the ability to grow and regenerate non-ash species, without eliminating the ash population. Also, thinning and selection cuts would maintain or improve stand vigor, allowing the stands to be more resistant to other insect and disease outbreaks (Perkins 2006 and Berrang 2009). Harvesting in mature and over mature stands would continue to address forest health concerns. The long-term trend would be a continued improvement in forest health conditions as management moves toward desired vegetation goals.

3.8.6 Alternative 1

3.8.6.1 Direct and Indirect Effects

There is little difference between the proposed action and Alternative 1. Almost all of the stand boundaries proposed for harvest were redrawn for several reasons, and may be slightly adjusted during implementation for the same reasons. The old stand boundary did not reflect current natural stand boundaries. Forests are dynamic and stand boundaries can change due to natural or human disturbances. Some of the stands could not be treated in their entirety due to them being larger than the desired temporary opening size of 10 to 25 acres.

Single tree selection, improvement cut and commercial thin harvests would result in improved stand quality and tree vigor, allowing residual trees to increase in size and value due to increase availability of soil nutrients, moisture and sunlight (Gilmore 2005, Smith 1962). Liberation harvest would also allow trees in the strips within the red pine stands to increase in size. This would promote species diversity within the red pine

stands. Clearcut, coppice cut and wildlife habitat improvement cut would result in ideal growing conditions for aspen. Planting would promote species diversity and insure National Forest Management Act (NFMA) requirements are met.

Harvest would provide usable wood products to local markets. It would also result in the accumulation of slash (tree tops and branches) on the forest floor. The amount of slash in a stand would vary depending on the number of trees removed and type of harvest. Slash would be visible in the understory of the stands for 3-5 years after harvesting until it is decomposed enough to lay flat on the forest floor.

Most of the snags and den trees would be retained as described in the Forest Plan (pp. 2-16 and 2-17). Either reserve islands or scattered trees would be retained in all stands to receive even-aged regeneration cuts see table C-1 in Appendix C – Silviculture and Transportation for details. These reserve islands would provide a future source of dead and down coarse woody debris, snags and den trees. If possible reserve areas would be associated with long lived conifer species. Retaining individual trees and reserve islands as described above would provide visual and ecological diversity, as well as providing habitat for raptors and other wildlife.

To protect riparian and aquatic habitat, Michigan state best management practices will be followed.

Aspen Seral Class

Even-aged regeneration cuts would regenerate stands to healthy vigorous young stands. It would also break up aspen stands greater than the 25 acres desired size into 10 to 25 acres stands. The follow up site preparation would remove cull trees to promote aspen sprouting.

Approximately 477 acres of aspen less than 4.5 feet tall (size class 1) would be created.

Approximately 112 acres of aspen would be treated with intermediate harvests in order to improve the growth of individual trees, salvage aspen and to shift species composition to midseral.

Approximately 47% of the aspen seral class stands would be of the desired acre range of 10 to 25 acres. In order to meet the FP vegetation composition goals and stand size desired condition about 6%-8% of the suitable aspen within Rudyard would need to be regenerated every 5 years. Alternative 1 regenerates 6% of the suitable aspen. This would lead to a more balanced age class structure (Issue 2 in section 1.8.2).

Mid Seral Class

Approximately 156 acres would be clearcut to be converted into aspen stands, size class 1. Approximately 150 acre would receive improvement cuts, (most of the dying trees removed and the rest of the stand thinned). This will result in about 125 acres of aspen size classes 2 and 3, and 24 acres mid seral size classes 2 and 3. Approximately 48 acres would be commercially thinned, resulting in improved individual tree growth and overall stand value. In general the mid seral class in MA 1.2 would not be affected. Only the percentage of size class 3 changes (11% to 12%).

Late Seral Class

One stand (about 14 acres) would be clearcut to create aspen size class 1. Approximately an additional 86 acres would be single-tree selection cut to introduce a new age class into the stand in order to move it towards an all age stand. Approximately 139 acres would be treated with intermediate harvests in order to improve the growth of individual trees, and to salvage aspen.

3.8.6.2 Cumulative Effects

There is little difference between the cumulative effects of the proposed action and Alternative 1. There is less aspen size class 1 created, but the overall movement is still towards FP vegetation composition goals. Also, less L1 is created as some of the acres are not planted. However, overall movement is still towards the FP vegetation composition goals.

3.8.7 No Action

3.8.7.1 Direct and Indirect Effects

This alternative would involve no new management activities in the project area. No harvesting would take place (see section 3.8.4, Affected Environment). Aging aspen, paper birch and mixed stands would be allowed to continue their existing successional process. This would not result in the Forest Plan vegetation composition and size class goals being met.

These stands would follow natural successional pathways. Older stands would likely convert to under stocked stands dominated by aspen, balsam fir, spruce and white cedar depending on site conditions and existing species composition. Younger stands will continue to grow into larger size class aspen. Under stocked stands will continue to be under stocked. The understory of many stands will become dominated by raspberry, hazel and or alder depending on ecological land type.

Northern hardwood and red pine stands would continue to be over stocked. Tree growth would be stagnated and there would probably be increased mortality as trees compete for light, nutrients and water. There would be an increase susceptibility to insect and disease infestations. Stand health and vigor would decrease until individual trees die off, causing the release of surviving trees.

3.8.7.2 Cumulative Effects

Cumulative effects only occur when a project's impacts are added to other past, present and reasonably foreseeable future actions. Since No Action Alternative does not have any vegetation projects planned, there are no cumulative effects that result from the implementation of this alternative.

3.8.8 Climate Change and Effects to Vegetation

Forests and forest management are influenced by climate change (and vice versa). The HNF is aware that climate change is occurring and has looked at the implications of climate change on this project's alternatives (adaptation), as well as how this project's alternatives affects climate change (mitigation). Because this project is extremely small in the global atmospheric CO2 context, it is not presently possible to conduct quantitative analysis, or even a meaningful qualitative analysis, of actual climate change effects. For this reason, a baseline comparison cannot be made using the No Action Alternative. Nor is this information essential to make a reasoned choice among alternatives. Although climate change and its specific effects to vegetation in the future are uncertain, there are some general suggestions for vegetation management. Millar et al. (2007) indicate that maintaining or restoring vegetation conditions indicative of past conditions may require large investments of energy and result in forests that are not adapted to current or future conditions. They recommend management that uses a variety of options that focus on heightening ecosystem resilience and resistance as well as being able to adapt to future changes. Promoting diverse species composition, structures, and age classes can permit vegetation to adapt to change (Millar et al. 2007). All of the action alternatives apply these suggested vegetation management principles to varying degrees (See sections of this chapter on TES plants, Non-Native Invasive Species, and Wildlife and Terrestrial MIS). Additional information may be found in the project record (A. Davy, Climate Change).

3.9 Non-Native Invasive Plants

3.9.1 Introduction

Table 3-25 below is a summary of effects for Non-Native Invasive Plants.

Table 3-25 Summary of NNIP Effects

Activity or Measure	Proposed Action Effects	Alternative 1 Effects	No Action Effects
Canopy removal activities, including wildlife openings maintenance	Increases open, sunny conditions favorable to NNIP establishment on approximately 599 acres.	Increases open, sunny conditions favorable to NNIP establishment on approximately 502 acres.	No change
Mechanical and manual site preparation	Disturbs soil and creates ground for NNIP to establish in a maximum of 723 acres.	Disturbs soil and creates ground for NNIP to establish in a maximum of 669 acres.	No change
Road construction	Creates approximately 6.4 miles susceptible to NNIP spread.	Creates approximately 6.4 miles susceptible to NNIP spread.	No change
Road decommissioning and closure	Stops vehicular NNIP seed spread on approximately 0.8 miles.	Stops vehicular NNIP seed spread on approximately 0.8 miles.	No change
Construction and use of log landings or back-ins	Creates 400 feet susceptible to NNIP introduction and spread.	Creates 400 feet susceptible to NNIP introduction and spread.	No change
NNIP treatment by manual, mechanical, or chemical methods	Reduces NNIP seed source and spread along 6.25 roadside miles and 66 acres of other disturbed sites or forested interior.	Reduces NNIP seed source and spread along 6.25 roadside miles and 66 acres of other disturbed sites or forested interior.	NNIP seed source remains and spread continues along 6.25 roadside miles and 66 acres of disturbed or forested sites.
Removal of non-native invasive Scotch pine from H40 roadside	Reduces seed source and Scotch pine spread from 46 acres of H40 roadside.	Reduces seed source and Scotch pine spread from 46 acres of H40 roadsides.	Growth and spread of Scotch pine along H40 continues.

Based on comments received from the public during scoping, the spread of non-native invasive plants (NNIP) was identified as an issue (Issue 3 in section 1.8.3).

Several plants from the HNF NNIP list are known to occur within the project area. It is likely that over time, NNIP have been intentionally and unintentionally introduced into the area. Because non-native species lack pathogens and predators from their native range, some plants have become persistent, aggressive invaders of disturbed habitats and native plant communities. These invaders may become the dominant component of vegetation, thus reducing native plant diversity and impacting ecosystem habitat. Consequently, NNIP can displace native plants and alter habitat conditions to reduce capacity to support healthy ecosystems (Mack et al. 2000). Once introduced, NNIP can spread rapidly under certain conditions, sometimes into undisturbed habitat. The effects on the native habitat may not be apparent until decades after NNIP are introduced. Invasive plant control methods are utilized on HNF land, but preventing introduction and spread is the most effective NNIP management strategy.

Overall, the risk of NNIP infestation resulting from the project is moderate. Although several occurrences of high priority species exist in the area, they are typically found in disturbed settings and along roadsides. Species that are present would be prevented from spreading into new areas by preventative measures such as cleaning of timber harvest machinery and control of invasive plants of gravel stockpiles used for road maintenance. Additionally, ongoing and future control measures would be implemented on National Forest lands under HNF NNIP control projects (USDA 2007; USDA 2012). The Forest Plan provides NNIS direction and management guidelines (Forest Plan 2006, p. 2-22).

The risk (high, moderate, or low) that each project activity poses to the introduction and spread of NNIP is analyzed in this section and summarized in Table 3-26 below. Low risk activities do not cause much ground disturbance or overstory alteration. As a result, low risk activities are less likely to alter the resiliency of the landscape to resist NNIP invasion. Conversely, high risk activities are those that are generally ground disturbing and result in open habitats through overstory vegetation alteration. High risk activities provide a combination of preparing the soil for NNIP seeds to establish while also creating high light intensity conditions in which many NNIP thrive. Moderate risk activities are those that either lack one facet of ground disturbance or vegetation alteration, or that have both facets in a low magnitude.

Table 3- 26 Summary of Risk of Non-native Invasive Species Spread

Factors Contributing to the Spread of NNIP	Proposed Action	Alternative 1	No Action
Timber harvest including site preparation	High	High	None
Wildlife openings maintenance	Moderate	Moderate	None
Road construction	Moderate	Moderate	None

Road decommissioning	Low	Low	Moderate
Log landings	High	High	None
Non-native invasive Scotch pine removal	Moderate	Moderate	Moderate
NNIP Control by manual, mechanical, and chemical methods	Low	Low	Low

3.9.2 Analysis Methods

NNIP inventories were conducted throughout the proposed activity areas in 2011 and 2012, concurrently with rare plant surveys and additional surveys focused on roadsides. Known locations were mapped in the Forest Service Natural Resources Information Systems (NRIS) Invasive Species database, which houses the most current location information for NNIP infestations. Survey results and NNIP maps are included in the project record. Survey information for NNIP infestation can never be considered complete, because it is not practical to inventory every acre, and because NNIP conditions frequently change based on their rate of spread, the suitability of their habitat, and the results of treatment. Updated NNIP maps would be used during the implementation phase of the Rudyard project.

The project record contains references that reflect the best available science for NNIP analysis. These include papers, literature reviews, and results of ground-based observations. The HNF NNIP control projects (USDA 2007; USDA 2012) also provide documentation of NNIP conditions throughout the HNF.

Activities which lead to physical transport and introduction of NNIP seeds and plants were analyzed and used as indicators of the potential changes in the number of NNIP infestations. These activities include timber harvest, site preparation, road construction, road decommissioning, log landing construction, and recreational use. Table 3-25 illustrates the number of acres or miles that may become susceptible to NNIP spread by each of the activities. The risk (high, moderate, or low) that each activity poses to the introduction and spread of NNIP is analyzed by each alternative below, and summarized in Table 3-26 above. The proposed treatment of Scotch pine is also analyzed, as well as manual, mechanical, and chemical treatment of herbaceous NNIP, not because these activities pose a risk of spread like the other activities, but because they would result in a reduction of infestation.

3.9.3 Analysis Areas

Project effects are analyzed for all proposed activity areas that result in ground disturbance. Effects of NNIP spread on the native landscape would occur within areas proposed for harvest, road construction, road closure, and log landing construction. Additionally, effects of NNIP spread from recreation use are also considered, as well as

reduction of spread from proposed Scotch pine and other NNIP removal. Access roads to project activity areas would increase traffic and potentially increase recreational use on a larger scale; therefore, the spatial boundary of the direct and indirect effects analysis is the entire project area. This also includes areas that would most readily be reached by NNIP seeds via natural and human vectors. NNIP seeds can be transported on equipment, but this scale is unpredictable and cannot be readily limited. Transport of seeds and plant parts would most likely occur near the source of NNIP.

The spatial boundary for cumulative effects for NNIP is Mackinac and Chippewa counties. This area was chosen as the area most likely to have past, present, and reasonably foreseeable future projects contributing to NNIP establishment or spread in the project area because the project area is located in both counties. Another reason this spatial boundary was used is that many of the present NNIP species distributed throughout the area are managed through the Eastern Upper Peninsula Cooperative Weed Management Area (CWMA), which incorporates multiple partners at this scale (see section 3.9.5.2 below for more information). The Great Lakes form natural barriers to terrestrial invasion on the entire south and north sides of the cumulative effects boundary. Activities on state and private lands outside of the HNF boundary within Mackinac and Chippewa counties are expected to contribute to cumulative effects.

The temporal boundary used for the cumulative effects analysis is 15 years from the signing of the decision notice for the Rudyard project. This is when all project activities are expected to be complete. This is an approximation of when direct and indirect effects of the proposed activities on soils and native landscape would result in cumulative effects. The timeframe for continued presence of NNIP varies widely between species. The process of invasion of new areas by NNIP would not stop at 15 years, but predictions about effects become increasingly speculative in longer timeframes. Also, after 15 years, succession would change habitats, and eventually some infestations of sun-tolerant invasive plants would be shaded out. Projects that have been implemented over the past 15 years are considered, and any reasonably foreseeable projects (applicable projects currently on the Schedule of Proposed Action) that are expected to contribute to cumulative effects over the next 15 years are also considered (Appendix H – Past, Present, and Future Projects).

3.9.4 Affected Environment

Invasive species have been identified as the second greatest threat to rare species (Wilcove et al. 1998). NNIP can lead to habitat changes that are harmful to native plants, including TES plant species. As NNIP become established and spread, they impact native plant species and ecosystems by introducing competition for sunlight, nutrients, moisture, and growing space (Mack et al. 2000). Some NNIP can impact native plant species by producing and releasing compounds that inhibit the growth of other plants. This strategy is known as allelopathy (Inderjit et al. 2008). Once established, NNIP could also indirectly impact TES plant species by changing the fire regime of the infested sites

(Brooks et al. 2004). Subsequent NNIP control efforts such as hand-pulling, mowing, or herbicide application could also impact TES plants.

NNIP infestations are directly correlated with the amount of soil disturbing activities, as disturbed soil provides a place for NNIP seeds to germinate and new populations to become established (Hansen and Clevenger 2005). Additionally, removal of forest canopy results in open conditions favorable for many NNIP species. Because NNIP populations may be already established prior to timber harvest activities, further spread of existing infestations is possible.

Areas of recent soil disturbance or areas that are kept permanently in an early successional condition provide suitable habitat for most NNIP species. Areas where NNIP commonly occur are roadsides, gravel pits, powerline and pipeline corridors, parking areas, campsites, and trails. The majority of NNIP populations on the HNF occur on roadsides, in skid trails, at landings, on temporary roads, and other disturbed areas. Few NNIP occur in undisturbed native plant communities, and infestations of NNIP are typically not in the interior of heavily forested stands.

The HNF has developed a list of NNIP species for inventory and control. The list can be found in Appendix F (HNF Non-native Invasive Plant List – 4/14/2008). The list represents the NNIP that most threaten ecological systems of the HNF. NNIP infestations are recorded in areas where specific project funding is available, and no systematic Forest-wide inventory for NNIP occurrences has been completed.

Species recorded in the project area include spotted knapweed, wild parsnip, Canada thistle, common St. Johnswort, leafy spurge, bull thistle, marsh thistle, reed canarygrass, purple loosestrife, smooth brome, and sweetclover. Several of these species are typically found on roadsides of major roads and highways in the project area. Mackinac Trail, County Road H-40, and I-75 are larger roadways within the project boundary that have numerous infestations of NNIP. These roadways provide a corridor for the transport of NNIP seeds and plant material. Open gravel or sand pits are commonly infested as well, although an NNIP treatment program reduces spread from these areas; one gravel pit is located in the project area. Closed, but not decommissioned, roads, unmanaged OHV trails, and old log landings may also provide a source for NNIP spread.

Purple loosestrife, an aggressive wetland invader, occurs in limited amounts on National Forest and private lands in the project area. There are no activities proposed in the Rudyard project that would affect the spread of NNIP that colonize strictly aquatic ecosystems, such as Eurasian water-milfoil; therefore, there will be no further analysis of this species.

Prevention measures, including off-road equipment cleaning and project design criteria, are expected to reduce the spread of NNIP and are considered in analysis of anticipated effects. Implementation of Forest Plan guidelines for NNIS (p. 2-22) and the National Forest Service NNIS Strategy (USDA 2004) would also help minimize the spread of

many species. As new occurrences of NNIP are found, actions would be designed to eradicate, suppress, contain, or monitor new populations, as appropriate.

3.9.5 Proposed Action and Alternative 1

3.9.5.1 Direct and Indirect Effects

The overall impacts to ecosystems include: displacing native plants and animals; reducing plant diversity; changing the structure of native terrestrial and aquatic plant communities; disrupting aquatic food webs; disrupting hydrologic processes of wetlands; increasing erosion; impacting recreational use of lakes and rivers; altering fuel loads for wildland fire potential; and altering soils and soil processes. These impacts are considered in each type of activity addressed below.

Timber Harvest Activities. Proposed timber harvest activities have the potential to transport seeds and plant parts by vehicles and equipment into and throughout the timber sale area. Canopy removal activities also create soil and light conditions conducive to establishment and spread of NNIP. Soil disturbance and removal of competition from native plants provides an opportunity for NNIP to establish. The magnitude of soil disturbance from timber harvest is related to the amount of timber removed, the type of machinery used, and the time of year when timber is harvested. Winter logging would be required for some stands with a high water table (Appendix B – Site Specific Activities and Design Criteria).

Clearcutting leads to the highest risk for NNIP spread because of the amount of traffic over the land and the high level of soil disturbance associated with mechanical site preparation. Soil disturbance associated with canopy removal may create conditions that favor the establishment of early successional (i.e. pioneer) species (Meier et al. 1995). Coppice cuts would create the next highest risk, while selection and thinning harvests contribute the lowest risk of NNIP spread. Uneven-age management activities such as thinning risk introduction of NNIP into areas several times during the management lifetime of a stand, but the disturbance level of this activity results in less soil exposure than even-age regeneration harvest. The canopy reduction caused by thinning is temporary (about five years). The remaining trees in a thinned stand provide some continuous shade, and shade increases as the canopy fills in.

Approximately 33% of the treatments in the Proposed Action are clearcutting and coppice cuts. Some treatments would have subsequent mechanical site preparation. For the Proposed Action, the resulting risk of NNIP spread from timber harvest activities and site preparation is considered high. Under Alternative 1, clearcutting would occur on 42 fewer acres than the Proposed Action, and would account for 31% of the proposed timber harvest. Despite this small difference in area affected, the types of effects from

timber harvest activities and site preparation would be the same as the Proposed Action, and these activities would still produce high risk of NNIP spread under Alternative 1.

Road Construction. Road construction provides a vector for NNIP spread through transport by vehicles and equipment onto newly disturbed soil. Roads facilitate dispersal of NNIP by three mechanisms: providing NNIP habitat by altering conditions, making invasion more likely by stressing or removing native species, and allowing easier movement by natural or human vectors (Hansen and Clevenger 2005). The resulting increased vehicle traffic also creates a vector for the spread of NNIP. Both the Proposed Action and Alternative 1 include approximately 6.4 miles of new and temporary road construction. The distance disturbed by proposed road construction is used to measure the effect on NNIP spread; 6.4 miles would be the maximum length of infested roadside, although the actual distance would likely be much less because not all roads become infested with NNIP.

Project design criteria (Appendix B – Site Specific Activities and Design Criteria) require that trees adjacent to roadsides would be retained in selection and thinning harvests to maintain shade and reduce establishment of NNIP. In the short-term (0-5 years), there would be a likely temporary increase in NNIP effects along roadsides in response to disturbance of native plant communities. New and temporary roads built on or near wetlands would result in a potential area for wetland NNIP such as reed canary grass, common reed, marsh thistle, and purple loosestrife to invade. Temporary roads would be closed when the sale is completed, and the risk of NNIP introduction would decrease with the reduction in disturbance from traffic. In the long-term (5-15 years), shaded conditions would return in areas where temporary roads were constructed, thereby reducing the suitable conditions for sun-loving NNIP species, specifically spotted knapweed, wild parsnip, common St. Johnswort, and sweetclover.

Road construction supplies such as sand and gravel provide a source for transport of NNIP plant parts and seeds. Forest Plan guidelines require the use of gravel from stored gravel piles that have programs for invasive species management (Forest Plan 2006, p. 2-22). Road construction material would likely be obtained from gravel pits on the east side of the HNF, and these pits have a NNIP management program in place and are treated on a regular basis to reduce or eliminate NNIP. All east side gravel pits were treated with herbicide in 2010 and 2012. Overall, because of design criteria (Appendix B – Site Specific Activities and Design Criteria) and HNF Forest Plan guidelines, both the Proposed Action and Alternative 1 would result in a low to moderate risk of NNIP introduction and spread from road construction.

Road Decommissioning. Road decommissioning is an indicator of reduced NNIP spread, because traffic is removed as a vector, and rehabilitation to a forested condition over time is less conducive to NNIP proliferation. In general, roads closed would gradually revegetate and convert back to native plant community types. Approximately 1 mile is proposed for road decommissioning or closure in the Proposed Action. The net effect from these actions would be a decrease in the amount of disturbed habitat for

NNIS to occupy. It also reduces opportunity for vehicle traffic or OHV use along these corridors to spread NNIS to other locations. These effects would lower the risk of future NNIP impacts. Therefore road closures under both the Proposed Action and Alternative 1 pose a low risk of NNIP introduction and spread.

Log Landings. The development and use of log landings can increase NNIP populations by providing disturbed soil and open conditions for plants to establish. Two log landings occupying 400 feet are proposed. This activity, in both the Proposed Action and Alternative 1, is considered a high risk for NNIP invasion, considering that log landings would most likely be in previously undisturbed areas with some NNIP infestations already established.

Wildlife Openings Maintenance

Existing wildlife openings often have at least low levels of NNIP infestation resulting from past maintenance activities. Equipment traffic associated with proposed wildlife openings maintenance would spread existing NNIP such as wild parsnip, spotted knapweed, and St. Johnswort within 25 acres of openings. Ground disturbance caused by tracked equipment would result in areas of soil exposure where NNIP seeds could germinate. This is especially likely in openings that are bordered by roadsides with dense NNIP infestations that can provide a large source of NNIP seeds.

Equipment traffic during wildlife openings maintenance is overall likely to spread NNIP already present within the openings. However, proposed maintenance activities have a low probability of introducing new NNIP species into wildlife openings because equipment would be free of soil, seeds, and other vegetative debris before arriving at the project site. For this reason, wildlife openings maintenance is unlikely to introduce new NNIP species, such as garlic mustard, into the 25 acres of proposed openings.

Removal of woody vegetation in wildlife openings is intended to maintain an open condition. These activities result in an increase in light available to NNIP in previously shaded areas of wildlife openings. The combination of these conditions with seed dispersal by wind or animals may facilitate the spread of existing NNIP such as white sweetclover, wild parsnip, or spotted knapweed throughout the proposed wildlife openings.

Recreation Activities. Ongoing recreation activities such as hiking, camping, fishing, and hunting result in a low risk of disturbance and spread of NNIP. Dispersed recreation throughout the area is likely to have effects that are small in magnitude and short in duration.

Areas with high recreation use are more prone to establishment of invasive plants due to transport by people and their recreational equipment, such as OHVs (Rooney 2005). There are no proposed increases in recreation facilities or trails in the Rudyard project. However, the increase of temporary timber harvest roads may lead to temporary unauthorized motorized vehicle use (see section 3.13, Recreation). Off-highway vehicle

impacts could include erosion of steep slopes, dislodging vegetation, compaction and displacement of soils, and transferring NNIP seeds. Although the HNF Forest Plan provides OHV direction, continued unregulated OHV use in some parts of the project area would likely continue despite control efforts and regardless of project activities. Overall, unregulated OHV use poses a moderate risk of NNIP spread and introduction.

Scotch Pine Removal. This proposed treatment is an indicator of reduced NNIP spread, because seed source would be removed and rehabilitation to natural conditions would occur over time. These effects would lower the risk of future impacts from Scotch pine in the project area. However, removal of the canopy provide by Scotch pine would create open conditions favored by several herbaceous NNIP species including spotted knapweed, white sweetclover, and bull thistle. Therefore, both the Proposed Action and Alternative 1 pose a low risk of spread for Scotch pine but create a moderate risk situation for spread of other NNIP species.

NNIP Control by Manual, Mechanical, and Chemical Methods. Like Scotch pine removal, proposed control of additional NNIP species would represent an overall decrease in NNIP infestation and spread. Proposed NNIP treatment would directly reduce the amount of infestation in the project area by reducing or eliminating NNIP populations at proposed sites, including 6.25 total miles of roadside and 66 acres of other disturbed sites or forested interior. Proposed control activities would reduce the spread of NNIP by removing the source at currently infested sites. Some treatments would occur adjacent to proposed timber harvest stands and may be implemented before harvest begins; these treatments would reduce the potential for the spread of NNIP by timber harvest activities. The reduction in spread would likely occur throughout the entire project area. Overall, both the Proposed Action and Alternative 1 pose a low risk of NNIP spread.

3.9.5.2 Cumulative Effects

Because the cumulative effects spatial boundary is Mackinac and Chippewa counties, several past, present, and reasonably foreseeable Forest Service projects have potential to affect the spread of NNIP. These projects are listed in Appendix H – Past, Present, and Future Projects. The most recent timber management projects include Shores, Niagara, and Rudyard. Timber harvest, road construction, and road maintenance are sources of disturbance that can alter vulnerability to NNIP invasion. These activities affect the spread of invasive plants by removing forest canopy and creating exposed soil and disturbed sites favorable for NNIP establishment. Vulnerability to NNIP invasion and establishment is greatly influenced by existing plant cover, soil conditions, and overstory shade. These factors vary widely across the cumulative effects boundary.

Activities on state and private ownership may contribute cumulative effects to NNIP spread because private owners are not required to follow the protective measures developed for Forest Service activities. NNIP populations are expected to increase on non-federal lands unless control measures are implemented. On private lands in the

cumulative effects area, new roads, soil disturbance, and increased recreational use may be expected to accompany population growth. Road maintenance on federal and non-federal lands is an activity that would likely continue indefinitely. Non-federal gravel sources likely do not have NNIP treatment programs. Overall, conditions favorable for the establishment of NNIP have probably increased in the cumulative effects area and probably would continue to increase into the future.

Some NNIP species are still expanding their ranges into the cumulative effects area. In the project area, there would be a continuing risk over the next 15 years that NNIP species new to the local area would be introduced. Species such as buckthorns, Japanese barberry, garlic mustard, and knotweeds are not currently known to occur in the project area. These species may be introduced either by long distance transport by equipment of all kinds or by gradual expansion of established populations by natural means. The Proposed Action would contribute to this cumulative effect by the creation of conditions favorable for transport and establishment. This would be minor because of mitigation measures that will be used, such as equipment cleaning. This risk would increase in proportion to the use of recreational, road building, or logging equipment in the area that may carry soil, plant parts, or seeds from an infested area. Consequences of introduction and spread of new NNIP species could include loss of habitat for native plant species as well as other species in the food web that depend on native plants.

Equipment cleaning is required for all off-road timber harvest equipment on Forest Service land. Equipment cleaning would be implemented on all present and reasonably foreseeable future projects (Moore 2004). These actions combined with equipment cleaning for Rudyard timber sale units would continue to mitigate the spread of NNIP from timber harvest activities in the project area.

Proposed Rudyard project activities include NNIP treatment at specific sites (see Table 2-3) by manual, mechanical, and chemical methods. The HNF Non-native Invasive Plant Control Project (USDA 2007a, pp. 30-31; USDA 2012 pp. 7-9) describe mechanical, chemical, and biological treatment methods and protocol approved for Forest-wide use over the next several years. Ongoing NNIP treatments under those decisions would reduce the spread of invasive plants throughout the project area. Invasive species treatment will likely continue on the HNF indefinitely. The Eastern Upper Peninsula Cooperative Weed Management Area (CWMA) (http://www.clmcd.org/weedmanagement_2.asp) is committed to the management of NNIP under an existing Memorandum of Understanding (MOU) and is anticipated to implement NNIP control projects on private, state, and federal lands in Mackinac and Chippewa counties. The combined efforts of the CWMA and HNF projects would overall likely reduce the introduction and spread of NNIP in the two counties.

Regardless of project activities and despite treatment described above, infestations of NNIP would persist in some locations at various densities and population sizes. NNIP would continue to spread in the project area as a result of present and reasonably foreseeable actions of HNF and private lands. The effects of NNIP would continue to be

concentrated in developed or disturbed areas, as opposed to undeveloped forested lands. Many invasive plant species occupy disturbed sites; therefore projects that create soil disturbance can facilitate their spread. As NNIP spread, infestation at formerly uninfested sites becomes more likely, and control becomes more difficult and expensive. Therefore, maintenance of infestations at their current levels is expected to require increasing effort in the future as NNIP spread elsewhere. The cumulative effects of current conditions and ongoing activities result in a moderate vulnerability to NNIP invasion.

3.9.6 No Action

3.9.6.1 Direct and Indirect Effects

Under the No Action alternative, timber harvest would not occur and roads would not be constructed as a result of the project. No road decommissioning would occur, which would result in a moderate risk of NNIP spread considering these roads would be left open and conditions for NNIP spread would be maintained. Road maintenance and control of NNIP would continue at its present level. NNIP infestations would likely remain at approximately their current levels, since no new areas would be disturbed. NNIP spread would still likely continue at the current rate along roads, OHV trails, recreation sites, and disturbed openings despite control efforts. Therefore, recreation activities in the No Action alternative would still pose a low risk to NNIP spread. Scotch pine removal on county road H-40 would not take place and spread of this species would continue, resulting in a moderate risk of NNIP spread. Although the No Action alternative precludes activities that would reduce the spread of NNIP, the No Action alternative nonetheless presents a low risk of NNIP spread in the project area.

3.9.6.2 Cumulative Effects

There are no activities in this alternative that would contribute to cumulative effects because there are no direct or indirect effects from project activities.

3.10 Threatened, Endangered, and Sensitive Plants

3.10.1 Introduction

Table 3-27 Summary of TES Plant Effects

Activity or Measure	Proposed Action	Alternative 1	No Action
Canopy removal activities	Long-term changes to light and moisture conditions, alters habitat (519 acres)	Long-term changes to light and moisture conditions, alters habitat (456 acres)	No change

Thinning, improvement, and selection harvest	Short-term changes to light and moisture conditions, alters habitat (1003 acres)	Short-term changes to light and moisture conditions, alters habitat (993 acres)	No change
Mechanical and manual site preparation	Disturbs soil, duff, and/or moss layer, disrupts mycorrhizae in soil (723 acres)	Disturbs soil, duff, and/or moss layer, disrupts mycorrhizae in soil (669 acres)	No change
Wildlife openings creation and maintenance	Changes light and moisture conditions, alters habitat (80 acres)	Changes light and moisture conditions, alters habitat (25 acres)	No change
Road construction	Reduces habitat, some of which may be suitable (6.4 miles)	Reduces habitat, some of which may be suitable (6.4 miles)	No change
Road closure and decommissioning	Potential recovery of habitat (0.8 miles)	Potential recovery of habitat (0.8 miles)	No change
Construction and use of log landings	Creates 2 areas with soil disturbance and potential reduction of habitat	Creates 2 areas with soil disturbance and potential reduction of habitat	No change
Scotch pine removal	Reduces NNIP spread; improves TES plant habitat (46 acres)	Reduces NNIP spread; improves TES plant habitat (46 acres)	Spread and population growth of NNIP continues
NNIP control	Reduces NNIP spread; improves TES plant habitat (6.25 roadside miles and 22 acres)	Reduces NNIP spread; improves TES plant habitat (6.25 roadside miles and 22 acres)	Spread and population growth of NNIP continues

Threatened, endangered, and sensitive (TES) plants were not identified as an issue in comments received from the public during scoping. There are five plant species on the HNF that are listed as federally threatened and 72 plant species considered Regional Forester Sensitive Species (RFSS). Many of these species are inherently uncommon because of limited suitable habitat; they are at the edge of their range or are relict species from previous climatic conditions. The Biological Evaluation (BE) for this project describes the process for determining which TES plants have potential to occupy areas that would be affected by project activities (Appendix E). There are no known occurrences and no suitable habitat in proposed activity areas for the federally threatened plant species on the HNF: Hart's tongue fern, Pitcher's thistle, dwarf lake iris, lakeside daisy, and Houghton's goldenrod. These species will not be discussed further in this section.

Field visits and historical survey data identified six RFSS plant species with occupied habitat and 32 RFSS plant species with suitable but unoccupied habitat in the project area. The Rudyard Project would have no impact on 34 RFSS plants without suitable habitat in the project activity areas; these species were not analyzed further. Walking fern, American sloughgrass, spreading woodfern, black crowberry, white adder's mouth orchid, and sweet coltsfoot are known to occur in the project area, but none of these occurrences are located within proposed activity areas. Potential effects to these six species and those with unoccupied habitat were analyzed in the BE. These effects are summarized in Table 3-27 above, and determinations for TES plant species are listed in Table 3-28 below. Impacts to TES plants are discussed in more detail in the BE (Appendix E).

Table 3-28 Summary of Effects Determinations for TES Plants

Species	Status	Habitat or Species Present	Proposed Action	Alternative 1	No Action
American hart's tongue fern	FT	No Habitat	NE	NE	NE
Pitcher's thistle	FT	No Habitat	NE	NE	NE
Dwarf lake iris	FT	No Habitat	NE	NE	NE
Houghton's goldenrod	FT	No Habitat	NE	NE	NE
Lakeside daisy	FT	No Habitat	NE	NE	NE
Allegheny vine	RFSS	Habitat	NI	NI	NI
Round-leaved orchis	RFSS	Habitat	MINLTF	MINLTF	NI
Walking fern	RFSS	Species	NI	NI	NI
American sloughgrass	RFSS	Species	NI	NI	NI
Goblin moonwort	RFSS	Habitat	MINLTF	MINLTF	NI
Blunt-lobed grapefern	RFSS	Habitat	MINLTF	MINLTF	NI
Pale moonwort	RFSS	Habitat	MINLTF	MINLTF	MINLTF
Ternate grapefern	RFSS	Habitat	MINLTF	MINLTF	MINLTF
Spathulate moonwort	RFSS	Habitat	MINLTF	MINLTF	MINLTF
Calypso orchid	RFSS	Habitat	MINLTF	MINLTF	NI
Hudson Bay sedge	RFSS	Habitat	NI	NI	NI
New England sedge	RFSS	Habitat	MINLTF	MINLTF	NI
Douglas' hawthorn	RFSS	Habitat	NI	NI	NI
Male-fern	RFSS	Habitat	MINLTF	MINLTF	NI
Ram's head lady slipper	RFSS	Habitat	MINLTF	MINLTF	NI
Spreading wood fern	RFSS	Species	MINLTF	MINLTF	NI
Black crowberry	RFSS	Species	NI	NI	NI
Limestone swamp bedstraw	RFSS	Habitat	MINLTF	MINLTF	NI
Boreal bedstraw	RFSS	Habitat	NI	NI	NI
Limestone oak fern	RFSS	Habitat	MINLTF	MINLTF	NI
Fir clubmoss	RFSS	Habitat	NI	NI	NI
Butternut	RFSS	Habitat	NI	NI	NI
Vasey's rush	RFSS	Habitat	NI	NI	NI
Small flowered woodrush	RFSS	Habitat	NI	NI	NI
White adder's mouth orchid	RFSS	Species	MINLTF	MINLTF	NI
Mat muhly	RFSS	Habitat	NI	NI	NI
Woodland cudweed	RFSS	Habitat	NI	NI	NI
Sweet-coltsfoot	RFSS	Species	NI	NI	NI
Rayless mountain ragwort	RFSS	Habitat	MINLTF	MINLTF	NI
Canada ricegrass	RFSS	Habitat	NI	NI	NI
Pinedrops	RFSS	Habitat	MINLTF	MINLTF	NI
Lapland buttercup	RFSS	Habitat	NI	NI	NI
Dwarf bilberry	RFSS	Habitat	NI	NI	NI
Small firedot lichen	RFSS	Habitat	NI	NI	NI
Spongy gourd moss	RFSS	Habitat	MINLTF	MINLTF	NI
Dotted line lichen	RFSS	Habitat	MINLTF	MINLTF	NI
Luminous moss	RFSS	Habitat	MINLTF	MINLTF	NI

FT = Federally threatened, RFSS = Regional Forester Sensitive Species, MINLTF = May impact individuals but not likely to cause a trend toward federal listing or loss of viability, NE = No effect, NI = No impact.

3.10.2 Analysis Methods

Botanical surveys for the Rudyard project were conducted May through September of 2011 and 2012. Field surveys were carried out by an experienced botanist using the intuitive meander method (Goff et al. 1982), which intends to sample the entire survey area while seeking out unique plant communities and habitat for TES plants. The method is a procedure for conducting a floristic examination of project activity areas to determine the presence or absence of TES plant species and to capture the diversity of the survey area by preparing a list of all plant species observed. Using this method, the surveyor chooses a route that meanders through the activity area to cover all possible variation that is likely to occur in the unit being surveyed. The route may be repeated in spring, summer, and fall in order to detect plants during the best season for observation. Surveys in proposed activity areas were prioritized according to potential for occurrence of listed plants.

Rare plant surveys took place on 950 acres and cover approximately 50% of the proposed stands. This percentage represents the percent of stands surveyed; it is important to note that it is not feasible to survey every acre of the stand. A map of areas surveyed and the survey reports are included in the project file. There is a chance that TES species could be overlooked during inventories, or missed due to dormancy periods, drought, and other factors. For this reason, the effects of the project on unoccupied suitable habitat for TES plants were also analyzed. Non-native invasive plants (NNIP) were included in the surveys to evaluate their threat to TES plants and identify infestations for treatment.

The BE and the project record includes references that reflect the best available science for TES plant effects analysis. These references include Forest Service Conservation Assessments, peer-reviewed journal articles, field guides, web sources such as NatureServe Explorer, recent EAs, Michigan Natural Features Inventory rare species and community abstracts, and results of ground-based observations. The BE lists botanical surveys that have been conducted in the past in proposed activity areas. These resources were used to determine whether TES plants may occur in the project area. Additionally, the Forest Plan BE (USDA 2006) provides species viability evaluations and represents current documentation of TES plants on the HNF.

3.10.3 Analysis Areas

The spatial boundary for direct and indirect effects to TES plants is limited to the proposed activity areas. This includes areas where proposed management activities would occur and affected habitat that lies directly adjacent to activity areas. Activity areas include all stands proposed for silvicultural treatment, wildlife habitat improvement, NNIP treatment, new road construction, maintenance of existing roads, and road decommissioning. The spatial boundary addresses project effects on known rare plant occurrences as well as suitable habitat. Habitat would remain unaffected in areas that are not proposed for management. The timeframe for analysis of direct and indirect effects is 15 years, beginning from the signing of the Rudyard project decision. All

project activities are expected to be complete after 15 years, and soil disturbance and forest canopy alteration resulting from the project would cease.

The cumulative effects analysis area is delineated by the ten LTA's that coincide with the Rudyard project boundary. While most of the project activities would be implemented within the Pine River patterned wetland association, nine additional LTA's occupy the project area. These include Huron Outcrop, Huron Patterned Outcrop, Lower Carp River Complex, Niagara Escarpment 1, Niagara Escarpment 2, Niagara Escarpment 3, Rudyard Clay Plain, Sand/Clay Transition South, and St. Martin Bay Wetland. Since much of the TES plant habitat is ecologically linked to the LTA on which the habitat occurs, the ten LTA's represent an appropriate boundary for discussion of cumulative effects.

The timeframe for determining cumulative effects varies widely among rare plant species because some species require or tolerate disturbances that would harm other species. The past and future timeframe used for consideration of cumulative effects is 15 years from the date a project decision is signed because project activities are expected to be completed within 15 years of a decision. Therefore, the timeframe for analysis of cumulative effects includes activities implemented in the past 15 years (1998-2012), and any reasonably foreseeable projects (Appendix H) that are expected to contribute to cumulative effects over the next 15 years (2013-2027) are also considered. After this timeframe, succession would continue to occur and habitats would continue to adjust, but predictions on forest composition and habitat availability would become increasingly speculative at longer timeframes.

3.10.4 Affected Environment

The Rudyard project area supports a diverse landscape of upland and wetland ecological communities. The communities present were determined through survey reports, LTA data, aerial photo interpretation, and personal observations. Community types follow classification by the Michigan Natural Features Inventory (Kost et al. 2007) and include: dry northern forest; dry-mesic northern forest; rich, poor, and hardwood conifer swamps; poor fen; patterned fen; northern wet meadow; northern shrub thicket; bog; intermittent wetland; emergent and submergent marshes. Each community has habitat characteristics that may support certain rare plant species. TES species known to occur or to have suitable habitat in these community types have been analyzed for potential effects from project activities.

3.10.5 Proposed Action and Alternative 1

3.10.5.1 Direct and Indirect Effects

Although there are occurrences of six RFSS plants within the project boundary (Table 3-28), none of these occurrences are located within proposed activity areas. Therefore, effects from the Proposed Action would be limited to those affecting suitable habitat or

undetected individuals that may be present in the affected environment. New TES plant locations that may be found during project planning or implementation would be protected by appropriate measures (Design Criteria, Appendix B). In addition to project design criteria, the Forest Plan provides TES direction and management guidelines (p. 2-17).

Due to dormancy periods, drought, and other factors, individual RFSS plants may not have been detected in suitable habitat. There is a possibility that undiscovered individuals may be affected inadvertently by the Proposed Action. For this reason, a determination of *may impact individuals but not likely to trend toward federal listing or loss of viability* has been made for 19 species (Appendix E – Biological Evaluation, Table 7 Summary of TES Determinations for the Rudyard Project). Direct effects to undetected individual plants considered in this discussion are those associated with timber falling, skidding, decking, site preparation for planting, and road construction. Effects from these activities include crushing or uprooting by road construction equipment and timber harvest machinery. Additionally, plants could be covered with soil, trees, or slash. As a consequence of being covered with debris, plants could experience altered growth and development, and reduced seed-set and population size (Maschinski et al. 1997).

Soil disturbance caused by the Proposed Action could result in impacts to suitable habitat for TES plants. Many of these species, particularly those in the genera *Cypripedium* and *Botrychium*, rely on complex associations with mycorrhizal fungi in the soil. Thus any disruption to this relationship may negatively impact these species. Mycorrhizae require organic material in the duff layer, and mechanical timber harvest and site preparation are particularly likely to disturb this layer (Fogel 1980). Ram's head ladyslipper, goblin moonwort, and blunt-lobed grapefern are such species that would be affected by changes in duff layers that could be caused by mechanical treatments. Similarly, pine-drops require a well-developed needle duff and are therefore susceptible to soil disturbance.

Several RFSS species may benefit from soil disturbance resulting from activities such as road construction and timber harvest. Effects would be temporary or long-term, depending on the type of harvest treatment. Disturbance likely maintains habitat for species such as fir clubmoss, woodland cudweed, and Canada ricegrass that favor some soil disturbance and often occur at habitat edges. Proposed activities would create habitat for New England sedge, which is often found in disturbed area such as old logging roads and tree tip-ups in shaded hardwoods. Spongy gourdmoss is capable of colonizing bare soil, so soil disturbance would also create habitat for this species. Wildlife openings maintenance would maintain habitat for some TES plants by perpetuating disturbance in wildlife openings and creating conditions for colonization by such species that rely on disturbance. Maintenance of an open condition would also provide habitat for species that require little or no canopy cover.

Road construction in the Proposed Action (6.4 miles) is not expected to alter hydrological conditions because implementation of Forest Plan soil and hydrology

standards and guidelines (Forest Plan 2006, p. 2-15) and Design Criteria (Appendix B – Site Specific Activities and Design Criteria) would provide protection for wetland plant habitat. The State of Michigan's BMPs (MDNR/MDEQ 2009) designed to protect riparian areas would also be used to reduce impacts to substrates available for RFSS plants in suitable habitats. These measures would nearly eliminate the risk of indirect effects by hydrological alteration to wetland species such as American sloughgrass, black crowberry, white adder's mouth orchid, sweet coltsfoot, and Lapland buttercup.

In contrast to disturbance tolerant species described above, some RFSS species that inhabit the interior forest are adapted to closed canopy and low light conditions. Species that thrive in cool, moist, and shaded conditions include ferns, orchids, goblin moonwort, blunt-lobed grapefern, and pine-drops. Changes in the vegetation structure to more open, warmer, and drier conditions, whether by timber harvest or road construction, would affect the suitability of habitat for these species (Meier et al. 1995). By creating drier forest conditions, canopy removal could also disrupt the mycorrhizal associations of *Botrychium* and *Cypripedium* species.

Road decommissioning would create suitable habitat for TES species that require shade but reduce habitat for those that thrive in open sites. Road decommissioning would be implemented through obliteration or by removing the road from the system map. Both processes would result in the long-term trend toward reestablishment of the native plant communities. Canopy conditions would fill in at some decommissioned road sites, creating habitat for TES species that require shade. However, road decommissioning would also lead to a reduction in suitable habitat for TES species that need open or disturbed conditions.

Duration and magnitude of effects resulting from timber harvest would depend on the type of treatment proposed. Clearcutting treatments, coppice cuts, and wildlife openings creation account for approximately 34% of proposed activities. These activities would result in the highest amounts of soil disturbance and light penetration in suitable habitat. Stands proposed for thinning or selection cuts would have less impact to the understory flora as only portions of the stands would be treated, resulting in less ground disturbance and therefore maintaining resilience of native plant communities. The effects of selection harvest would be short-term as shaded conditions would be expected to return within five years. The forest canopy would likely close within two years following clearcutting, except in areas that would be maintained open for wildlife habitat.

NNIP could have major indirect effects on RFSS habitat in the short- or long-term, especially since invasive species are considered the second greatest threat to rare species (Wilcove et al. 1998). Because non-native species lack pathogens and predators from their native range, some NNIP are capable of becoming persistent, aggressive invaders of both disturbed habitats and native plant communities. These invaders may become the dominant component of vegetation, thus reducing native plant diversity. Consequently, NNIP could displace native plants and alter habitat conditions to reduce capacity to support healthy ecosystems (Mack et al. 2000). For these reasons,

NNIP have the potential to invade and impair suitable habitat for RFSS plants, although design criteria developed to prevent the introduction and spread of NNIP would minimize effects of NNIP. The risk of NNIP spread is further documented in section 3.9.

Proposed removal of Scotch pine and other NNIP control would improve habitat quality by reducing or eliminating the source for spread of NNIP. There are no known RFSS plant occurrences in NNIP treatment sites. Furthermore, impacts to RFSS plants from manual, mechanical, or chemical control of NNIP would be avoided by the implementation of design criteria (Appendix B). For example, design criteria indicate that hand-pulling would be the only NNIP treatment method used where TES species are present. Overall, NNIP treatment would benefit RFSS plants by reducing sources of NNIP and decreasing the likelihood for NNIP to spread into suitable habitat.

3.10.5.2 Cumulative Effects

Historical changes in abundance of TES plants included in the Rudyard analysis are unknown; these species may have always been rare, or they may have historically been common, but due to past land use practices, may have relatively recently become rare (Forest Plan). Overall, management activities that have contributed to the condition of the existing landscape include timber harvest, fire suppression, prescribed fire, recreational use, road construction, urban development, and introduction of NNIP. The development of a forest road system and installation of underground gas pipelines have, in general, likely reduced the TES plant habitat suitability in the project area. The effects of past management on TES plant habitat have not been documented well due to a lack of long-term habitat monitoring.

Past, present, and reasonably foreseeable Forest Service projects that have potential to affect TES plants are listed in Appendix H. Projects considered for both past and future management activities in the cumulative effects area include East Red Pine II, Sand Clay, Sprinkler, and Interior Wetlands. Current and future activities from the Niagara and Shores projects are also planned within the cumulative effects boundary. Timber management activities in these projects include mainly single-tree selection harvest in hardwoods and shelterwood, thinning, and regeneration treatment in conifer stands. NNIP treatments have occurred and are expected to continue under the NNIP control project decisions (UDSA 2007, USDA 2012). The BE describes more specific cumulative effects to individual species.

The anticipated effects of Rudyard project activities are similar to effects the projects identified in Appendix H. This section discusses the contribution of effects to TES plants from the Rudyard project to the accumulation of effects from other projects. Road construction and past and future timber harvest may provide an increase of suitable habitat in the future for disturbance-tolerant and sun-loving TES plants. Apparently suitable habitat for such species is already abundant on the HNF, yet these species remain rare. Therefore, any additional habitat for disturbance tolerant species is not expected to affect these species because habitat availability does not seem to limit their

abundance. Additionally, harvest activities with some associated ground disturbance and creation of openings would be expected in present and future management activities on other adjacent private lands, although the amount of which is unknown. The Proposed Action may result in a temporary (5-10 years) decrease in habitat availability or quality for TES plants that require closed canopy conditions by removal of overall shade in the project area.

Activities such as road construction, ditching, and other alterations of wetland habitat may have slightly reduced the amount of suitable habitat for species dependent on wetland and riparian habitats in the past. The overall area covered by wetlands, however, would not change as a result of the Rudyard project because measures are in place to protect wetlands through Forest Plan standards and guidelines, State of Michigan BMPs, and project design criteria.

Past and future development on private land, recreational use, and gravel pit development could have a negative cumulative effect on TES plant habitat or populations since private landowners are not required to follow the protective measures developed for Forest Service activities. Activities on private lands will likely continue and increase in the future, with the possibility of TES plant habitat decline. On private lands, new roads, soil disturbance, and increased recreational use may be expected to accompany population growth.

Decommissioning roads would result in a cumulative decrease in road access over time, which may improve habitat conditions. Vehicle travel in the cumulative effects area across forest roads provide a vector for NNIP seed spread into TES plant locations and suitable habitat. Maintenance and use of roads for transportation and recreation in the cumulative effects area would be expected to continue at least at present levels in the immediately foreseeable future. Damage to suitable TES plant habitat resulting from OHVs could occur. NNIP concerns would likely continue to increase on private lands as no control measures would be implemented. Ongoing control measures would be implemented on Forest lands, under the HNF NNIP Control Projects (USDA 2007, USDA 2012). These treatments would contribute to positive cumulative effects by improving overall TES plant habitat. New road construction or timber harvest activities in the Proposed Action could contribute to further NNIP spread in the project area and would likely contribute to a minor reduction in suitable TES plant habitat for species that favor undisturbed conditions. However, proposed NNIP treatment would also be expected to have beneficial cumulative effects to TES plant habitat over the long-term by removing impacts from NNIP.

3.10.6 No Action

3.10.6.1 Direct and Indirect Effects

The No Action alternative would involve no new management activities in the project area. Previously approved activities in the project area would still be implemented.

Design criteria would not be implemented in the No Action alternative. Existing road conditions would remain unchanged, and no roads would be closed or decommissioned. Current ongoing activities would continue, such as routine road maintenance, management of NNIP, trail use and maintenance, and suppression of wildfires. Natural processes such as blowdown or tree mortality from forest insect and diseases would continue. No direct or indirect effects to TES plants would be expected from the No Action alternative.

Existing native vegetation conditions would not measurably change from current conditions over the short-term (0-5 years). The existing vegetation structure and composition would remain much the same as current conditions. In the long-term (5-15 years), TES plant habitat that is currently early-successional would transition toward late-seral conditions. Forest succession, combined with a lack of suitable disturbance such as scraping of the soil or natural wildfire events, could impact species that prefer early-successional or open canopy habitats, such as Alleghany vine, fir clubmoss, Canada rice-grass, and woodland cudweed. Over the long-term, forest succession may also provide more dead and down material, closed canopy and moist, shaded conditions favored by other TES species. This would also result in increased soil nutrient availability. Natural succession without forest management could be beneficial for species such as ferns, orchids, goblin moonwort, blunt-lobed grapefern, and pine-drops that favor later successional conditions.

3.10.6.2 Cumulative Effects

There are no management activities in the No Action that would contribute to cumulative effects.

3.11 Wildlife and Terrestrial Management Indicator Species

3.11.1 Summary of Effects

Table 3-29 Summary of Wildlife Effects.

Activity or Measure	Proposed Action	Alternative 1	No Action
Habitat availability for early successional species	Create about 600 acres of early successional habitat.	Create about 500 acres of early successional habitat.	Creation of early successional habitat would depend on natural disturbance events such as windthrow.
Availability of snag and woody debris habitat	Reduce snag and woody debris availability on about 1,600 acres.	Reduce snag and woody debris availability on about 1,500 acres.	More future snag and woody debris habitat would be available (no trees removed).
Disturbance to	Increased	Similar to the	No change from

wildlife from road access	disturbance from about 4 miles of new road construction.	Proposed Action	current condition.

3.11.2 Introduction

The HNF received public comments about the impacts that the Rudyard project would have on wildlife. Some questions were answered in the response to scoping comments section of this document (Appendix A). Other comments dealt with the disclosure of effects, and these comments are addressed by discussing potential impacts in this section of the EA and the Biological Evaluation (BE). Other concerns were outside the scope of this project (i.e. Forest Plan direction). There were issues about cutting vegetation before Forest Plan rotation age, and creating/reclassifying openings that were related to wildlife (Issue 2 in section 1.8.2).

In addition to this EA, there are several documents that discuss the impacts that the Forest Plan would have on wildlife habitat. The Forest Plan Final Environmental Impact Statement (FEIS) discloses impacts on indicator habitats, such as mature northern hardwoods and young/aspen birch, and the wildlife species that are associated with these habitats (USDA 2006b). Additionally, impacts that the Forest Plan direction would have on Management Indicator Species (MIS), Regional Forester Sensitive Species (RFSS), Federally Threatened and Endangered species also are discussed in the FEIS (p. 3-101 through 3-180). The Forest Plan Biological Evaluation (USDA 2006a), Biological Assessment (USDA 2005), and Biological Opinion (USDI 2006) also discuss Forest Plan impacts on RFSS and federally listed species.

Effects determinations for threatened, endangered, and sensitive (TES) species, such as lynx, bald eagle, and goshawk are summarized in Table 3-30. A more detailed discussion of impacts to wildlife TES species is in the BE (Appendix E).

Table 3-30 Summary of Wildlife TES Species Effects Determinations.

Species	Status	Habitat or Species Present	No Action	Proposed Action	Alternative 1
Canada lynx	FT	Habitat	NE	NLAA	NLAA
Hine's emerald dragonfly	FE	No Habitat	NE	NE	NE
Kirtland's warbler	FE	No Habitat	NE	NE	NE
Piping plover	FE	No Habitat	NE	NE	NE
Hine's emerald critical habitat	FE	No Habitat	NE	NE	NE
Piping plover critical habitat	FE	No Habitat	NE	NE	NE
Little brown bat	RFSS	Habitat	NI	MINLTF	MINLTF
Northern myotis	RFSS	Habitat	NI	MINLTF	MINLTF
Gray wolf	RFSS	Species	NI	MINLTF	MINLTF
Northern goshawk	RFSS	Species	NI	MINLTF	MINLTF
Le Conte's sparrow	RFSS	Habitat	NI	NI	NI
Short-eared owl	RFSS	Habitat	NI	NI	IN
Bald Eagle	RFSS	Species	NI	MINLTF	MINLTF
Red-shouldered hawk	RFSS	Species	NI	MINLTF	MINLTF
Loggerhead shrike	RFSS	Habitat	NI	NI	NI

Species	Status	Habitat or Species Present	No Action	Proposed Action	Alternative 1
Connecticut warbler	RFSS	Habitat	NI	MINLTF	MINLTF
Black-backed woodpecker	RFSS	Habitat	NI	MINLTF	MINLTF
Sharp-tailed grouse	RFSS	Species	NI	NI	NI
Land snail – *Euconulus alderi*	RFSS	Species	NI	MINLTF	MINLTF
Land snail – *Planogyra asteriscus*	RFSS	Species	NI	MINLTF	MINLTF
Land snail - *Vertigo bollesiana*	RFSS	Species	NI	MINLTF	MINLTF
Incurvate emerald	RFSS	Habitat	NI	MINLTF	MINLTF
Ebony boghaunter	RFSS	Species	NI	MINLTF	MINLTF
Ringed boghaunter	RFSS	Habitat	NI	MINLTF	MINLTF

FE = Federally Endangered, FT = Federally Threatened, RFSS = Regional Forester Sensitive Species, MINLTF = May impact individuals but not likely to cause a trend to federal listing or loss of viability, NE = No Effect, NI = No Impact, and NLAA = Not Likely to Adversely Affect

3.11.3 Analysis Methods

Queries to available vegetation data were used to summarize habitat availability for MIS (Table 3-32). However, there are delays in database updates, so information of current habitat conditions is not always represented. Additionally, habitat classification could change in the future, based on updated species observation/habitat information. Finally, vegetation is expected to grow and change (natural disturbance), so this information should only be used as a coarse scale estimation of habitat for these species.

Complete summaries of queries and ecological definitions can be found in the project record. American marten utilize older, coniferous and deciduous, forest conditions (Baker 1983). Therefore, older habitat on various Ecological Land Types (ELTs) was classified as suitable American marten habitat. Ruffed grouse utilize different aspen age classes to satisfy particular habitat requirements (Gullion 1984), so habitat consisted of primarily aspen or aspen/mix on several different ELTs. Young and old aspen/mix was classified as nesting and breeding habitat, but brood rearing was specific to young aspen and winter habitat was specific to older aspen. Sharp-tailed grouse habitat (large opening/early successional habitat) exists within the project area, but it is located on private land. Due to limited potential for use of HNF land in the project area, habitat availability for sharp-tailed grouse was not included in this EA (further analysis is in the BE).

In addition to habitat availability (terrestrial MIS and lynx), various reference resources (research papers, books, conservation assessments, species accounts, etc.) were used to consider effects on different wildlife species. These resources are located in the project file.

Field surveys were part of the analysis process and were utilized to inventory species of concern (RFSS, Federally listed, and MIS) within the Rudyard project area. These surveys focused on a variety of species: red-shouldered hawk, northern goshawk, dragonflies, bald eagles, sharp-tailed grouse, land snails, various breeding birds (Breeding Bird Surveys (BBS)), and various mammals (winter track surveys). All of the field survey information is located in the project file and a summary of the survey effort

can be found in the BE (Appendix E - section 3B). This survey information was used to discuss the status of specific species within this EA and the BE.

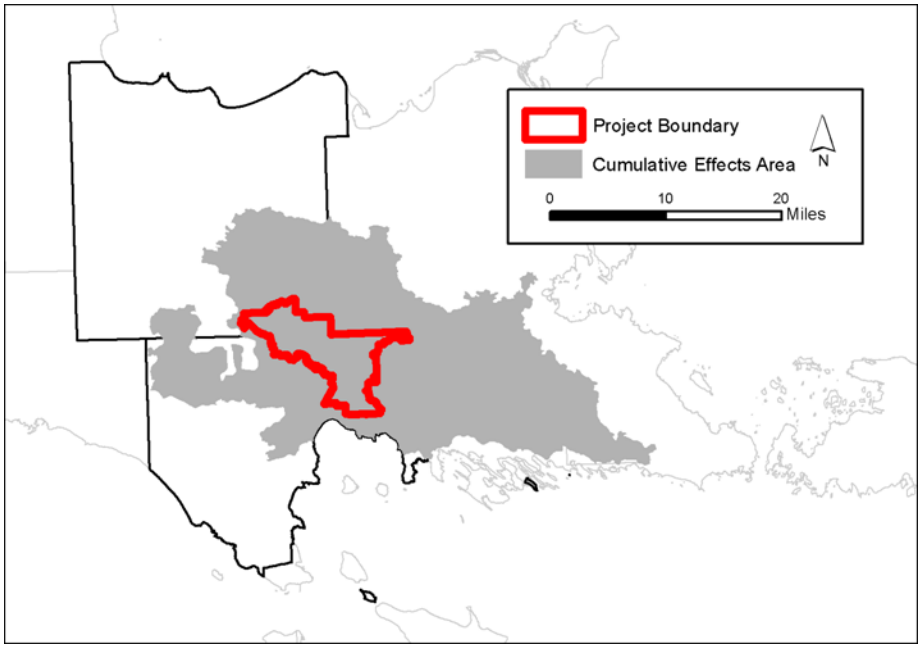
3.11.4 Analysis Areas

The majority of management activities would take place within the Pine River Patterned Wetlands Landtype association (LTA), which encompasses a group of ecosystems with similar ecological processes and management concerns (USDA 2006b, HNF FEIS Appendix I). Most of the direct and indirect effects would occur within areas proposed for harvest, road construction, etc. However, some effects, such as increased traffic on surrounding roads due to hauling, would occur on a larger scale.

Therefore, the project area boundary was chosen as the direct and indirect effects boundary. This boundary generally follows LTA boundaries, so it serves as a reasonable, ecological boundary that includes much of the surrounding landscape where impacts could occur. The time period for direct and indirect effects is based on the predicted time period within which proposed management activities would occur. The NEPA analysis is normally considered relevant for 5 years, harvest contracts can generally extend an additional 5 years, and funding for post-harvest Knutson-Vandenberg activities can commonly extend an additional 5 years. Therefore, the time period used is 15 years from the date a project decision would be signed.

Most of the direct and indirect effects, which would contribute to cumulative effects, would occur within the project boundary. However, small portions of the project boundary overlap with several different LTAs, which each provide unique habitat characteristics to wildlife populations on and off HNF land. Additionally, there are individual stands located near the edge of the project boundary, and activities in adjacent LTAs could contribute to cumulative effects on some wildlife species. Therefore, there are ten ecologically unique LTAs that make up the cumulative effects boundary: Huron Outcrop, Huron Patterned Outcrop, Lower Carp River Complex, Niagara Escarpment 1, Niagara Escarpment 2, Niagara Escarpment 3, Pine River Patterned Wetland, Rudyard Clay Plain, Sand/Clay Transition South, and St. Martin Bay Wetland. This list includes the LTAs where proposed management activities would take place (project area) and the LTAs adjacent to proposed management (map in project file). Some information that is not available at the LTA boundary, such as human population trends, is applied from larger political boundaries.

Figure 3-2 Wildlife & Terrestrial MIS Cumulative Effects Area



The past and future time scale used for consideration of cumulative effects is 15 years from the date a project decision would be signed. On large projects, management activities can take 15 years before they are complete, so this is the time period during which direct and indirect effects from proposed management activities would result in cumulative effects. Therefore, projects (within the cumulative effects boundary) that have been signed within the past 15 years are considered (List of Past, Present, Future Projects - Appendix H). Any reasonably foreseeable projects (applicable projects currently being analyzed) that are expected to contribute to cumulative effects over the next 15 years are also considered (List of Past, Present, Future Projects – Appendix H). After 15 years, habitat would continue to change, but predictions on habitat availability become increasingly speculative with longer timeframes.

3.11.5 Affected Environment

The Rudyard Mid-scale Assessment contains additional affected environment information for the Rudyard project area (USFS 2010). Therefore, this section briefly discusses the species analyzed, current habitat, and species status in the project area.

Species impacts are based on habitat conditions and known occurrences. Specific species considered throughout the analysis process are from the following wildlife lists: Federal endangered, Federal threatened, RFSS, and MIS. A BE was completed to analyze impacts to threatened, endangered, and RFSS (Appendix E), and effects determinations are summarized in Table 3-29. Therefore, the effects discussed in this section will focus on MIS and wildlife species associated with them.

A MIS is one whose presence in a certain location or situation, at a given population, indicates a given environmental condition. Their population changes are believed to indicate effects of management activities on a number of other wildlife species. American marten, ruffed grouse, and sharp-tailed grouse are the wildlife species that

make up the terrestrial MIS list for the HNF. Recent trends for these three species are shown in Table 3-31, and habitat availability within the Rudyard project area is shown in Table 3-32.

Table 3-31 Population Trend Summary for MIS.

Species	Population Trend
American marten	Stable in Upper Peninsula (Frawley 2012).
Ruffed grouse	Drumming surveys suggest that the population has declined slightly from 2011 levels (Maples 2012).
Sharp-tailed grouse	Stable/slightly increasing population on the HNF (HNF 2012).

Table 3-32 Habitat Availability Summary for MIS.

Species		Amount of Habitat (Approximated Acres)		
		No Action	Proposed Action	Alternative 1
American marten		3,659	3,389	3,395
Ruffed grouse	Winter Habitat	3,354	3,157	3,176
	Breeding Habitat	4,747	5,256	5,282
	Nesting Habitat	4,231	4,254	4,279
	Brood Rearing Habitat	4,578	5,330	5,293
	Total Habitat	8,390	8,939	8,926
Sharp-tailed grouse		Habitat on private land		

3.11.6 Proposed Action

3.11.6.1 Direct and Indirect Effects

The impacts of this alternative on wildlife are primarily:

- Increases habitat for early successional species.
- Snag and woody debris habitat would decrease.
- Road construction would increase wildlife disturbance in some areas.
- Road decommissioning would decrease wildlife disturbance in other areas.

There are some common effects within stands being harvested. Within all treatment areas, some sedentary animal species would be killed during implementation (from felling, skidding, etc.). Other, more mobile, species would be displaced into adjacent habitat.

Aside from common effects, specific harvest treatments result in unique changes to wildlife habitat. Early successional aspen habitat creation is part of the Proposed Action, so about 520 acres of aspen habitat would be cut (coppice and clearcut,) and regenerated. For ruffed grouse, this activity would transition some mature aspen stands, which currently serve as winter forage habitat, into young aspen brood and breeding cover (Gullion 1984). Harvest in some of the younger aspen stands would maintain

brood and breeding cover. Additionally, this harvest would break up some larger blocks of single age classes, so spatial distribution of age classes would increase (ex. winter forage habitat next to brood habitat). However, the harvest of mature aspen habitat also would remove canopy cover and woody debris, which would reduce American marten habitat. This harvest activity, and all other proposed activities, are not expected to impact sharp-tailed grouse habitat (Appendix E - BE).

The proposed selection harvest (about 140 acres) would result in more understory growth and increased habitat for species such as chestnut-sided warblers and mourning warblers (Jobes 2004). Additionally, the 550 acres of proposed thinning (primarily red pine) is expected to increase some understory growth (nesting/forage habitat), and the release of white pine and yellow birch would improve diversity of mature tree species in the future. Therefore, forage habitat (understory growth) for American marten may increase. However, the removal of trees through selection and thinning harvest would remove a future source of woody debris habitat (Duvall 1999 and Goodburn 1998), which provides den and forage habitat for American marten.

About 310 acres of improvement harvest are part of the Proposed Action. This treatment would occur in northern hardwood/aspen mix stands, and this prescription would result in some patches of early successional aspen habitat within thinned hardwood stands. Therefore, effects would be a combination of those already discussed for clearcuts and thinnings. Some patches of suitable habitat for early successional species (ruffed grouse brood habitat, snowshoe hare habitat, etc.) would be created. However, this treatment would reduce the future habitat structure (dying/down trees) important for species associated with the older forest types.

Site preparation activities would occur within many of the proposed harvest areas, which would occur to promote growth of desirable trees. In some areas this would help provide more cover for woodcock and snowshoe hare, or result in an increase in understory habitat for various species of mammals and birds. Most of these activities would occur in areas already impacted by harvest, so impacts would be similar to those already discussed. However, the proposed mechanical site preparation would include scarifying the soil in some areas. This activity can lead to direct mortality of some animal species (ex. ground nesting birds, small mammals, etc.) and may result in a loss of snag and woody debris habitat. Site preparation is expected to provide a more suitable condition for white pine, spruce, or oak, to develop, which would increase habitat diversity within the areas proposed.

The proposed white pine, spruce, and oak planting would help restore habitat components, which were historically more abundant throughout the northern hardwood/conifer region (Mladenoff and Pastor 1993). This activity is expected to provide some mast for various species, thermal cover for ruffed grouse, and forage habitat for American marten.

Log landing construction also would be part of the Proposed Action. Log landings can be used as courtship areas for woodcock and can provide forage habitat for species such as ruffed grouse and deer. However, these openings would reduce habitat for species that require mature forest types such as American marten.

The proposed wildlife habitat improvement activities are expected to have impacts similar to the vegetation management actions. Areas of early successional habitat (most

about 10 acres) would be created or maintained (loss of habitat for late seral wildlife species, but potential increase in habitat for early successional wildlife species). Some areas that have been maintained as early successional habitat in the past would merge into adjacent stands. There would not be any effects from this reclassification (no management is proposed) in many areas, but effects in those areas merged into stands that are planned for vegetation management would be the same as those discussed for vegetation management (clearcut, selection, thinning, etc.).

NNIP treatments would occur mainly in disturbed habitat types (roadsides, utility corridors, gravel pit, etc.). However, there would be noise/human presence associated with all treatment types (chemical, mechanical, and hand pulling), which could potentially alter individual movement patterns for some species. Chemical treatments would involve one or more of the following chemicals: Clopyralid (SERA 2004a), Dicamba (SERA 2004b), Glyphosate (SERA 2011a), Imazapic (SERA 2004c), Picloran (SERA 2011b), and/or Tricolpyr (SERA 2011c). The risk assessments, referenced with each chemical, contain detailed information on potential impacts to various wildlife species. The target of these chemical treatments would be vegetation; however, it is possible that flying insects may come in contact with a chemical, or some mammals/birds may consume vegetation or exposed insects. On the HNF, appropriate personal (pesticide applicator license) and adherence to the manufacturer label (application rates, equipment maintenance, weather conditions, etc.) would occur in all areas treated by chemicals. Based on the information in the risk assessments and localized treatment areas, potential impacts would be limited.

Road construction activity can have several different impacts on wildlife habitat, and the Proposed Action would create about 4 miles of new system roads. Impacts include increased mortality from road construction, modification of animal behavior, and increased alteration and use of habitat by humans (Trombulak and Frissell 2000). However, all new temporary roads would be obliterated following proposed management activities. Additionally, proposed road decommissioning and road closures would increase habitat seclusion for species such as gray wolves and goshawks.

3.11.6.2 Cumulative Effects

The total size of the cumulative effects area is about 323,100 acres, and the HNF manages about 36% of the land within the cumulative effects boundary. Past, present, and future forest management activities have occurred and are expected to occur on HNF land within the cumulative effects area. Several projects (Appendix H) are currently being planned or implemented on the HNF in Chippewa and Mackinac County. However, not all of the project activities (past and future) overlap with the cumulative effects area.

Over the past 15 years, HNF management projects (Appendix H) have resulted in the creation of about 4,340 acres of early successional habitat (0-15 years old) within the cumulative effects boundary. This habitat consists of mainly aspen (about 65%), and aspen/mix (about 34%). Additionally, about 3,070 acres of early successional habitat (about 37% aspen/mix, 25% aspen, 19% white/red/jack pine, 7% birch, 6% maple, and 6% other species) would be created by other projects that overlap with the cumulative effects boundary within the next 15 years (Sprinkler, Niagara, Shores, etc.). Cumulative effects of even-aged harvest activities (clearcut, shelterwood, seed tree, etc.) are the

reduction of mature forest habitat for species such as American marten, and the increase in early successional forest habitat, which provides brood habitat for ruffed grouse.

Other vegetation management also has occurred on HNF land within the cumulative effects area in the past and several activities are planned to occur in the future. Uneven-aged management (mainly selection harvest) has not occurred much in the past 15 years, but about 3,560 acres of selection harvest (mainly maple/hardwood) is planned for harvest in the next 15 years. Also, about 1,350 acres of thinning has occurred, and about 2,870 acres (mainly red pine and hardwood) is planned to occur. The cumulative effects of uneven-aged harvests are the loss of snag/cavity habitat and an increase in understory growth, which provides forage and nesting habitat for various species.

The cumulative effects area contains portions of Mackinac Wilderness, Delirium Wilderness, Fibre Roadless Area, designated old growth, and unsuited wetlands, so about 13% of the entire cumulative effects area is unsuited for timber harvest. Within the cumulative effects area, these areas provide unique habitat (older forest types, increased seclusion, etc.) for species such as lynx, American marten, and goshawk.

The Michigan Department of Natural Resources (MDNR) has divided state land into management units, and there are two management units (Sault Ste. Marie and Newberry) that border the HNF. A variety of even and uneven aged harvest activities occur on state land, and a summary of state management in the Sault Ste. Marie and Newberry Units (2007-2014) can be found in the project file. The amount of harvest varies by year, and acreage values are not available for each year within the cumulative effects temporal boundary. The Sault Ste. Marie management unit overlaps with the cumulative effects boundary, so about 7% of the land within the cumulative effects boundary is managed by the MDNR. Management activities, within compartments that overlap with the cumulative effects area are summarized in Table 3-33. Additional management is expected to occur after 2014, but compartment reviews have not been written for these areas, so activities and acres are not known. As mentioned above, these harvest activities can result in a cumulative loss of habitat (i.e. nesting habitat for goshawk), but can increase habitat for other species (i.e. breeding habitat for woodcock).

Table 3-33 Summary of MDNR Management Activities within Compartments that Overlap with the Wildlife Cumulative Effects Area

Compartment	Year	Management Activity						Total Compartment Management
		Clearcut	Selection	Shelterwood	Thinning	Opening Maintenance	NNIS Treatment	
22	2010	252	0	0	46	0	0	**298**
23	2008	341	16	0	0	0	0	**357**
24	2008	366	0	0	0	0	0	**366**
25	2008	184	47	0	0	52	0	**283**
27	2008	483	0	0	0	77	0	**560**
29	2010	108	0	0	0	0	0	**108**
31	2012	203	271	0	0	0	0	**474**
32	2013	142	91	0	0	0	0	**233**
33	2014	229	163	0	0	0	0	**392**
34	2011	34	109	6	106	0	174	**429**

36	2014	123	0	0	0	0	0	**123**
48	2012	469	540	0	0	0	0	**1,009**
58	2009	34	0	0	0	645	0	**679**
Total		**2,968**	**1,237**	**6**	**152**	**774**	**174**	**5,311**

Source: MDNR Compartment Reviews (project file)

Human populations are increasing in Chippewa County and decreasing in Mackinac County (US Census Bureau 2012), and about 56% of the cumulative effects area is privately owned. On private land past management is difficult to quantify, and future management is speculative. Large agriculture fields are present in the eastern portion of the cumulative effects area, and this land use is expected to continue into the future. Some private landowners are enrolled in the Commercial Forest Program, a program in which the landowner agrees to manage land for timber production. Therefore, development activities (i.e. home construction) and timber harvest from private land can contribute to cumulative loss of habitat seclusion/connectivity and alter potential habitat.

In addition to timber harvest, past and future projects create/improve roads and trails and create/maintain openings (List of Past, Present, Future Projects - Appendix H). The road construction and maintenance activities on HNF, state, or private land may lead to cumulative impacts (reduce habitat seclusion) due to increased recreational access within the cumulative effects area. Increases in road density may lead to a loss of remote habitat areas that some species use for nest/den construction. Cumulative impacts from opening creation/maintenance would be similar to those discussed for timber harvest.

NNIP control and herbicide use within the cumulative effects area is difficult to quantify, but it has occurred and is expected to occur throughout the area. Based on current risk assessments, the use of chemicals according to label direction limits potential impacts to wildlife, and supporting native vegetation through NNIP control is expected to maintain or improve habitat for various species.

3.11.7 Alternative 1

3.11.7.1 Direct and Indirect Effects

The impacts of this alternative on wildlife are primarily:

- Provides less habitat for early successional species than the Proposed Action.
- Provides more snag and woody debris habitat than the Proposed Action.
- Road access would be similar to the Proposed Action.

Harvest before Forest Plan rotation age, and opening reclassification would not occur in Alternative 1. Therefore, the amount of early successional habitat created and maintained would be less than the Proposed Action. This would result in less brood habitat and age class diversity for ruffed grouse than the Proposed Action, but winter/breeding/nesting habitat would be maintained. Since some forested areas would not be treated (converted to opening or existing openings treated with adjacent stands) there may be more snag and woody debris habitat for species such as American marten. Many areas classified as openings are not consistent with Forest Plan direction, but Alternative 1 would keep existing areas classified as openings for planning purposes. However, the limitations to actual management in these areas would still exist, so many

areas designated as openings would not provide early successional habitat for wildlife species.

The effects for the other management activities would be similar to those discussed for the Proposed Action.

3.11.7.2 Cumulative Effects

The condition of the cumulative effects area and summary of past, present, and future management activities on HNF, state, and private land is the same as discussed in the Proposed Action. However, since less harvest activity is proposed, cumulative effects from creation of early successional habitat, and loss of snag/woody debris habitat would be lower in Alternative 1 than the Proposed Action. Therefore, cumulative impacts on snag/den habitat for American marten would be lower than the Proposed Action, and increase in brood habitat for ruffed grouse would be lower than the Proposed Action. Cumulative impacts from road access and NNIP treatments would be similar to the Proposed Action.

3.11.8 No Action

3.11.8.1 Direct and Indirect Effects

The impacts of this alternative on wildlife are primarily:

- Early successional habitat creation would depend on natural disturbance events such as windthrow.
- More snag and woody debris habitat.
- No new roads and associated disturbance to wildlife.

Implementation of this alternative would maintain the existing plant communities and allow natural succession to occur. Some early successional habitat would be created as aspen stands decay and gaps in the canopy support small pockets of new regeneration. These small pockets may provide forage habitat within and adjacent to nesting habitat for raptor species like goshawk. Additionally, windthrow would most likely create small pockets of this condition, which would create brood/breeding habitat for ruffed grouse. However, some young stands would mature, resulting in a loss of brood habitat for ruffed grouse.

The remaining forested stands would mature and result in continual snag, cavity tree, and downed woody debris recruitment. Additionally, the small gaps in the canopy, due to tree mortality, would increase patches of understory growth. This natural disturbance would increase nesting and forage habitat for several bird species and maintain woody debris habitat for species such as American marten.

NNIP would continue to impact habitat provided by native vegetation, and impacts from existing roads (access, disturbance, etc.) would continue.

3.11.8.2 Cumulative Effects

Since there are no actions proposed, there would be no cumulative effects.

3.12 Fisheries

3.12.1 Introduction

Table 3-34 Summary of Resource Effects.

Activity or Measure	Proposed Action	Alternative 1	No Action
Acres of effect	0 acres	0 acres	0 Acres
Changes in availability or Quality of Brook Trout(MIS) Habitat	No Change	No Change	No Change

The HNF received no specific comments in response to the project scoping process regarding impacts to the fishery resources. There are no management activities proposed in any of the alternatives which specifically target fisheries resources. There are however, vegetation and transportation management actions being proposed, some in close proximity to streams within the Rudyard (LTA) project area.

3.12.2 Analysis Methods

The USDA Forest Service (USFS) in cooperation with the Michigan DNR Fisheries Division (MDNR) periodically inventories the fisheries resources on the HNF. Fish collection and habitat measurements are taken at several locations within and along lakes, rivers, and streams to determine the status of the fishery and associated habitat conditions. A report is prepared with the findings and used to facilitate decisions regarding future courses of management activity and assess results of past management activities on the resources. For the purpose of this analysis, the most recent information available is the Bear Creek and Elmhirst Creek Inventory Data Sheets of 1999 (unpublished reports, USFS Gladstone, Michigan), and information gathered from a failed attempt to inventory Garden Hill Creek due to impoundment of inventory stations (specialist observation, 9/2000).

3.12.3 Analysis Areas

The spatial and temporal boundaries for effects range from 0 to 500’ from the edge of streams and rivers adjacent to the project activity areas and ¼ mile downstream with duration of 5-10 years after the completion of an activity. This is a reasonable time and area to expect changes in shade, sediment deposition, and inputs of large woody debris (LWD).

3.12.4 Affected Environment

This section briefly describes current habitat conditions and known occurrences of Brook Trout (*Salvelinus fontinalis)*, the only fish designated on the HNF as a Management Indicator Species (MIS).

Brook trout is the only native salmonid found within the project area and is a popular sport fishing species. They are more dependent on cold groundwater input than any other salmonid species on the forest. With the exception of some small headwater streams, brook trout occur in virtually all waters classified as cold. Highly suitable habitat for a self-sustaining brook trout population has these characteristics: maximum daily water temperatures below 68 degrees Fahrenheit, clean spawning gravel, abundant in-stream large woody debris, low sediment load, and no barriers to migration. Anadromous salmon and steelhead require most of the same habitat characteristics as brook trout, but can tolerate maximum daily water temperature above 68 degrees Fahrenheit. Therefore, all three salmonids may co- exist in some streams (Garden Hill Creek, Elmhirst Creek) depending on season and habitat quality.

Unfortunately, brook trout habitat in some of the coldwater environs within the project area are showing signs of degradation; specifically, in Elmhirst and Garden Hill Creeks, two coldwater streams where brook trout populations used to flourish. Upstream and downstream of the H-63 crossings, aspen regeneration (up to the riparian edge in some cases) has resulted in beaver infestations along these streams. These vegetative treatments were undertaken prior to 2006 Forest Plan implementation. The consequence is loss of spawning habitat due to sediment deposition, warmer water temperatures due to beaver impoundments lack of long lived tree species, and in-stream blockage of fish movement throughout the stream courses. This has led to declining brook trout and other salmonid populations (Bear Creek and Elmhirst Creek Inventory Data Sheets, 1999 and specialist observation, 9/2000).

3.12.4.1 Management Indicator Species

Table 3-35 Population Trend Summary for Management Indicator Species.

Species	Population Trend
Brook trout	Generally stable where systems are healthy (Bear Creek), declining where beaver activity has compromised habitat (Elmhirst,Garden Hill creeks)

Table 3-36 Habitat Availability Summary for Management Indicator Species.

Species	Proposed Action	Alternative 1	No Action
Brook trout	No change	No Change	27 miles (GIS)*

*****Designated as cold water, high priority streams, miles calculated with GIS data.

3.12.5 Action Alternatives (Proposed Action, Alternative 1)

3.12.5.1 Direct and Indirect Effects

Proposals to harvest timber and manage roads in both action alternatives would have little or no impact on the fishery resources. Forest plan standards and guidelines

establish river and stream buffers of at least 100 feet wherein timber harvest is typically seasonally restricted to minimize erosion (Forest Plan 2006, p. 2-14). Trees growing within 100 feet of a stream provide most of the shade and LWD input and also act to stabilize soil. Along stream reaches protected by this buffer, some timber may be harvested while 60-80 basal area is allowed to remain and mature allowing natural processes to resume. In addition, a 500 foot buffer is identified in which aspen regeneration should not be prescribed adjacent to coldwater, high priority streams (most conducive to MIS occupation (Forest Plan 2006, p. 2-14)). This discourages habitation of these areas by beaver since they rarely travel more than 500 feet (but can travel up to 656 feet) to obtain aspen, one their preferred foods (Allen, 1982). These protection measures ensure less aspen regeneration near the riparian areas, and encourage establishment of long lived, large diameter trees; providing future LWD input, shade, and soil stabilization.

Some delivery of sediment to streams through runoff, culvert crossings, normal road use and maintenance is expected. This impact is minimized by adherence to Best Management Practices (BMP) as described in *Sustainable Soil and Water Quality Practices on Forest Land* (MDNR/ MDEQ 2009). There would be no measurable effects to the fisheries resources resulting from any planned transportation activity in the project area.

3.12.5.2 Cumulative Effects

By limiting proposed activities through the design criteria described above, there are no expected effects to the fisheries habitat and overall resource. Therefore, there are no cumulative effects to discuss.

3.12.6 No Action

3.12.6.1 Effects

The implementation of this alternative would maintain the existing condition of the riparian vegetation and allow natural succession to occur. Road management activities identified in the roads analysis would not be implemented. The existing condition of available habitat and population trends described in the analysis would persist.

3.12.6.2 Cumulative Effects

Since there are no actions proposed, there are no cumulative effects.

3.13 Recreation

3.13.1 Introduction

Table 3-37 Summary of Recreation Effects

	No Action	Proposed Action	Alternative 1
Displacement during harvest related activities			
• Trout Brook Pond dispersed site and NCT trailhead	No Change	Displacement of recreationists for 97 days over 10 years from this project. Cumulatively, displacement of recreationists for 317 days over 10 years.	
• NCT	No Change	Displacement of recreationists for 204 days over 10 years from this project. Cumulatively, displacement of recreationists for 568 days if travelling north of the project area and 1157 days if travelling south of the project area over 10 years.	Displacement of recreationists for 74 days over 10 years from this project. Cumulatively, displacement of recreationists for 557 days if travelling north of the project area and 1146 days if travelling south of the project area over 10 years.
Changes in Motorized Access	No Change	No Change	No Change
NCT	No Change	No Change	No Change

Managing for recreation requires different kinds of data and management concepts than does most other activities. While recreation must have a physical base of land or water, the product - recreation experience - is a personal or social phenomenon. Although the management is resource based, actual recreational experiences are a result of people, their perceptions, wants, and behavior" (Final Report of the Committee of Scientists for Implementation of Section 6 of the National Forest Management Act of 1976, February 22, 1979, as published in the Federal Register, Part V, May 4, 1979, p. 26628).

Several components of the recreation resource were dropped from consideration from this analysis because they are not within or adjacent to the project area: Wilderness Areas, Wild and Scenic Rivers, Roadless Area, National Recreation Areas, candidate or designated Research Natural Areas, and developed recreation sites. Snowmobile Trail 47 weaves in and out of the southern project boundary, but there are not proposed activities near the trail.
There are no dispersed recreation sites within the project area. Trout Brook Pond dispersed camping site and the North Country Trail (NCT) trailhead at Trout Brook Pond are adjacent to the project boundary, and are affected by proposed activities. In addition to these two sites, the North Country Trail travels through the northwest portion of the project area.

Based on comments received from the public during scoping, the recreation experience was raised as an issue. In particular, some people felt that harvest related activities will

adversely impact the recreational experience. In order to measure the effects of this issue, the displacement during harvesting (duration of displacement from particular sites) and changes in motorized access (change in miles of road open to motorized use) will be calculated and analyzed (Issue 4 in section 1.8.4).

3.13.2 Analysis Methods

Displacement During Harvesting.
The level of noise (decibels) was calculated for harvest machines used on a typical harvest operation on the Eastside of the Hiawatha National Forest (HNF) (see Recreation Specialist Report, project file). The distance it would take for these noises to dissipate to the same level of "secluded woods with little or no wind" (30 dBA) was then calculated (Minnesota Pollution Control Agency, Guide to Noise Control in Minnesota, p. 17). Within this distance (1879 feet), one could expect to hear some harvest related noise.

The stands proposed for harvest were buffered by this distance to determine if any recreation sites or non-motorized trails would be within hearing distance. The estimated number of days it would take to harvest each stand within hearing distance of each site or trail was calculated based on the average acres per day (2 acres per day) a typical operation on the Eastside HNF would take to harvest (see Recreation Specialist Report, project file).

Together, these calculations are used to determine the distance and length of time those who do not wish to hear the sounds of timber activities would either have a diminished recreation experience or would be displaced to another location where harvest related activities could not be heard.

Changes in Motorized Access. This analysis first compares the proposed road changes to the Motor Vehicle Use Map (MVUM, 2012). This analysis assumes that roads which are not on the MVUM are physically closed to motorized use, and do not have unauthorized motorized use. There are several proposals to the road system that would not have an effect on the motorized access since they would not have a change to the MVUM. Those road activities that could have an effect on the motorized access and are the focus of this analysis are:

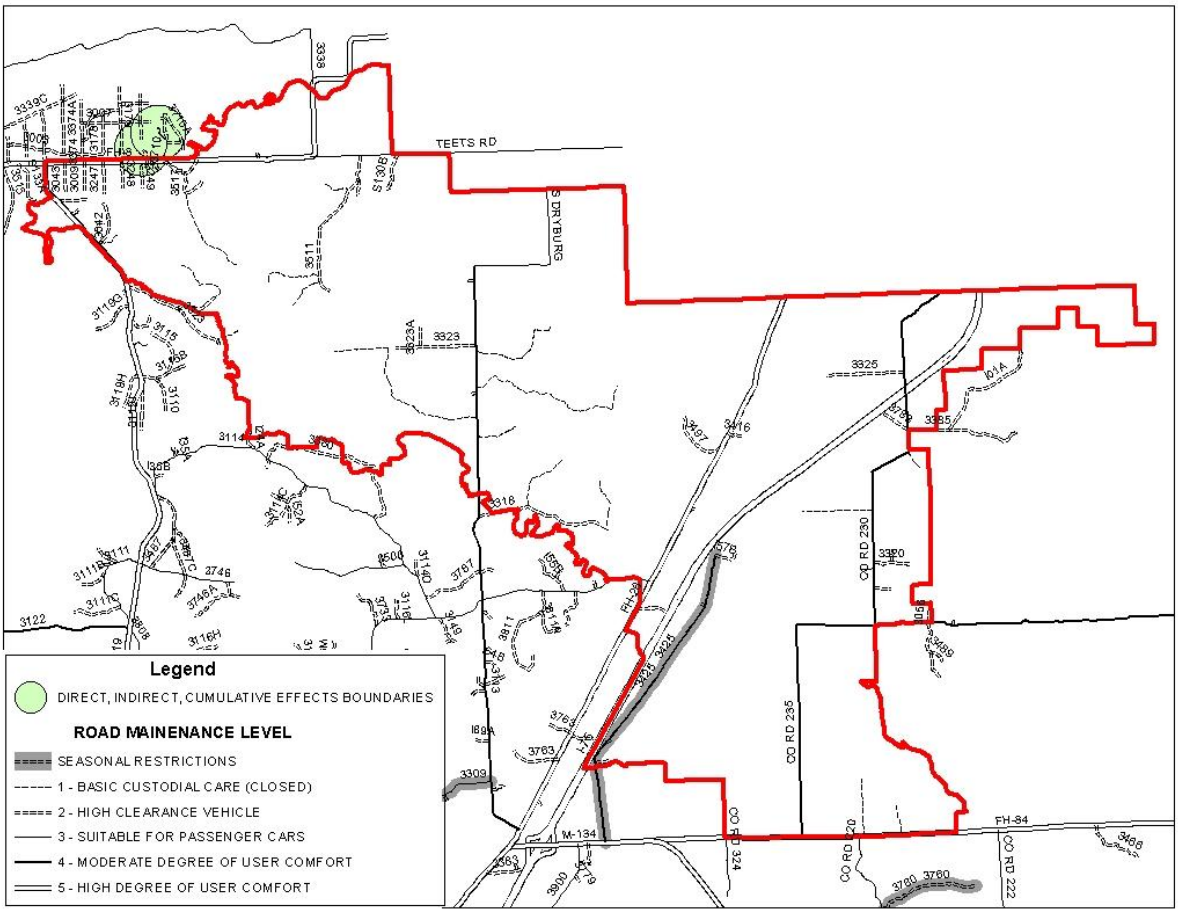
- Open roads to be decommissioned.
- Open roads to be closed.
- Existing roads to be added to the system that are currently open to motorized use but are proposed to be closed to motorized use.
- Existing roads to be added to the system that are currently closed to motorized use but are proposed to be open to motorized use.

NCT. Existing roads layers in the HNF geographic information systems (GIS), the alternative maps displaying the roads proposals, and the Motor Vehicle Use Map (MVUM) were used to analyze the effects. A one mile analysis boundary was placed around the NCT, within the project area. The number, miles, and location of closed roads and new permanent roads and new temporary roads were calculated and analyzed for the NCT.

3.13.3 Analysis Areas

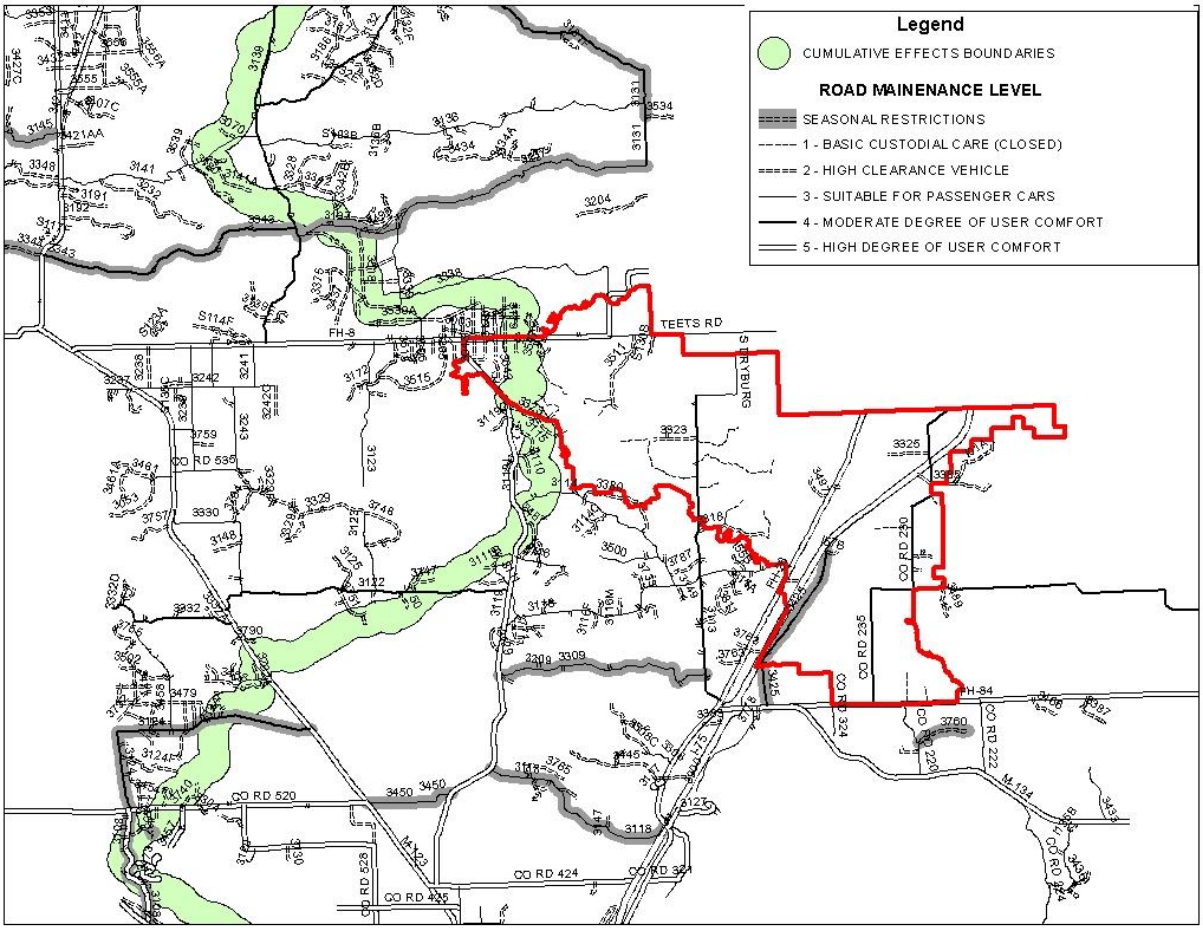
Displacement During Harvesting. The direct, indirect and cumulative effects spatial boundary for Trout Brook Pond dispersed site, and NCT trailhead, is 1879 feet beyond each of these two sites; since this is the distance it takes noise from a typical East Administrative Unit harvest to dissipate to a level similar to secluded woods.

Figure 3-3 Direct, Indirect and Cumulative Effects Boundary for Trout Brook Pond Dispersed Site and NCT Trailhead.



The spatial boundary for direct, indirect and cumulative effects for the NCT is also 1879 feet on either side of the trail from where it crosses Brevort Lake Road to where it crosses Dick Road (the north crossing) or about 15 miles in each direction from the project boundary. This boundary was selected because 15 miles is about an average day's hike, and would represent the cumulative sounds from harvest related activities.

Figure 3-4 Cumulative Effects Boundary for NCT

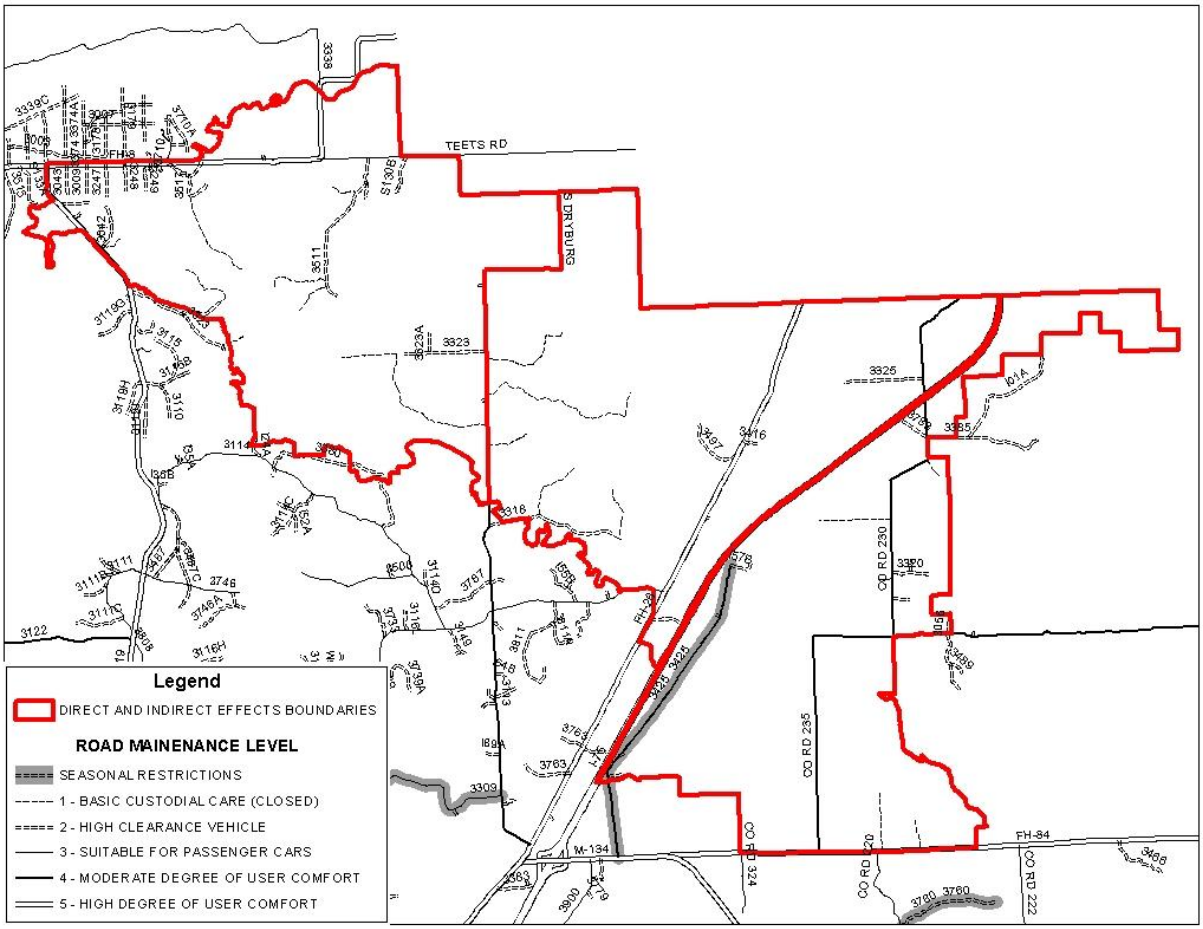


The direct, indirect and cumulative temporal boundary for both the NCT and the dispersed sites is 10 years (2014-2024) because that is the length of time it would take to sell and harvest the stands.

Changes in Motorized Access. There are three direct and indirect effects spatial boundaries for motorized access, because each area is bound by a higher maintained road in order to access the area. They are roads within the project area that are bound as follows:

- West of FR 3113 (Akrigg/Dryburg Road)
- Between FR 3113 and I-75
- East of I-75

Figure 3-5 Map of Motorized Access boundaries and Authorized Motorized Use



The spatial boundary for cumulative effects is defined as the Eastside of the HNF because recreationists feeling displaced in the approximately 34,300 acre project area will still have access to approximately 397,500 acres of non-project area adjacent national forest lands that parallel ROS type, road maintenance levels, hunting opportunities, vegetation types, trail types, etc. that are available on the Eastside of the HNF.

The temporal direct, indirect and cumulative effects boundary is 10 years, or the time it takes to implement all of the road changes.

NCT. The direct and indirect effects spatial boundary for the NCT is 1 mile on either side of the portion of the trail within the project area boundary, because motorized recreationists are not likely to travel more than one mile down an unfamiliar road.

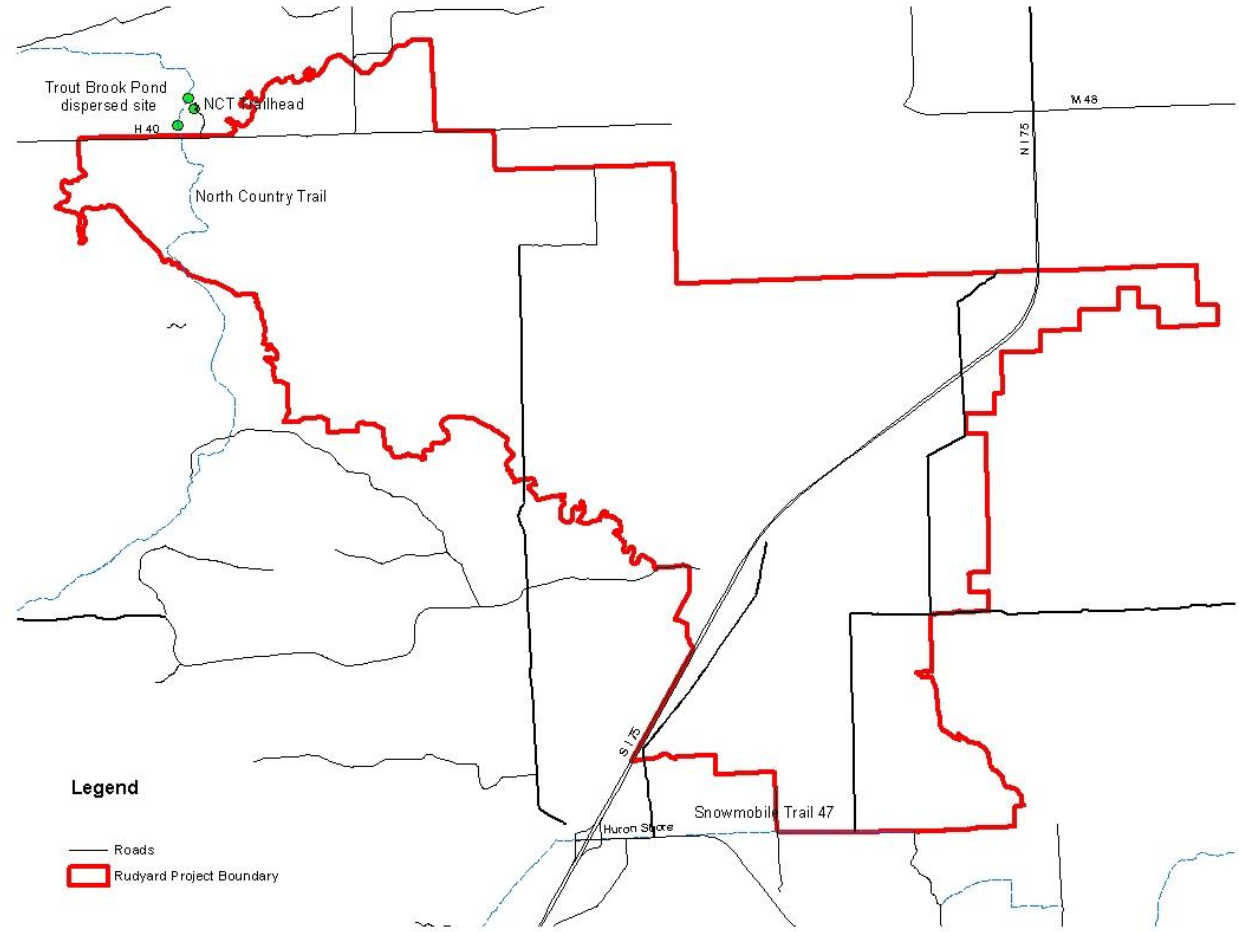
The spatial boundary for cumulative effects for the NCT is 1 mile on either side of the trail from where it crosses Brevort Campground Road to where it crosses FR 3139 (Dick Road, the north crossing) or about 15 miles in each direction from the project boundary. This boundary was selected because 15 miles is about an average day's hike.

The direct, indirect and cumulative temporal boundary for both the NCT and the dispersed sites is 10 years (2014-2024) because that is the length of time it would take to sell and harvest the stands.

3.13.4 Affected Environment

Trout Brook Pond dispersed campsite is located on the north side of H-40 and on the west side of Trout Brook Pond at the end of FR3032 and along the NCT. The campsite is rustic, with only a user developed fire ring to identify its location. Noise from H-40 is evident at the campsite. While this dispersed site is not within the project boundary, it is within the direct and indirect effect boundary.

Figure 3-6 Map of Recreation Locations



The NCT trailhead is located on the north side of H-40 and on the east side of Trout Brook Pond at the end of FR3710 and along the NCT. The trailhead contains a sign and a bulletin board. Because this is a trailhead, and not a destination point, recreationists do not stay for long periods of time. This is a starting, stopping and resting point. Confidence markers guide hikers to the trail and to the beginning of their journey. While this trailhead is not within the project boundary, it is within the recreation effects boundary.

The NCT travels about 2.5 miles through the project area. This stretch of the trail crosses several creeks including Bear Creek and Little Bear Creek. Finding a dry location for the trail is a challenge, and as a result there is at least a mile of boardwalk within the project area. Beaver dams are another challenge for the NCT. The beaver have actively blocked off Little Bear Creek in several locations. As a result, the trail has been relocated several times, each time succumbing to rising water backed up by the beaver dams.
This national scenic trail is a non-motorized trail. However, motorized vehicles are accessing the trail in locations where the trail crosses a road opened to motorized use. Within the project area, the NCT crosses one road that is open to all motorized vehicles. The NCT also crosses one road closed to all motorized vehicles.

Changes in Motorized Access. The MVUM shows the National Forest System roads, trails, and the areas on National Forest System lands in the HNF that are designed for motor vehicle use pursuant to 36 CFR 212.51 for the purpose of enforcing the prohibition at 36 CFR 261.31. The map also contains a list of those identified roads, trails, and areas that enumerates the types of vehicles that are allowed on each route and in each area as either: "roads open to highway legal vehicles" (motor vehicles licensed under state law for general operation on all public roads within the State), "roads open to all vehicles" (motor vehicles, including smaller off highway vehicles that may be licensed for highway use – but not to oversized or overweight vehicles under State traffic law). This map also displays any seasonal restrictions that apply on those routes and in those areas.

West of FR3113.The northwest corner of the area has a readily identifiable block of roads running south from H-40 through the pine plantations. They are FRs 3043, 3009, 3247, 3248, and 3249, each of which is open to all motorized vehicles for the first ½ mile. The remaining area is difficult to gain motorized access due to Bear Creek, Little Bear Creek and the beaver dams on both. FR3323 travels west off the FR3113, and travels east off FR3119. The road travels through private land for the first mile off FR3113, and is open to all motorized vehicles for the first 1 ½ miles off FR3119. The remaining section of the road is closed to motorized vehicles. FR3511 travels south off the Teets Road, and travels northeast off FR3119 (outside the project area). The road is open to all motorized vehicles for the first 2 miles off the Teets Road, and is open to all motorized vehicles for the first ½ mile off FR3119. The remaining section of the road is closed to motorized vehicles. FRs 3119I, S132F, and 3042, travel ¼ to ½ mile east of FR3119, and each are open to all motorized vehicles. FRs S132A, S132C, S131A, 3517, and S130B travel ¼ to ½ mile south off H-40/Teets Road, and each are open to all motorized vehicles.

Between FR 3113 and I-75:
FR3318 travels east from FR3113. It is open to all motorized vehicles for approximately the first 1 ½ miles. FR3497 travels west from Mackinac Trail toward private land in section 11. The road is open to all motorized vehicles the entire length (approximately ½ mile) from Mackinac Trail to the private land. There are two short spurs, FRs 3416 and I131A that travel east from Mackinac Trail. They are both open to all motorized vehicles. There are several roads closed to motorized vehicles, 3 of which travel east of FR3113 and contain several spurs, and 2 which spur toward the north and west off of FR3318.

East of I-75:

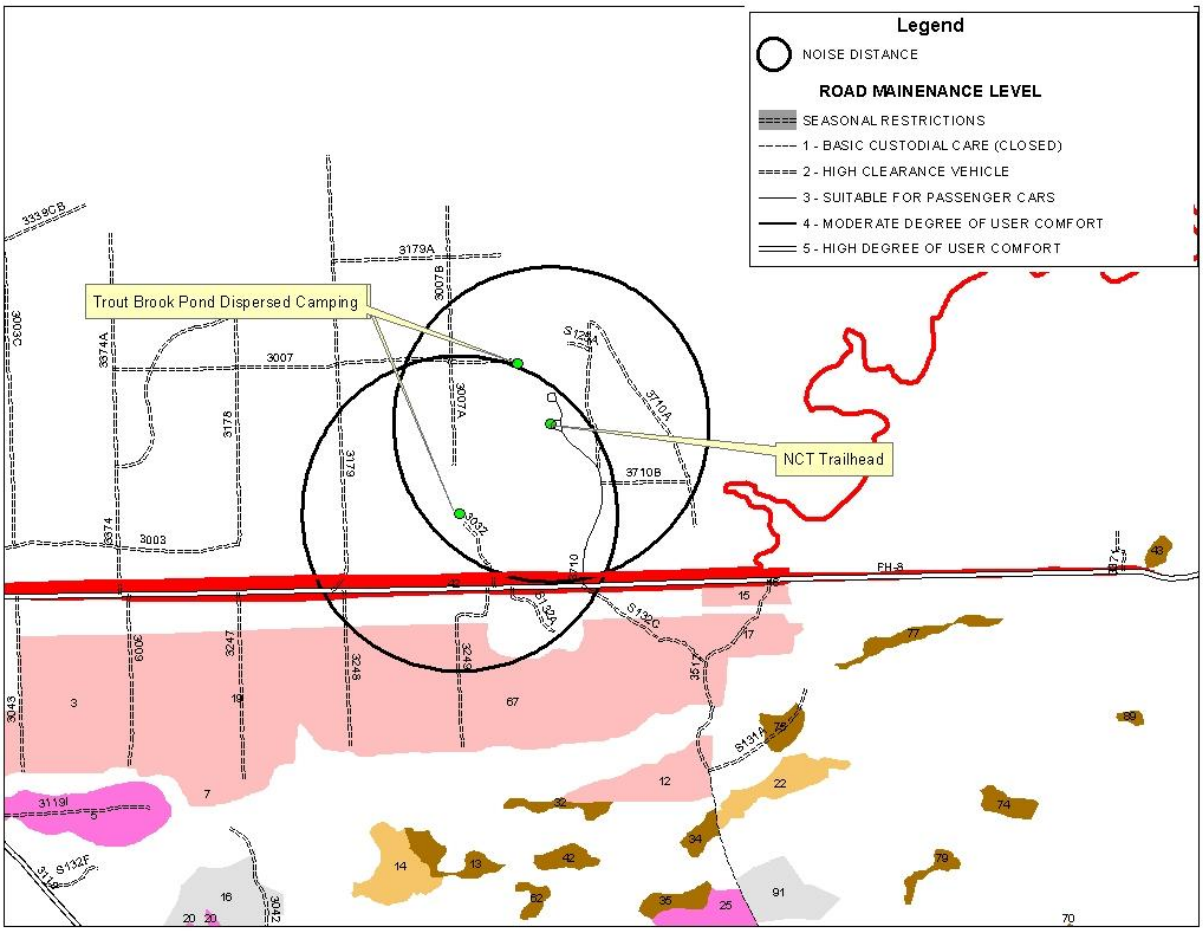
FR3783 travels northwest off CR230, dead ending at I-75. It is open to all motorized vehicles. FR3325 travels west off CR230 for approximately 2 miles toward the Pine River. This road is open to all motorized vehicles. FR3425 travels approximately 4 miles north off of M-134. It is open to highway legal vehicles only, and is part of the snowmobile trail in the winter time. There are 4 spurs off FR3425, each less than ½ mile and are open to all motorized vehicles.

3.13.5 Proposed Action

3.13.5.1 Direct and Indirect Effects

Displacement During Harvesting. Figure 3-7 below displays the area around Trout Brook Pond dispersed camping site and around NCT trailhead where noise from harvest related activities could be heard. Harvest related activities within these green areas are within sound distance of these two sites, and where those recreationists who prefer not to hear harvest activities would be displaced from. In this case, harvest activities could be heard at the southern dispersed site and the NCT trailhead. The northern dispersed site would not hear harvest activities.

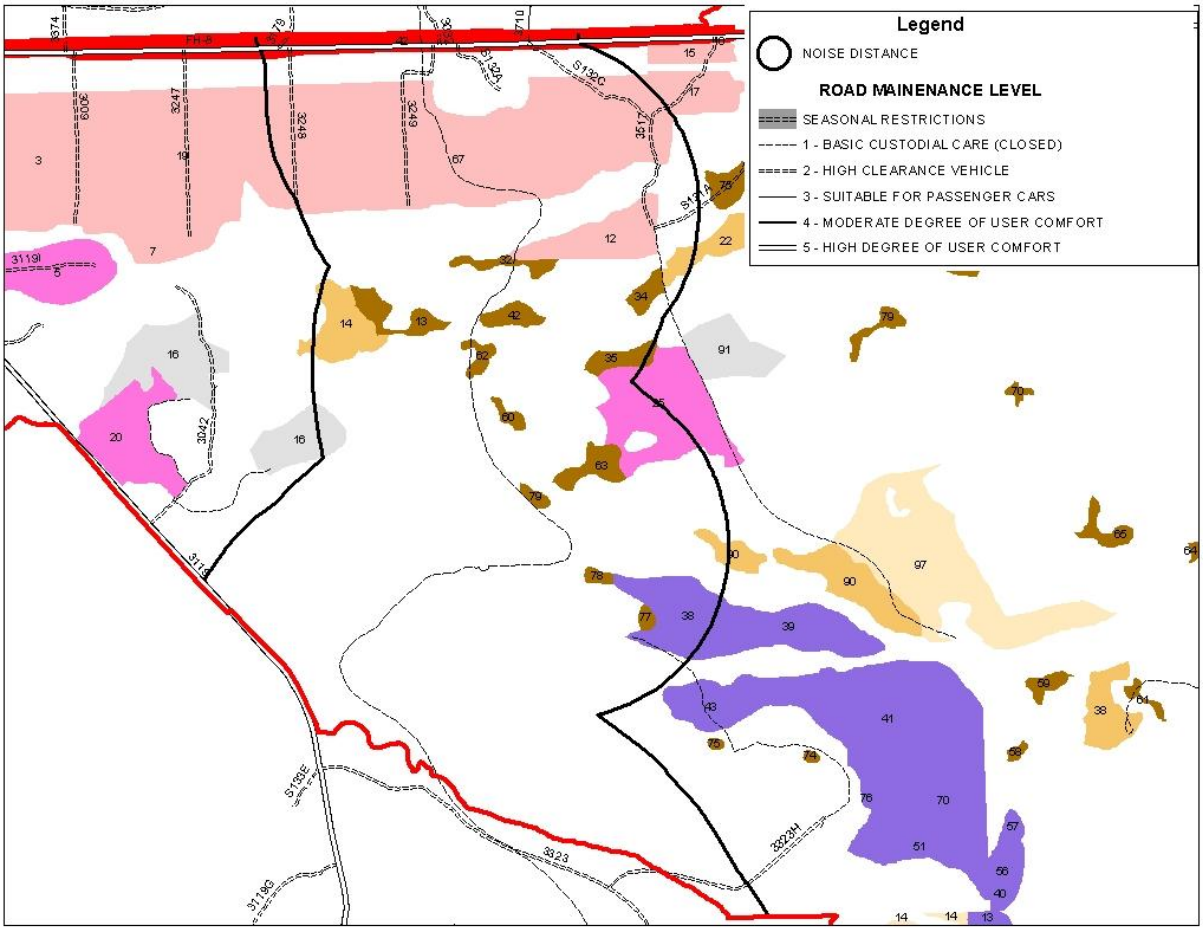
Figure 3-7. *Area in Which Harvest Related Activities Could be Heard at Trout Brook Pond Dispersed Site and the North Country Trail Trailhead.*



Recreationists who do not wish to hear the sounds of harvest related activities would be displaced from the Trout Brook Pond dispersed camping site and NCT trailhead for about 97 days over a 10 year period. Because both of these sites are located across the highway (H-40) from the proposed harvest activities, the sounds of the harvest related activities would be melded with the intermittent sounds of highway traffic.

Figure 3-8 below displays the area around Trout Brook Pond dispersed camping site and around NCT trailhead where noise from harvest related activities could be heard, and where those recreationists who prefer not to hear harvest activities would be displaced from. In this case, harvest activities could be heard along the NCT north of H-40 and south to East Lake Road. It is estimated that hikers could hear harvest activities along approximately 2.2 miles of trail in this area. The stands identified as "Suitability Classification" if the map below were not considered in this analysis since they do not involve harvesting.

Figure 3-8. *Proposed Action Harvest Activities Noise Impacts on the North Country Trail.*



If all of the stands within hearing distance of the NCT were harvested one after the other, they would diminish the hiking/snowshoeing experience or displace hikers who do not

want to hear the sounds of harvest related activities from this area of the NCT for 204 days over a 10 year period.

Changes in Motorized Access. The roads proposed for decommissioning are roads that are closed to all motorized vehicles. Therefore, there would be no change in motorized access related to decommissioned roads.

The temporary roads are proposed to be constructed off of existing roads that are currently closed to all motorized vehicles. In addition, the temporary roads would be constructed for access to harvesting, and would not be open to motorized vehicles for other purposes. Therefore, there would be no change in motorized access related to temporary roads.

The new system roads are proposed to be constructed off of existing roads that are currently closed to all motorized vehicles. Therefore, there would be no change in motorized access related to new system roads.

NCT. Three temporary roads are proposed be constructed within one mile of the NCT; however, all three temporary roads connect to roads not open to motorized vehicles, and all three temporary roads are on the opposite side of the road (travelling away) as the NCT. No permanent roads are proposed to be constructed. Therefore, there would be no effect to the NCT related to potential motorized access.

Mitigation measures identified in Chapter 2 protect the integrity of the NCT during harvest related activities.

3.13.5.2 Cumulative Effects

Displacement During Harvesting. Table 3-38 below displays the number of acres of harvest activities within the sound distance (1879 feet) to the dispersed camping site for all harvest activities known to occur from 2014 to 2024.

Table 3-38 Cumulative Harvest Activities Noise Impacts on the Trout Brook Pond Dispersed Site and the North Country Trail Trailhead.

District	Compartment	Stand	Acres	Sale or Analysis Name	Estimated Harvest Year
SSM	125	25	129	Only Choice Timber Sale	2010-2015
SSM	125	30	28	Only Choice Timber Sale	2010-2015
SSM	125	31	34	Only Choice Timber Sale	2010-2015
SSM	125	41	11	Only Choice Timber Sale	2010-2015
SSM	125	42	64	Rudyard EA	2014-2024
SSM	125	63	196	Only Choice Timber Sale	2010-2015

SSM	127	58	38	Only Choice Timber Sale	2010-2015
SSM	127	60	4	Only Choice Timber Sale	2010-2015
SSM	132	67	130	Rudyard EA	2014-2024

If all of the harvest activities were to occur consecutively, recreationists who do not wish to hear the sounds of harvest related activities would be displaced from the Trout Brook Pond dispersed camping site and NCT trailhead for about 317 days over a 10 year period.

Table 3-39 below displays the number of acres of harvest activities within the sound distance (1879 feet) to the dispersed camping site for all harvest activities known to occur from 2014 to 2024.

Table 3-39 Cumulative Harvest Related Noise Impacts on the North Country Trail.

Sale Name	Total Sale Acres within Noise Distance of NCT	Estimated Harvest Year	North (N) or South (S) of Project Boundary
Rudyard EA	441	2014-2024	-
B-52	315	2014-2019	S
Meatloaf Timber Sale	649	2015-2020	S
Journey Timber Sale	247	2013-2018	S
Foreigner Timber Sale	561	2015-2020	S
Interior Wetlands EIS	76	2017-2022	S
Red Squirt Timber Sale	32	2014-2019	S
Queen Timber Sale	24	2016-2021	N
Red Hot Timber Sale	228	2012-2017	N
Only Choice Timber Sale	450	2010-2015	N

If all of the stands within hearing distance of the NCT within and north of the project area were harvested one after the other, they would diminish the hiking/snowshoeing experience or displace hikers who do not want to hear the sounds of harvest related activities from this area of the NCT for 568 days over the next 10 years.

If all of the stands within hearing distance of the NCT within and south of the project area were harvested one after the other, they would diminish the hiking/snowshoeing experience or displace hikers who do not want to hear the sounds of harvest related activities from this area of the NCT for 1157 days over the next 10 years.

Changes in Motorized Access. Since there are no direct or indirect effects to changes in motorized access, there are no cumulative effects.

NCT. Since there are no direct or indirect effects to the NCT, there are no cumulative effects.

3.13.6 Alternative 1

3.13.6.1 Direct and Indirect Effects

Displacement During Harvesting. The stands near the Trout Brook Pond dispersed site and NCT trailhead area identified for harvesting in Alternative 1 are the same as the Proposed Action. Therefore, the effects are the same as the Proposed Action.

Figure 3-9 Area in Which Harvest Related Activities Could be Heard at Trout Brook Pond Dispersed Site and the North Country Trail Trailhead.

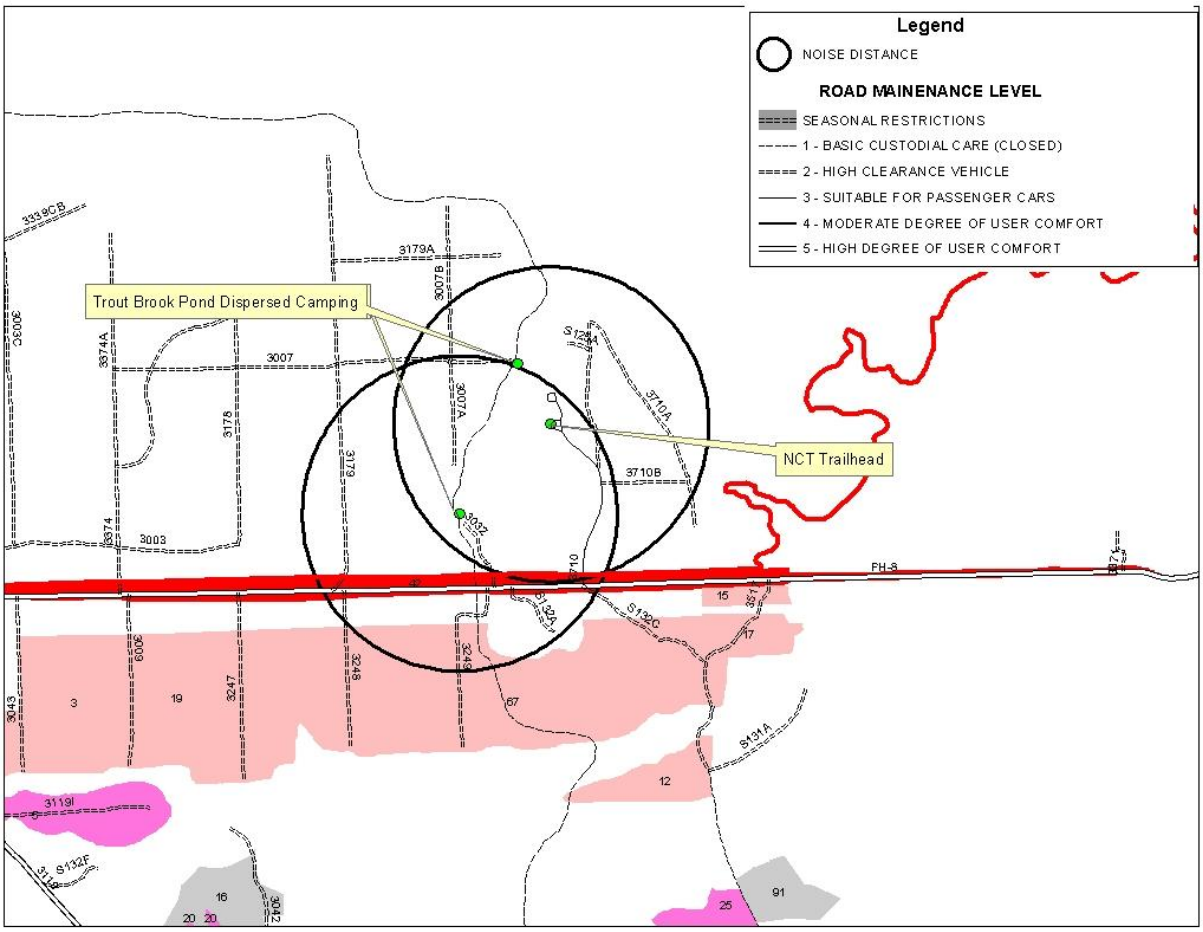
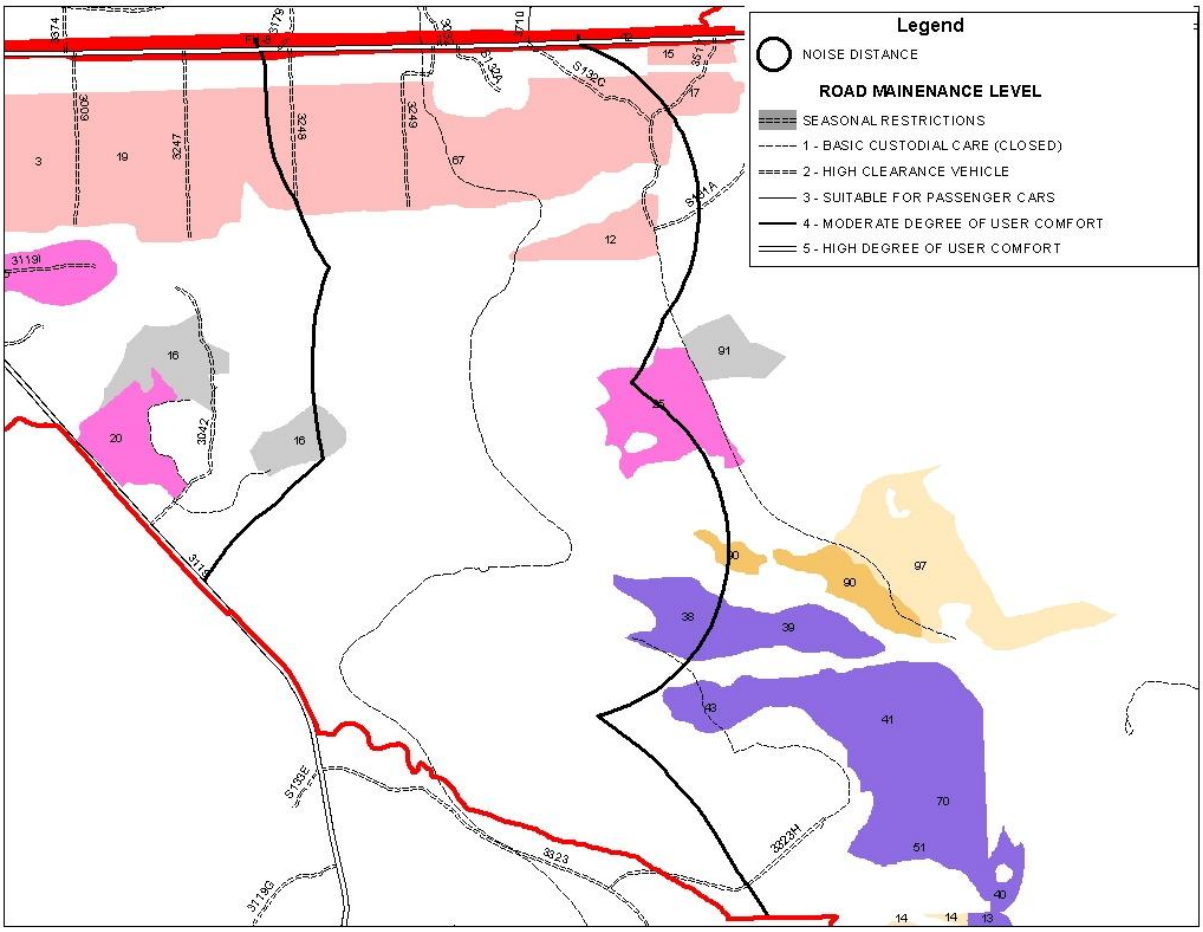


Figure 3-9 displays the area around Trout Brook Pond dispersed camping site and around NCT trailhead where noise from harvest related activities could be heard, and where those recreationists who prefer not to hear harvest activities would be displaced from. In this case, harvest activities could be heard along the NCT north of H-40 and south to East Lake Road. It is estimated that hikers could hear harvest activities along approximately 2.2 miles of trail in this area.

Figure 3-10. Alternative 1 Harvest Activities Noise Impacts on the North Country Trail within the project area.



If all of the stands within hearing distance of the NCT were harvested one after the other, they would diminish the hiking/snowshoeing experience or displace hikers who do not want to hear the sounds of harvest related activities from this area of the NCT for 74 days over a 10 year period.

Changes in Motorized Access. The roads proposed for decommissioning are roads that are closed to all motorized vehicles. Therefore, there would be no change in motorized access related to decommissioned roads.

The temporary roads are proposed to be constructed off of existing roads that are currently closed to all motorized vehicles. In addition, the temporary roads would be constructed for access to harvesting, and would not be open to motorized vehicles for other purposes. Therefore, there would be no change in motorized access related to temporary roads.

The new system roads are proposed to be constructed off of existing roads that are currently closed to all motorized vehicles. Therefore, there would be no change in motorized access related to new system roads.

NCT. Three temporary roads are proposed be constructed within one mile of the NCT; however, all three temporary connect to roads not open to motorized vehicles, and all three temporary roads are on the opposite side of the road (travelling away) as the NCT. No permanent roads are proposed to be constructed. Therefore, there would be no effect to the NCT related to potential motorized access.

Mitigation measures identified in Chapter 2 protect the integrity of the NCT during harvest related activities.

The Hiawatha Shore-to-Shore Chapter of the North Country Trail Association has proposed a reroute within the project area, and has identified some of the roads proposed for decommissioning. The reroute proposal was not included in this analysis because it does not meet the purpose of and need for this project; however, those roads identified in the reroute proposal are not included in Alternative 1.

3.13.6.2 Cumulative Effects

Displacement During Harvesting. The stands in the Trout Brook Pond dispersed site and NCT trailhead area identified for harvesting in Alternative 1 are the same as the Proposed Action. Since the direct and indirect effects are the same as the Proposed Action, the cumulative effects are the same as the Proposed Action.

Table 3-40 below displays the number of acres of harvest activities within the sound distance (1879 feet) to the dispersed camping site for all harvest activities known to occur from 2014 to 2024.

Table 3-40 Cumulative Harvest Related Noise Impacts on the North Country Trail.

Sale Name	Total Sale Acres within 1879 Feet of NCT	Estimated Harvest Year	North (N) or South (S) of Project Boundary
Rudyard EA	407	2014-2024	-
B-52	315	2014-2019	S
Meatloaf Timber Sale	649	2015-2020	S
Journey Timber Sale	247	2013-2018	S
Foreigner Timber Sale	561	2015-2020	S
Interior Wetlands EIS	76	2017-2022	S
Red Squirt Timber Sale	32	2014-2019	S
Queen Timber Sale	24	2016-2021	N
Red Hot Timber Sale	228	2012-2017	N
Only Choice Timber Sale	450	2010-2015	N

If all of the stands within hearing distance of the NCT were harvested one after the other, they would diminish the hiking/snowshoeing experience or displace hikers who do not want to hear the sounds of harvest related activities from this area of the NCT for 557 days over the next 10 years.

If all of the stands within hearing distance of the NCT were harvested one after the other, they would diminish the hiking/snowshoeing experience or displace hikers who do not want to hear the sounds of harvest related activities from this area of the NCT for 1146 days over the next 10 years.

Changes in Motorized Access. Since there are no direct or indirect effects to changes in motorized access, there are no cumulative effects.

NCT. Since there are no direct or indirect effects to the NCT, there are no cumulative effects.

3.13.7 No Action

3.13.7.1 Direct and Indirect Effects

Displacement During Harvesting. Since there would be no harvest related activities, there would be no sounds associated with harvesting. Those who do not wish to hear the sounds of timber related activities would not be displaced from Trout Brook Pond dispersed site, the NCT trailhead, or the NCT.

Changes in Motorized Access. There would be no change in access to NFS lands within the project area as a result of this project. Those who recreate within the project area would not notice a difference in their recreational experience under this alternative.

NCT. There would be no change in access to NFS lands within the project area as a result of this project. There would be no change in motorized access to the NCT.

3.13.7.2 Cumulative Effects

Displacement During Harvesting. Since there are not direct or indirect effects to recreationists under this alternative, there are no cumulative effects.

Changes in Motorized Access. Since there are not direct or indirect effects to recreationists under this alternative, there are no cumulative effects.

NCT. Since there are not direct or indirect effects to recreationists under this alternative, there are no cumulative effects.

3.14 Visual Quality

3.14.1 Introduction

Table 3-41 Summary of Visual Quality Effects

Visual Quality Objective	Proposed Action	Alternative 1	No Action
Preservation	NA	NA	NA
Retention	Would not be met during harvest related activities along 0.3 miles of NCT, but would be met once harvest equipment is removed.	Would not be met during harvest related activities along 0.3 miles of NCT, but would be met once harvest equipment is removed.	No change
Partial Retention	Meets VQO	Meets VQO	No change
Modification	Meets VQO	Meets VQO	No change

While there were no public concerns raised about the visual resources during scoping, a Forest Plan goal says "the visual diversity and the natural-appearing character of the Forest is maintained or enhanced." The Forest Plan objective calls for "increasing the amount of NF lands meeting Visual Quality Objectives as identified on the VQO map or as otherwise specified within individual management area direction." (Forest Plan, pg. 2-8).

3.14.2 Analysis Methods

Forest-wide management direction for Visual Quality (FP, HNF 2006a p. 2-8) and Visual Quality Objectives (VQO) found in Appendix C of the Forest Plan (p. C-1 through 3) were reviewed and used to analyze project effects. The harvest treatments, design criteria and mitigation measures in the Proposed Action and the alternatives were analyzed using Forest Plan direction.

Forest Plan guidelines for visual quality along the NCT suggest limiting the view of temporary openings to 5 acres and 10 acres from any point along the trail in retention and partial retention areas respectively (Forest Plan, p. 2-9). Since clearcut with reserves, shelterwood, and seed-tree final removal cut with reserves are considered temporary openings, the analysis of the NCT focuses on these harvest prescriptions. The other harvest prescriptions reduce the density of the stand either from below or above, but are not considered temporary openings.

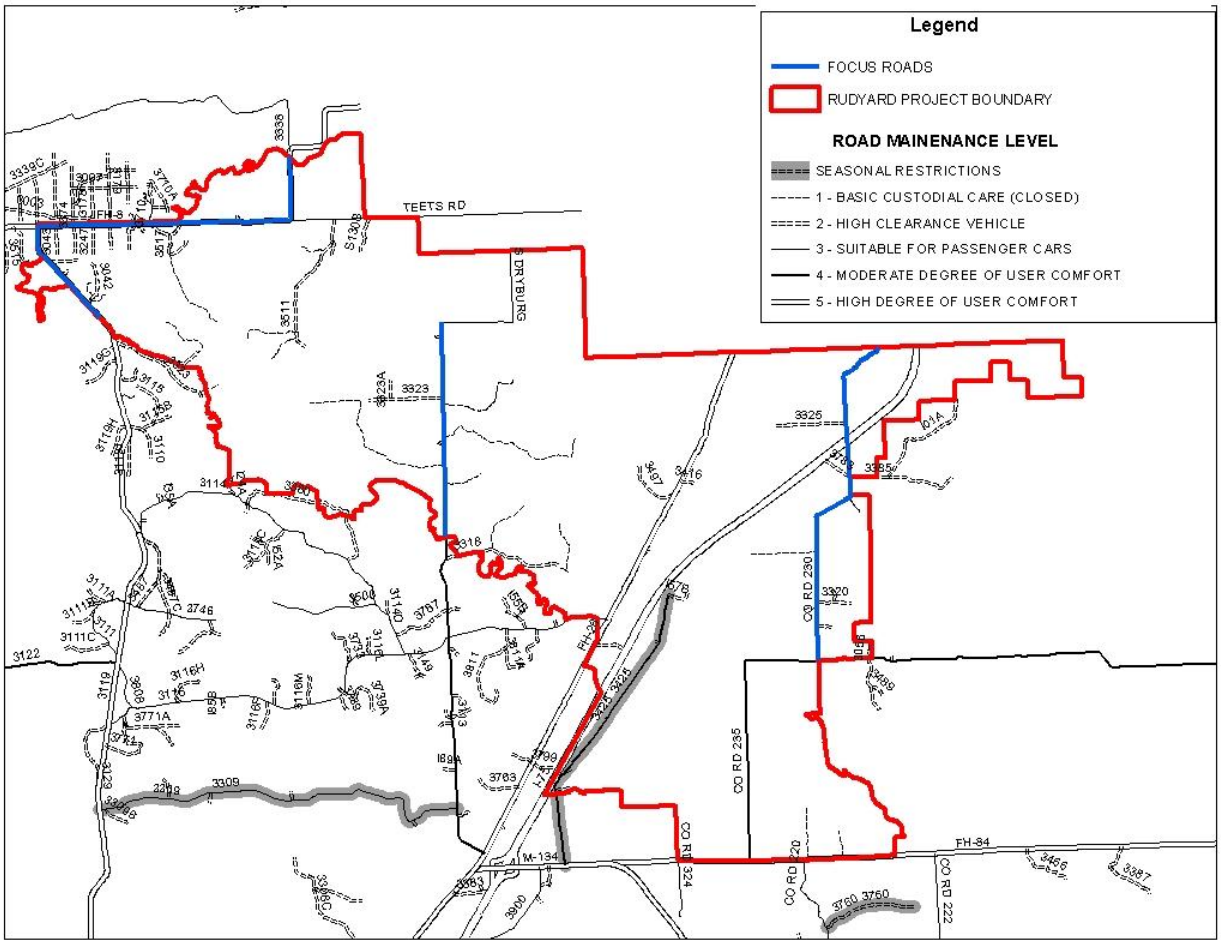
3.14.3 Analysis Areas

The direct, and indirect effects spatial boundary for visual quality is the project area boundary. The direct and indirect analysis will focus on the arterial roads as described below, since the majority of the public travel these roads, and harvest activities are proposed on these roads:

- H-40 from East Lake Road (FR3119) to Teets Road
- East Lake Road (FR3119) from H-40 to FR3323
- Akrigg Road (FR3113) from Dryburg Road to FR3118
- CR230 (Bay Road) from I-75 overpass to CR235 (Simmons Road)

Mackinac Trail was not identified as a focus road because this analysis does not propose any harvest activities along Mackinac Trail.

Figure 3-11 Direct and Indirect Visual Effects Boundaries

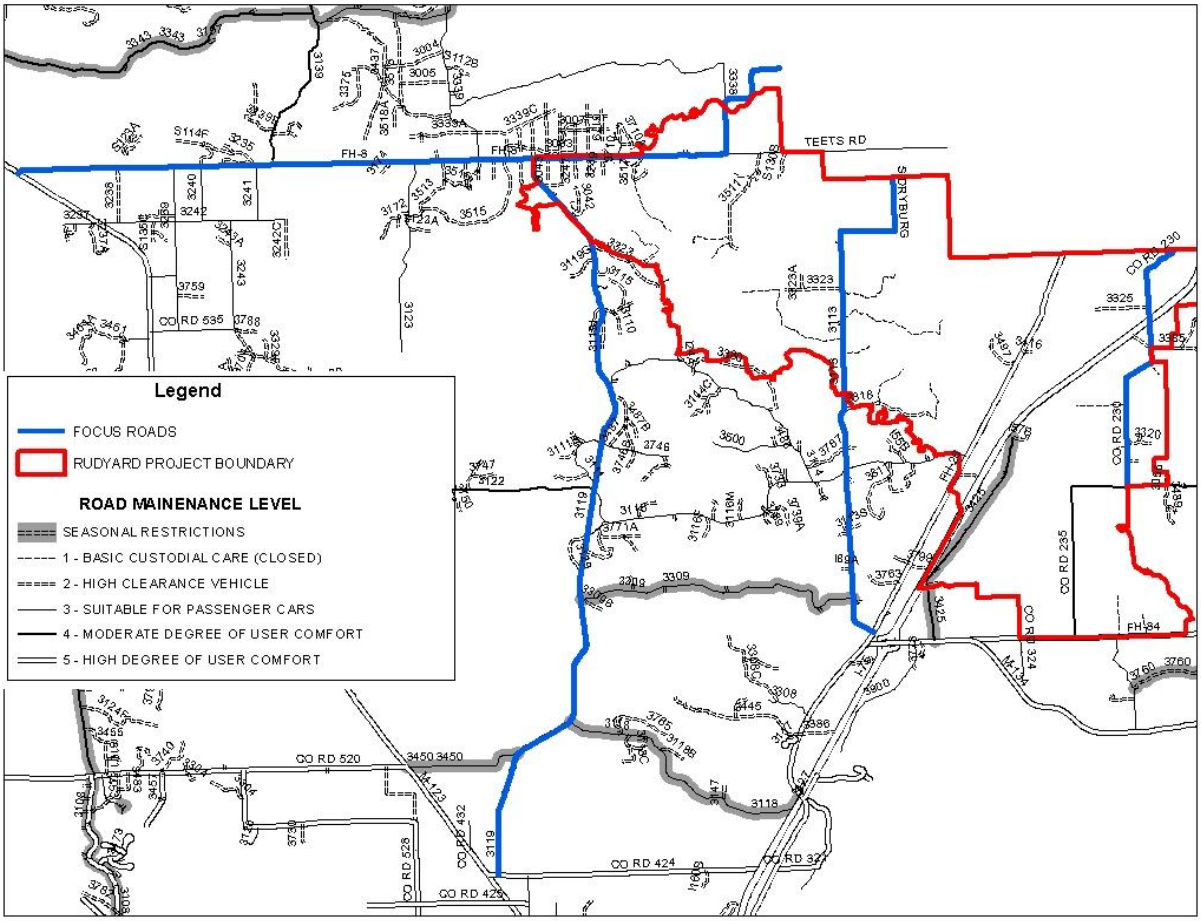


The cumulative effects analysis will expand to the entire road as identified below because it is reasonable to assume that the public would drive on most or the entire road since these are through-ways:

- H-40 from Trout Lake to Rudyard
- East Lake Road from H-40 to Charles Moran
- Dryburg/Akrigg Road from H-40 to Mackinac Trail
- CR230 (Bay Road) from M-48 to CR235 (Simmons Road)

NCT. The direct and indirect effects spatial boundary for visuals along the NCT is ¼ mile on either side of the NCT within the project area boundary. The effects of proposed management activities are very limited and do not extend beyond the immediate area. The spatial boundary for cumulative effects on the NCT is the length of the trail from the where the Brevort Campground Road to where it crosses Dick Road (the north crossing). This is because the average daily hike is approximately 20 miles.

Figure 3-12 Cumulative Visual Effects Boundaries for NCT



The temporal boundary used for direct, and indirect effects analysis 15 years, the time it would take for all vegetation management activities to take place after the signing of the DN. The temporal boundary for cumulative effects analysis is for the NCT is10 years prior to and 25 years after signing of the ROD. Vegetation management activities that took place more than 10 years prior would have enough tree growth to no longer be considered an opening. Twenty-five years would be the approximate time required to implement the proposed management activities and have enough tree growth to no longer be considered an opening.

3.14.4 Affected Environment

Visual quality management on the forest is described in terms of VQOs which are a measure of the degree to which a landscape is visually perceived to be complete (FP, Appendix E, pg. E-13). It refers to the degree of acceptable alteration of the characteristic landscape in five levels: Preservation, Retention, Partial Retention, Modification, and Maximum Modification.

The definitions are as follows:

- Preservation: Only ecological changes permitted.
- Retention: Management activities are not usually evident.
- Partial Retention: Management activities remain visually sub-ordinate.
- Modification: Management activities in the foreground and middle ground are dominant, but appear natural.
- Maximum Modification: Management activities are dominant, but appear natural when seen as background.

The project area is predominately modification VQO with partial retention along parts of the NCT, Chub Creek, Bear Creek, Mackinac Trail and I-75. A VQO of retention is along the Pine River

Partial Retention and Retention VQOs are fairly equal along the NCT within the project area.

3.14.5 Proposed Action

3.14.5.1 Direct and Indirect Effects

Table 3-42 Acres of stands in each VQO to be harvested by each method.

Proposed Harvest Type	Even or Uneven Age Management	M	PR	R	P
Commercial Thin	N/A	77	64	0	0
Commercial Thin/Liberation	N/A	121	215	73	0
Coppice Cut	Even	132	13	8	0
Improvement Cut	Even	234	76	0	0
Invasive Species Treatment	Even	22	37	0	0
Single-tree Selection Cut	Uneven	86	58	0	0
Stand Clearcut	Even	229	74	0	0
Wildlife Habitat Improvement	Even	32	30	0	0

The effects of proposed harvesting on the VQO will focus on 5 high visibility areas:

- H-40 from East Lake Road (FR3119) to Teets Road
- East Lake Road (FR3119) from H-40 to FR3323
- Akrigg Road (FR3113) from Dryburg Road to FR3118
- CR230 (Bay Road) from I-75 overpass to CR235 (Simmons Road)
- NCT

The remaining areas will be generalized based on the type of proposed harvest, the seasonal restrictions for that proposed harvest, the type of access to the proposed harvest area, and the VQO for that area.

H-40 from East Lake Road (FR3119) to Teets Road. This highway passes through 2 stands east of East Lake Road. One 5 acre stand of red pine is completely within the partial retention VQO where management activities remain visually subordinate. One 64 acre stand of Scotch pine running along the highway is within partial retention and modification VQOs where management activities in the foreground and middle ground are dominate but appear natural.

Since the majority of the trees, both merchantable and non-merchantable would be removed, the 64 acres would have a similar appearance as a clear cut. This long, narrow stand would open up the viewshed along H-40 for an additional 50 feet. Since this stand is within a powerline ROW, it is expected that the vegetation would be removed on a periodic basis.

Logging equipment would be present during harvesting and invasive species treatment, which would total approximately 146 days. In addition to logging equipment, decked logs, slash and fresh cut stumps would be dominate during the harvest activities. During this time, the VQOs of modification and partial retention along this stretch of H-40 would be met.

Within a year or two, the freshly cut stumps in the invasive species treatment stand along H-40 will weather and gray, and the ground vegetation will help the stumps blend in. The stand will appear more natural, with the exception of the straight cut along the corridor, which would meet the partial retention VQO. Although the area still appears as an opening, it would meet the VQO of modification since the evidence of management would appear natural.

East Lake Road (FR3119) from H-40 to FR3323. There are 3 red pine stands along East Lake Road that are proposed for harvesting. Two are proposed to be commercial thinned, and one proposed to be commercial thinned/liberation cut. The 71 acre commercial thin/liberation cut and the 26 acre commercial thin are both in a modification VQO, while the 22 acre commercial thin is in a partial retention VQO.

Logging equipment would be present during harvesting, which would total approximately 60 days. In addition to logging equipment, decked logs, slash and fresh cut stumps would be dominate during the harvest activities. During this time, the VQOs of modification along this stretch of East Lake Road would be met.
.

Akrigg Road (FR3113) from Dryburg Road to FR3118. The 10 acre stand along FR3113 is a proposed coppice cut. This stand is in a modification VQO. Logging equipment would be present during harvesting, which would total approximately 5 days. In addition to logging equipment, decked logs, slash and fresh cut stumps would be dominate during the harvest activities. During this time, the VQO of modification along this stretch of Akrigg Road would be met. Once the harvesting equipment is removed, the natural appearance of the stand would dominate and the VQO of modification would be met.

CR230 (Bay Road) from I-75 overpass to CR235 (Simmons Road). There are 4 proposed stands along the Bay Road. One 14 acre stand of sugar maple, beech/yellow birch is proposed for clearcut and one 65 acre balsam fir, aspen/paper birch stand proposed for commercial thinning are completely within the partial retention VQO. Two balsam fir, aspen/paper birch stands of 11 and 15 acres are both proposed clearcut are completely within the modification VQO. Logging equipment would be present during harvesting, which would total approximately 53 days. In addition to logging equipment, decked logs, slash and fresh cut stumps would be dominate during the harvest activities. During this time, the VQOs of modification and partial retention along this stretch of Bay Road would be met. Once the harvesting equipment is removed, the natural appearance of the stand would dominate and the VQO of modification would be met.

Within a year or two, the freshly cut stumps in the commercial thinning will weather and gray, and the ground vegetation will help the stumps blend in. After two to three years, the residual stand would appear natural again and would meet the partial retention.

In subsequent years, the clearcuts would appear as openings ranging up to 10 acres. The slash that was evident during harvesting would start to decompose and would be covered by ground vegetation within 2-3 years. Any remaining decked logs and the fresh cut stumps would weather to a dull grey, and be camouflaged by ground vegetation. The area would appear as an opening for about 15-20 years when the new growth is tall enough to blend in with the surrounding vegetation. Although the area appears as an opening, it would meet the VQO of partial retention since the evidence of management would appear natural.

NCT. Table 3-43 below lists the harvest method, acres and VQO for each stand in the project area within ¼ mile of the NCT.

Table 3-43 Harvest Activities within 1/4 mile of NCT

C	S	Harvest Prescription	Even/ Uneven	Acres	VQO
127	42	Invasive Species Treatment	E	64	PR
132	67	Commercial Thinning Liberation Cut	U	131	PR, R
132	12	Commercial Thinning Liberation Cut	U	17	R
132	25	Commercial Thinning	U	35	M, PR
132	38	Improvement Cut	E	22	M, PR

There are 5 stands proposed for harvest that are adjacent to the NCT. One stand is proposed for invasive species treatment, two stands are proposed for commercial thinning liberation cut, one stand is proposed for commercial thinning and one stand is proposed for improvement cut. One stand is completely within a partial retention VQO where management activities remain visually subordinate, and one stand is completely within a retention VQO where management activities are not usually evident. One of the stands is partly in a partial retention VQO and partly in a retention VQO. Two stands are

partly in a partial retention VQO and partly in a modification VQO where management activities in the foreground and middle ground are dominate, but appear natural.

Mitigation measures identified in Chapter 2 would retain most of the vegetation within 30 feet of the NCT, in order to reduce the amount of brush. This 30 foot boundary would also provide a screen between the NCT and the harvest activities. Logging equipment would be present during harvesting and would still be evident for approximately 135 days along the trail.

While C132 S25 and C132 S38 are with ¼ mile of the NCT, there are no openings between the NCT and these stands, and they would therefore not be visible from the NCT. The trail does travel through the two Commercial Thin Liberation Cuts and an invasive species treatment.

In addition to logging equipment, decked logs, slash and fresh cut stumps would be dominate during the harvest activities. During this time, the VQOs along this stretch of NCT would not be met. However, once the harvesting equipment is removed, the natural appearance of the stand would dominate and the VQO of retention would be met in these red pine plantations.

Since the majority of the trees, both merchantable and non-merchantable would be removed in the invasive species treatment, the 64 acres would have a similar appearance as a clear cut. This long, narrow stand would open up the viewshed along H-40 for an additional 50 feet. Since this stand is within a powerline ROW and along a highway, it is expected that the vegetation would be removed on a periodic basis.

The thinned red pine stands will appear more open, with more light penetrating to the forest floor. Because there is little understory, the stumps and skid trails will be evident.

Within a year or two, the freshly cut stumps in the commercial thinning will weather and gray, and ground vegetation will help the stumps blend in. After two to three years, the residual stand would appear natural again and would meet the VQOs of retention and partial retention.

3.14.5.2 Cumulative Effects

H-40 from Trout Lake to Rudyard. Table 3-44 below lists past, present and reasonably foreseeable future harvest activities along this stretch of H-40.

Table 3-44 Past, Present, Reasonably Foreseeable Future Harvest Activities along H-40

C	S	Acres	Activity	Analysis	Year
123	62	16	Clearcut	Interior Wetlands	2017
123	82	1.4	Clearcut	Interior Wetlands	2017
123	61	26	Clearcut	Interior Wetlands	2017
135	41	10	Clearcut	Niagara	2016
123	27	9	Single Tree Selection Cut	Niagara	2016

127	25	66	Single Tree Selection Cut	Niagara	2016
114	5	55	Commercial Thin	Niagara	2016
134	63	23	Commercial Thin	East Red Pine 2	2014
134	2	14	Commercial Thin	East Red Pine 2	2014
124	4	87	Commercial Thin	East Red Pine 2	2012
133	28	6	Commercial Thin	East Red Pine 2	2014
125	1	191	Commercial Thin	East Red Pine 2	2014
125	3	30	Commercial Thin	East Red Pine 2	2014
125	63	196	Commercial Thin	East Red Pine 2	2010
125	30	34	Commercial Thin	East Red Pine 2	2010
125	41	11	Commercial Thin	East Red Pine 2	2010
127	60	4	Commercial Thin	East Red Pine 2	2010
127	58	38	Commercial Thin	East Red Pine 2	2010

In addition to the activities listed above, there is private land near the old town of Dick where houses, outbuildings and manicured lawns are evident. East of the project area, the highway travels along open farmland where crops and cattle are evident as well as houses, barns, outbuildings and manicured lawns.

Most of the harvesting activity along H-40 consists of thinning the large expanses of red pine plantation. Those stands that were sold in 2010 appear more open, but the evidence of harvest activities is now more natural appearing. Harvest related activities along H-40 would be evident over the next 10 years for approximately 249 days. One can expect to see some evidence of harvest related activities from single tree selection cuts and commercial thins, such as logging equipment, fresh cut stumps, decked logs, and slash as they travel along H-40. The older harvest would appear more natural, with the stumps weathered and the slash degrading. Evidence of both could even be covered by ground vegetation. Because these stands are not harvested all at once, there would be varying degrees of evidence.

The clearcuts would be evident longer, first appearing as openings that changes the narrow corridor and provides a larger visual expanse. As the young trees grow, the tall slender saplings provide a break visual break from the open understory of the older stands and red pine plantations. Eventually, these stands will thin out and appear similar to the adjacent stands.

East Lake Road from H-40 to Charles Moran Road. Table 3-45 below lists past, present and reasonably foreseeable future harvest activities along this stretch of H-40.

Table 3-45 Past, Present, and Future Activities H-40 to Charles Moran Road

C	S	Acres	Activity	Analysis	Year
133	26	86	Commercial Thin	East Red Pine 2	2014
133	27	4	Commercial Thin	East Red Pine 2	2014
133	2	30	Commercial Thin	East Red Pine 2	2014
133	9	18	Commercial Thin	East Red Pine 2	2014
8	1	245	Single Tree Selection Cut	Niagara	2014
9	1	80	Single Tree Selection Cut	Niagara	2014

22	8	72	Single Tree Selection Cut	Niagara	2015
51	1	14	Single Tree Selection Cut	Niagara	2015
22	11	39	Single Tree Selection Cut	Niagara	2015
51	7	72	Single Tree Selection Cut	Niagara	2015
49	32	247	Single Tree Selection Cut	Niagara	2013
50	13	8	Single Tree Selection Cut	Niagara	2013
49	18	14	Single Tree Selection Cut	Niagara	2013
50	36	7	Seed Tree Cut with Reserves	Niagara	2013
50	23	27	Seed Tree Cut with Reserves	Niagara	2013
84	16	33	Single Tree Selection Cut	Niagara	2013
84	8	40	Salvage Clear Cut	Niagara	2013
84	29	48	Single Tree Selection Cut	Niagara	2013
138	5	43	Salvage Clear Cut	Sprinkler	2010
140	2	20	Salvage Clear Cut	Sprinkler	2010
140	16	51	Shelterwood	Sprinkler	2011
140	26	5	Salvage Clear Cut	Sprinkler	2011
152	1	34	Shelterwood	Sprinkler	2011
140	24	14	Salvage Clear Cut	Sprinkler	2015
151	20	8	Salvage Clear Cut	Sprinkler	2015

In addition to the activities listed above, there is private land near East Lake and near the Charles Moran Road where houses, outbuildings and manicured lawns are evident.

The commercial thinning, single tree selection cut and shelterwood cuts would blend in quickly, since remnants of the stand would remain. The stands would have varying degrees of openness, depending on the amount of trees removed. Harvest related activities along East Lake Road would be evident over the next 10 years for approximately 401 days. One can expect to see some evidence of harvest related activities, such as logging equipment, fresh cut stumps, decked logs, and slash as they travel along East Lake. The older harvest would appear more natural, with the stumps weathered and the slash degrading. Evidence of both could even be covered by ground vegetation. Because these stands are not harvested all at once, there would be varying degrees of evidence.

The clearcuts, seed tree cut with reserves, and salvage clear cut would be evident longer, first appearing as openings that changes the narrow corridor and provides a larger visual expanse. As the young trees grow, the tall slender saplings provide a break visual break from the open understory of the older stands and red pine plantations. Eventually, these stands will thin out and appear similar to the adjacent stands.

Dryburg/Akrigg Road H-40 to Mackinac Trail. Table 3-46 below lists past, present and reasonably foreseeable future harvest activities along this stretch of the Akrigg Road.

Table 3-46 Past, Present, and Future Activities H-40 to Mackinac Trail

C	S	Acres	Activity	Analysis	Year

26	5	41		Rudyard 2002	
33	3	18	Shelterwood with Reserves	Niagara	2015
54	27	23	Commercial Thin	East Red Pine 2	2015
55	6	3	Commercial Thin	East Red Pine 2	2015
64	3	17	Commercial Thin	East Red Pine 2	2015

The Dryburg Road travels along open farmland where crops are evident as well as houses, barns, outbuildings and manicured lawns. The Dryburg Road turns into the Akrigg Road where it becomes more forested. There is private land on the south end of the Akrigg Road, near Mackinac Trail where houses, outbuildings and manicured lawns are evident. There is an active clear cut on private land, which has opened up the visual corridor to a large opening containing freshly cut timber, slash and logging equipment.

In addition, the Akrigg West gravel pit is along the west side of the road, across from the existing Akrigg pit. Removal of the overstory is necessary in order to recover the minerals. Evidence of this 3 acre opening and exposed gravel will remain for many years to come.

The commercial thins and shelterwood cut with reserves would blend in quickly, since remnants of the stand would remain. Harvest related activities along East Lake Road would be evident over the next 10 years for approximately 26 days. One can expect to see some evidence of harvest related activities, such as logging equipment, fresh cut stumps, decked logs, and slash as they travel along H-40. The older harvest would appear more natural, with the stumps weathered and the slash degrading. Evidence of both could even be covered by ground vegetation. Because these stands are not harvested all at once, there would be varying degrees of evidence.

The clearcuts would be evident longer, first appearing as openings that changes the narrow corridor and provides a larger visual expanse. As the young trees grow, the tall slender saplings provide a break visual break from the open understory of the older stands and red pine plantations. Eventually, these stands will thin out and appear similar to the adjacent stands.

CR230 (Bay Road) from M-48 to CR235 (Simmons Road). Table 3-47 below lists past, present and reasonably foreseeable future harvest activities along this stretch of the Akrigg Road.

Table 3-47 Past, Present, and Future Activities CR230 from M-48 to CR235

C	S	Acres	Activity	Analysis	Year
2	14	3	Clearcut	Rudyard	2002

East of I-75, the Bay Road travels along open farmland southeast of Rudyard where crops are evident as well as houses, barns, outbuildings and manicured lawns. West of I-75 it becomes more forested with a few gates as the only evidence of private ownership. Evidence of past clearcuts along south end of the Bay Road consists of expanses of dense aspen saplings.

The clearcuts would be evident longer, first appearing as openings that changes the narrow corridor and provides a larger visual expanse. As the young trees grow, the tall

slender saplings provide a break visual break from the open understory of the older stands and red pine plantations. Eventually, these stands will thin out and appear similar to the adjacent stands.

NCT. While there is private land within the cumulative effects boundary, the NCT travels through NFS lands only.

In addition to the Rudyard stands, nine stands from Niagara, 2 stands from Interior Wetlands, 1 stand from Sprinkler and 8 stands from East Red Pine II has been or will be implemented within the cumulative effects area, as identified in the table below.

Table 3-48 Past, Present, Reasonably Foreseeable Activities along NCT

C	S	Acres	Activity	Analysis	Year
70	7	436	Overstory Removal	Niagara	2015
22	10	25	Selection Harvest	Niagara	2015
22	11	40	Selection Harvest	Niagara	2015
22	8	72	Selection Harvest	Niagara	2015
21	12	292	Overstory Removal	Niagara	2015
51	1	14	Selection Harvest	Niagara	2015
35	2	46	Selection Harvest	Niagara	2015
8	1	245	Overstory Removal	Niagara	2014
23	17	28	Overstory Removal	Niagara	2015
125	25	129	Commercial Thin	Interior Wetlands	2010
125	31	34	Commercial Thin	Interior Wetlands	2010
110	17	12	Commercial Thin	East Red Pine 2	2014
145	5	116	Commercial Thin	East Red Pine 2	2010
145	12	28	Commercial Thin	East Red Pine 2	2010
125	30	28	Commercial Thin	East Red Pine 2	2010
115	14	35	Clearcut	East Red Pine 2	2014
115	31	16	Clearcut salvage	East Red Pine 2	2014
78	6	50	Shelterwood	East Red Pine 2	2014
124	12	22	Commercial Thin	East Red Pine 2	2012
144	16	80	Overstory	Sprinkler	2008

Design criteria identified in Chapter 2 and within all of the other analyses would retain most of the vegetation within 30 feet of the NCT, in order to reduce the amount of brush. This 30 foot boundary would also provide a screen between the NCT and the harvest activities.

The commercial thins, selection harvests, overstory removal and shelterwood cut with reserves would blend in quickly, since remnants of the stand would remain. Harvest related activities along East Lake Road would be evident over the next 10 years for approximately 656 days. One can expect to see some evidence of harvest related activities, such as logging equipment, fresh cut stumps, decked logs, and slash as they travel along H-40. The older harvest would appear more natural, with the stumps weathered and the slash degrading. Evidence of both could even be covered by ground

vegetation. Because these stands are not harvested all at once, there would be varying degrees of evidence.

The clearcuts would be evident longer, first appearing as openings that changes the narrow corridor and provides a larger visual expanse. As the young trees grow, the tall slender saplings provide a break visual break from the open understory of the older stands and red pine plantations. Eventually, these stands will thin out and appear similar to the adjacent stands.

3.14.6 Alternative 1

3.14.6.1 Direct and Indirect Effects

Since this alternative does not change the number, size or harvest method of the stands proposed to be harvested, the effects related to this alternative are the same as those in the proposed action.

3.14.6.2 Cumulative Effects

Since this alternative does not change the number, size or harvest method of the stands proposed to be harvested, the effects related to this alternative are the same as those in the proposed action.

3.14.7 No Action

3.14.7.1 Direct and Indirect Effects

The direct and indirect impacts to visual quality may be expressed in terms of the extent to which timber harvest practices meet the VQOs. Under the No Action Alternative, there would be no timber harvesting; therefore, there would be no direct or indirect effects on visual quality.

3.14.7.2 Cumulative Effects

There are no cumulative effects because no actions related to this analysis occur that might accumulate with past and present actions.

3.15 Heritage Resources

3.15.1 Introduction

The scope of this heritage resource analysis includes timber stands proposed for treatment in the Rudyard EA, newly constructed or maintained access routes leading into these stands, and the construction, decommission, and closure of several roads located within the Rudyard project area. In compliance with Section 106 of the National Historic Preservation Act of 1966, as amended, and in accordance with 36 CFR 800, all

public lands involved with actions proposed for this project have been inventoried for heritage resources through numerous cultural resource surveys and monitoring visits conducted between 1983 and 2011. Pursuant to 36 CFR 800.2(c-f), the results of this heritage analysis, along with all cultural resource survey reports covering the areas of potential effects, have been submitted to the Michigan State Historic Preservation Officer (SHPO) for review and consultation. Under the authority of Section 106 of the National Historic Preservation Act of 1966, as amended, the Michigan SHPO has concurred that "no historic properties are affected" within the area of potential effects for the Rudyard EA (SHPO compliance letter, August 2, 2012).

In accordance with Executive Order 13007 and 36 CFR 800.2(c-f) the Tribal Historic Preservation Officer (THPO) and NAGPRA coordinator for the Bay Mills Indian Community (BMIC) was consulted regarding the potential location of American Indian cultural, historical, and/or religious sites. All heritage resource concerns raised by the BMICTHPO (issue 1.8.1 from Chapter 1**)** were addressed in the analysis of effects for this proposed project.

3.15.2 Analysis Methods

All public lands associated with areas of potential effects for this project have been inventoried for heritage sites through numerous cultural resource surveys conducted between 1983 and 2011. Heritage resources located inside or within 30 meters (approximately 100 feet) of areas of potential effects (e.g., timber harvest stands, access routes, new road construction, and roads slated for decommissioning or closure) were considered to be potentially at risk and included in the analysis of effects.

3.15.3 Analysis Area

The geographical boundary used to determine the direct, indirect, and cumulative effects for heritage resources includes an area extending 30 meters (100') beyond the boundaries for areas of potential effects detailed in the Rudyard EA. Thirty meters represents the average height of a mature tree and provides an appropriate distance for establishing a zone of protection around individual heritage resources. Heritage sites located within 30 meters of the project boundary, therefore, could be considered potentially at risk.

The temporal boundary for the heritage effects analysis includes a five year projection from the day on which the final decision notice for the Rudyard EA is signed by the deciding official. Five years is assumed to be the timeframe in which the activities proposed for the Proposed Action and Alternative 1 alternatives would be implemented.

3.15.4 Affected Environment

A total of 16 potentially at risk archaeological sites were identified within the geographical scope for heritage resources. Archaeological sites are defined as any pre-European contact or post-European contact locations where the physical remains or residues of human activities can be identified. Such physical remains include artifacts and/or features (i.e., non-portable artifacts, such as pits, hearths, and structural earthen

berm foundations, to name a few). The range of site types includes late 19th and 20th century logging camps, farmsteads, recreation sites and pre-European contact era lithic scatters and stone tool production sites.

3.15.5 Proposed Action

3.15.5.1 Direct/Indirect Effects

Earth disturbances resulting from timber harvesting and the construction, maintenance, decommissioning, and closure of roads can result in irreversible damage to heritage resources. A total of 16 heritage sites were identified in the analysis of effects for the proposed Action. One of these sites has been determined “not eligible” for the National Register of Historic Places (NRHP) and will not require protection (site 04-82). In addition, seven sites are listed as archival sites whose existence has not been field verified despite the efforts of numerous cultural resource surveys (sites 04-162, 05-131, 05-220, 05-226, 05-237, 05-245, and 05-279). Unless otherwise encountered during the layout of the timber sale, these seven sites should be regarded as either already destroyed, lacking significant physical remains, or outside the project area. Consequently, a remaining total of eight sites will require protection through the implementation of heritage site avoidance measures. This list of sites includes sites 04-309, 04-404, 05-41, 05-126, 05-218, 05-223, 05-352, and 05-427.

3.15.5.2 Cumulative Effects

There will be no cumulative effects for heritage resources. No direct or indirect effects are expected due to the implementation of effective heritage resource protection measures, i.e., site avoidance. Past experience in site protection on the forest has been generally successful. A greater threat to heritage sites includes relic hunting by the public and erosion. Based on this experience, it is assumed that successful site protection will occur, resulting in long-term maintenance and protection of heritage resources.

3.15.6 Alternative 1

3.15.6.1 Direct/Indirect Effects

Alternative 1 involves the removal of several timber stands from the list of stands to be treated, as well as road maintenance and construction related activities. As a result, the area of potential effects for Alternative 1 involves fewer heritage resources than the Proposed Action alternative. Only 7 of the original sixteen sites identified in the Proposed Action remain in the analysis of effects for Alternative 1. Six of these seven heritage sites will require protection in Alternative 1. This list of sites includes sites 04-309, 04-404, 05-41, 05-126, 05-223, and 05-427.

3.15.6.2 Cumulative Effects

No change from the “Proposed Action” alternative.

3.15.7 No Action

3.15.7.1 Direct/Indirect Effects

No direct or indirect effects to heritage resources are expected under the "No Action" alternative.

3.15.7.2 Cumulative Effects

Since there are no Direct/Indirect Effects, no cumulative effects to heritage resources are expected.

3.16 Transportation

3.16.1 Introduction

Table 3- 49 Rudyard Proposed Road Work Summary

Activity	Approximate Miles		
	Proposed Action	Alternative 1	No Action
New construction, classified road (winter only)	4.3	4.3	0
New construction, temporary road	2.1	2.1	0
Existing Road Reconstruction	26.9	25.1	0
Road Closure	0.2	0.2	0
Decommissioning	0.6	0.6	0
Landings	2	2	0

Table 3- 50 Road Densities in Rudyard Project Area

MA	Forest Plan Density Maximum (miles/mile^2)	Existing Project-Area Density (miles/mile^2)	System Road Construction (mi)	Roads to Decommission (mi)	New Density (miles/mile^2)
1.2	3.0	2.1	4.3	0.6	2.2

3.16.2 Analysis Methods

The objective of the proposed transportation system for the Proposed Action is to provide access to proposed timber harvest areas and to provide a safe and efficient transportation system (Section 1.4.2). The road analysis for the proposal used the most current information available in the Forest Service database. Routes into vegetation treatment were developed using a Geographic Information System (GIS). Route development utilized information from topographic maps, soil surveys, existing road maps, aerial photographs, wildlife and botanical surveys, staff field knowledge, and heritage surveys. Route lengths and land areas were calculated using GIS software.

Road density is the key metric for transportation in the Forest Plan. Road density for the project area was based upon the roads and MAs within the project boundary. Density was calculated for MAs with proposed activities only (Forest Plan 2006, p. 2-25 and 26).

3.16.3 Analysis Areas

Direct and Indirect Effects Area. The analysis area will consider Management Areas where road corridors are used to access stands where treatment is proposed as well as those corridors proposed to be closed or decommissioned. The project area encompasses five MAs. All road work, including decommissioning and construction of system roads, occurs in only MA 1.2. Therefore, the analysis will focus solely on MA 1.2. The temporal boundary will consider all activities for the next 10 years which is the reasonably expected timeframe for these activities to be completed.

Cumulative Effects Area. The analysis will consider transportation activities on the HNF in comparable MAs where proposed activity occurs within the project boundary. This area will account for how road activities from this and other projects will affect road densities in comparable MAs. All road work occurs in MA 1.2 and, therefore, only MA 1.2 will be analyzed. The time period for cumulative effects will consider activities underway concurrently with the Proposed Action and for the next 10 years, the reasonably expected maximum time period for the proposed activities to be completed.

3.16.4 Affected Environment

The transportation system in the project area is made up of arterial, collector, and local roads. Arterial roads provide service to large land areas, and usually connect with public highways or other forest arterial roads to form an integrated network of primary travel routes. Many roads in the project area function as arterial roads because the project area is long and narrow. These roads include I-75, H-40, Mackinac Trail (FH-26, CR H-63), and East Lake Road (FH-85). Collector roads serve smaller land areas than an arterial road and usually connect to an arterial or public highway. It collects traffic from local roads. Its location and standard are influenced by both long-term multi-resource service needs and travel efficiency. Teets Road, Akrigg Road (FR 3113), Spring Road (FR 3119), and Bay Road (CR 230) are designated collector routes within the project area. A local road connects terminal facilities (resources) with a Forest collector, arterial, or state highway. Its location and standards are usually determined by a single specific resource activity rather than travel efficiency. The remaining roads in the Rudyard project area are local roads. The HNF is responsible for maintenance on local roads within the project area (Appendix G - Vicinity Map).

Roads are further qualified as system (classified) or non-system (unclassified) roads. System roads are permanent, managed roads that provide forest access. They are inventoried and include arterials, collectors, and locals. Non-system roads are not managed and may be old temporary roads used for timber harvest or other management activities that were not returned to forest production or are a user-developed road.

There are approximately 78 miles of identified, existing roads on Forest Service land in the project area. Approximately 56 miles of these roads are classified as local and approximately 66 miles of roads are open to public passenger car traffic. Approximately 17 miles of road are open to all motorized vehicles, including OHVs.

Road density for each MA has been defined by the Forest Plan (p. 2-26). Of the five MAs in the project area, work only occurs in 1.2 and, therefore, the analysis will focus solely on that MA.

To help slow the spread of non-native invasive plants, all road construction equipment shall be washed in accordance with BMPs (FS-990a, p. 46). Washing equipment using the proper equipment can help reduce NNIP spread (0551 1203-SDTDC, 2005).

3.16.5 Proposed Action

3.16.5.1 Direct and Indirect Effects

Construction: The Proposed Action calls for the construction of approximately 4.3 miles of new roads to access proposed harvest stands. The approximate locations of new road construction may be seen on the Proposed Action map in Appendix G. The newly constructed roads, in most cases, would extend existing roads into proposed vegetation treatment areas; and therefore, would provide more access to these areas for the Forest Service and public. The newly constructed roads would be classified as ML 1 roads (i.e. closed to motorized use) because of the wet nature of the soils where roads are to be constructed. All new system roads will have a seasonal designation for use as winter-only roads. These roads would add minimal new maintenance costs because ML 1 roads are only maintained when needed for administrative purposes. The roads would be closed with various tools such as root wads, timber slash, rocks, gates, or berms. With proper installation and monitoring, these can be effective tools to limit resource damage from motorized use and trespassing on to neighboring property (Range, Sjogren 2007, TMP, p. 13). Placement, construction, closure, and decommissioning would follow state and Forest Service BMPs (MDEQ/MDNR 2009, Keller & Sherar 2003).

Decommissioning: The Proposed Action would obliterate approximately 0.6 miles of road in the project area. Obliteration of the road includes ripping the road and eliminating the corridor for all traffic, motorized and non-motorized. The proposed roads are a mix of OML 1 and OML 2 (see Table 3-49). Roads were proposed for decommissioning if they were no longer needed for administrative purposes, if they are showing signs of resource damage due to motorized vehicles, or if the road provided access to an area receiving resource damage from motorized vehicles (Forest Plan, pp. 2-25; Travel Management Policy (TMP), p. 5). Reducing road density lowers the potential for resource damage due to roads such as soil erosion, sediment loading in streams, and alterations to the natural hydrology (Travel Management Rule, p. 10; FS BMP 33-35).

The Proposed Action would lead to a net change of 0.1 mi/mi^2 in road density in MA 1.2, from 2.1 to 2.2 mi/mi^2 (see Table 3-48). The work would move the area closer to the Forest Plan guideline for maximum road density.

The Proposed Action would decrease the total miles of road in the project area by less than 1 percent and would decrease the miles of road open to all motor vehicles by less than 1/2 a percent by closing an OML 2 road. The decrease in miles open to all vehicles is not perceptible at the scale of the Eastside. The transportation purpose and need,

stated in chapter 1, is met because the Proposed Action would provide a safe, manageable transportation system that also discourages resource damage. Many opportunities for motorized access remain open and users would be able to find other areas to enjoy (TMP, p. 14).

Access to Timber: The Proposed Action would allow approximately 1,602 acres of timber to be harvested. Existing forest roads would be utilized to access many of these stands for harvesting and hauling. Timber purchasers are required to maintain roads commensurate with their use and designated maintenance level so the transportation system is not degraded from heavy use. Approximately 27 miles of existing roads would be utilized to access harvest stands, with approximately 16 miles of OML 1 and 11 miles of OML 2. Most roads would receive normal maintenance, which would include, but not be limited to, clearing and grubbing, brushing, excavating, spot graveling, and replacing drainage culverts. Fewer roads may have light work, such as brushing and excavating, or heavy work, such as cutting and filling, placing sand borrow and heavy gravel, as well as water crossings. It is anticipated that less than 10% of the access roads would require heavy maintenance, but because of variable conditions, unexpected use, and length of time until implementation, the final amount may be higher. The determination of work details, including material amounts, locations along the road, and cost estimate would be performed by a member of the Forest engineering staff prior to sale of the timber units. See Appendix C – Silviculture and Transportation for a complete list of routes and lengths and a general cost estimate for road work.

Unclassified Roads: Unclassified roads can be found across the project area. While these alpha-numeric roads are not managed as system roads, their length is included in road density calculations for the MA they occur in. Routes close to proposed timber sale areas that are currently used or needed for forest management would be added to the system and assigned a route number and maintenance level. Roads that have already been assigned an operational maintenance level in the Forest Service database would keep their designation. For a complete list, See Appendix C – Silviculture and Transportation. This action would add approximately 1.4 miles to the Forest System road maintenance schedule but, as stated above, would not add to the road density in the project area.

Table 3-51 Proposed Unclassified Roads Added to System

Road ID	Miles	Operational Maintenance Level
S132G	0.31	OML1 – MA 1.2
S132H	0.27	OML1 – MA 1.2
S132J	0.82	OML1 – MA 1.2

Combined, these actions to adjust the transportation system would meet need 2.

3.16.5.2 Cumulative Effects

Past Activities. Many of the roads in the Eastside and in the Rudyard project area were established in the late 1800s and early 1900s, primarily to provide access for logging. Throughout the last 40 years, the majority of these roads classified as collector or arterial have been reconstructed or maintained. Construction, reconstruction, and

maintenance of local roads have taken place throughout the years to meet the needs of general forest management.

The amount of recreational use by 4-wheel drive vehicles, motorcycles, snowmobiles, and other OHVs has increased on National Forest roads. This use varies by road. While some receive little or no use, others are used heavily. Past management activities on the HNF often left corridors open as opportunities for travel. Corridors that were established as temporary roads, skid trails, or winter-use only roads were not always sufficiently closed or decommissioned. As a result, many of these corridors have been perpetuated without authorization from the Forest Service.

Present Activities.

Table 3- 52 Road Work from Current EAs in MA 1.2

Assessment Area	Net Road Work To Be Done (miles)	
	Sprinkler	East Red Pine II
Road Decommission	3	0
New Construction	0	0
Total	**3**	**0**

Projects are currently underway from two decision notices (DN) that would affect road density. See Table 3-52 (above) for net miles of roadwork by MA. The Sprinkler and East Red Pine II DNs cover an area on the Eastside of the HNF. Estimates of road work remaining in MA 1.2 for sales in the above DNs were made after discussions with the East Zone Timber Sale Administrator and listed in Table 3-52. Road density for the MA would remain below Forest Plan guidelines.

Table 3- 53 Cumulative Effects Road Density Change

MA	Existing Forest-Wide Density	New Density	Change (All Rds)
1.2	2.5	2.5	0.0

These projects, when included with the Proposed Action in this analysis, would result in a no change in Forest-wide road density for MA 1.2.

All of the above projects also include temporary road construction. Temporary roads on National Forest System lands are decommissioned after the use for which they are established is completed. Current Forest Service policy is to decommission the temporary roads and to monitor the effectiveness of the decommissioning (FP, p. 2-25; Forest Service Manual (FSM) 7703.2; FS BMP pp. 33-35).

Local roads on state or private lands are usually maintained by the landowners or by local government to a standard commensurate with use.

Roads developed on private land are generally for use by the landowner to access their dwellings. Roads developed or maintained on private land for timber harvest are usually very low standard and are usually not left open to the public.

The above projects have identified several corridors within their project areas that meet the current Forest Service Manual definition of a road, but are not necessarily needed for management of the Forest. These roads are unclassified and some were identified as being needed on the road system. These unclassified roads are already counted against the road density in the MA in which they are located; and therefore, would not add to the road density when they are added to the HNF road system.

East Red Pine II DN overlaps the defined temporal and spatial boundaries of this analysis, but no relevant work (road construction or decommissioning) is occurring within the Rudyard boundary. The recently signed decisions for Niagara EIS, Shores EA, and Sand Clay EA projects do not fall within the spatial effects boundaries.

Future Activities. No Forest Service activities have been identified in MA 1.2 for the near-future.

There is little information available for future activities on private land. No state land is within the cumulative effects boundary. There would likely continue to be private land developed. Roads would be constructed and reconstructed in the populated areas across the Eastside. The exact number of miles of road is unknown.

There are no new collector or arterial roads foreseen to be constructed by either the Forest Service, state, county, or private landowners.

The Forest Service would continue to work toward a road system that meets the needs of these users within the guidelines set by the Forest Plan and by other controlling regulations and laws. The Motor Vehicle Use Map is republished annually in April. The map identifies authorized road use in the HNF. Signing on the Forest Service roads will continue to improve, which will help people identify what routes they are on and should help deter unauthorized road use and make law enforcement efforts more effective (EM-7700-30 p. 6).

3.16.7 Alternative 1

3.16.7.1 Direct and Indirect Effects

This alternative would have the same direct and indirect effects on road density or access as the Proposed Action because there would be no change to road construction or decommissioning. The only difference is to potential reconstruction of existing roads to access timber stands. Approximately 1,495 acres of timber would be accessed by approximately 25 miles of existing FS roads. While reconstruction of existing roads to access timber may reduce road maintenance costs in those locations, these roads are already accounted for in the road density calculation.

3.16.7.2 Cumulative Effects

This alternative would have the same cumulative effects on road density or access as the Proposed Action because there would are no differences to road construction or decommissioning between the two alternatives. The only difference is to potential reconstruction of existing roads to access timber stands. Approximately 1,495 acres of timber would be accessed by approximately 25 miles of existing FS roads. While reconstruction of existing roads to access timber may reduce road maintenance costs in those locations, these roads are already accounted for in the road density calculation.

3.16.8 No Action

3.16.8.1 Direct and Indirect Effects

This alternative would have no effect on road density or access because there would be no road construction or decommissioning. Without closures and decommissioning, some roads would continue to see resource damage from illegal motorized vehicle use.

3.16.8.2 Cumulative Effects

There would be no cumulative effects because no direct or indirect effects to transportation for this alternative would occur.

3.17 Socio-Economics

3.17.1 Introduction

Specific issues for the Rudyard project area include (Issue 1.8.2 from chapter 1):

1. The amendment of the Forest Plan may lead to a Forest-wide cutting before rotation age and does not represent the management of those stands for the best value if it produces low-value biomass now instead of high-value pulpwood later.

This section assesses the social and economic impacts of the No Action Alternative, the Proposed Action and Alternative 1. To identify the potential impacts of each of the alternatives, this section incorporates the results of several of the analyses in this chapter, including harvest species and volume estimates, changes in aesthetics and recreation, and estimates of necessary road construction.

The socio-economic analysis of the proposed Rudyard Project includes separate assessments of two specific types of economic impacts associated with proposed harvest plans:

- Regional Economic Analysis: Assesses impacts on the regional economy. For example, changes in employment and economic activity related to harvest of timber, road construction and patterns of recreational use.
- Non-Market Amenities Analysis: Assess changes to “non-market value” related to timber harvest, such as visual impacts, changes in recreation opportunities and changes in access.

Because the regional economic analysis and social welfare analysis address different aspects of economic and social value, quantitative results of these analyses can be added together to provide a broader assessment of economic impact.

3.17.2 Analysis Methods

This economic analysis presents costs and returns associated with timber sales, reforestation, road work and Scotch pine reduction. These are the major costs of the alternatives. The values presented are estimates based on the most recent stumpage and unit cost estimates of activities. Values were not compounded to the future nor depreciated, but simply represent estimates as if they occurred at the present time.

3.17.3 Analysis Areas

The spatial boundary for both direct/indirect and cumulative effects is Chippewa and Mackinac counties. The temporal boundary for direct/indirect and cumulative effects is 10 years, which is the expected timeframe for vegetation management activities (to include wildlife habitat management and site preparation of some stands). It is important to note that the values estimated in the effects analysis are as if they occurred at the present time. The Rudyard Project would affect areas east and west of Interstate 75 in the southern portion of the eastside of the Hiawatha National Forest (HNF). The region affected by the alternative actions is interspersed with a large number of private landholdings in southern Chippewa and Northern Mackinac Counties.

Current patterns of forest visitation (which emphasize use by local area residents) in the Upper Peninsula suggest that the recreational economic impacts of the proposed Rudyard Project would likely be limited primarily to Chippewa and Mackinac Counties. Moreover, because there are similar recreation experiences throughout Chippewa and Mackinac counties, most recreationists displaced by the sights and sounds of the Rudyard projects are most likely going to recreate in other locations within Chippewa and Mackinac counties (Lyn Hyslop Eastside Recreation Program Manager, personal communication).

Most of our timber sale purchasers are based in the Upper Peninsula of Michigan. Most of the aspen harvested on the Eastside of the HNF goes to Louisiana Pacific (LP) in Newberry, most of the rest of the pulp goes to New Page paper mill in Escanaba, MI (Martha Sjogren, Timber Management Assistant, personal communication).

3.17.4 Affected Environment

Social benefits in the Rudyard Project Area are primarily related to aspen. Economic benefits come from tourism, sale of forest products, and jobs related to logging and post-harvest activities such as reforestation/ timber stand improvement projects. The combined population of both Mackinac and Chippewa Counties represent approximately 0.5 percent of Michigan's total population. Both counties have experienced little growth over the past decade (US Census Bureau Website). Median household income in the counties is lower than the state average and unemployment is slightly higher than the state average (Bureau of Labor Statistics). The largest industries in the two counties

include government and services. Examples include hotels, restaurants, health care, and education (Northern Michigan University Center for Rural Community and Economic Development 2010).

The service and retail economy in the Eastern Upper Peninsula is consistent with the local emphasis on tourism. Economic data for the Eastern Upper Peninsula indicates that Chippewa County year round tourism brings in $50 million per year. The largest employer in Mackinac County is the Grand Hotel (Northern Michigan University Center for Rural Community and Economic Development 2010). According to the Eastside Recreation Program Manager, aspen age class maps – used by grouse and deer hunters - are one of the most popular maps requested by the public. Similarly, the "Sites to See" booklet is one of the most popular brochures requested by the public (Eastside Recreation Program Manager personal communication 2012).

The forestry and logging sector do not directly employ a large percentage of the population in Mackinac and Chippewa Counties. According to the Michigan Department of Natural Resources there are 36 logging companies in Chippewa and Mackinaw Counties. There are also 15 small mills seven of which process some aspen (Michigan Department of Natural Resources, Michigan Forest Industry web page). There is a hardwood cellulosic ethanol plant (Mascoma) under construction in Chippewa County. It would utilize hardwood pulp; hardwood pulp does not include aspen pulp (Department of Energy press release 2011).

3.17.5 All Action Alternatives (Proposed Action and Alternative 1)

3.17.5.1 Direct and Indirect Effects

Table 3-54 only reflects Forest Service expenditures and estimated receipts that would be collected. It does not reflect any sunk costs, such as NEPA and previous road construction. Stumpage values are volatile; by the time the environmental analysis is completed and the time the timber sales are sold, the markets may have changed, increasing and decreasing stumpage values.

This analysis also assumes stewardship contracting was not used. It is expected that stewardship contracting would reduce costs, but not increase revenues. If stewardship contracting is used, it would be to accomplish aspen site preparation and to create wildlife openings. This would reduce move-in, move-out costs of people and equipment. However, there are currently limited local markets for this small diameter material. The future market for small diameter stems and tops is uncertain. The Forest Plan amendment to allow some harvesting of aspen younger than normal rotation age or allowing removal of other stems smaller than five inches in diameter is not targeted at increasing revenues but rather at reducing the cost of aspen site preparation (Issue 2 in section 1.8.2).

Table 3-54 Estimated Costs and Returns for Rudyard Project

	Proposed Action	Alternative 1	No Action
	Estimated Cost		
Timber Sale Preparation & Admin	$1,169,608	$1,162,284	$0.00
Site Preparation	$31,160	$30,600	$0.00
Planting	$32,376	$30,780	$0.00
New System Road Construction	$52,900	$52,764	$0.00
Decommission roads	$2,400	$2,400	$0.00
Reconstruction	$15,497	$15,400	$0.00
Scotch Pine Treatment	$3,840	$3,840	$0.00
Wildlife treatments	$17,820	$12,000	$0.00
Total Costs	$1,325,601	$1,310,068	$0.00
	Estimated Returns		
Volume (CCF)	29,240	29,057	0
Value of Timber	$1,363,272	$1,357,932	$0.00
Grand Total	$37,671	$47,864	$0.00

As described in the Recreation section, those who do not wish to hear or see the timber related activities in the Rudyard project area would be temporarily displaced from those areas where the activities would occur. It is unlikely that the displaced recreationists would completely leave the Eastern Upper Peninsula to find suitable recreation activities. Therefore, there would be little to no change in the regional economy due to proposed activities.

Alternative 1 and the Proposed Action would result in early successional habitat for some game species (ruffed grouse, deer, woodcock, etc.). Therefore, future use by hunters may be higher than the No Action alternative, which would rely on natural disturbance to create early successional habitat.

3.17.5.2 Cumulative Effects

Both the Proposed Action and Alternative 1 would provide a steady, sustainable flow of tangible and intangible benefits to consumers of forest products and local governments in terms of wood fiber and payments. Current timber sales from Sprinkler, Red Pine II, Shores, Sand Clay and Raco EAs are also contributing these benefits. In particular the Sprinkler EA has a lot of aspen timber sales, and as those sales taper off, sales from the Rudyard Project will replace them.

3.17.6 No Action

3.17.6.1 Direct and Indirect Effects

This alternative would have no effect on the socioeconomic resource since no activities would take place.

3.17.6.2 Cumulative Effects

Since there are no direct and indirect effects, there would be no cumulative effects.

3.18 Environmental Justice

3.18.1 Introduction

This project has not been identified as a potential environmental justice case.

The United States Environmental Protection Agency (EPA) defines environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies (EPA Environmental Justice website 2012). Fair treatment means that no group of people, including racial, ethnic, or socioeconomic groups should bear disproportionately high and adverse human health or environmental effects resulting from federal agency programs, policies, and activities (Executive Order 12898 February 11, 1994).

3.18.2 Analysis Methods

US Census data were gathered from the 2010 Census in order to determine if there is potential for an environmental justice case. This is completed through the use of income data and ethnic data (US Census Bureau 2011)

3.18.3 Analysis Areas

The spatial boundary considered for direct, indirect, and cumulative effects consists of Chippewa and Mackinac counties, since Census data is extrapolated at the county level.

The temporal boundary will consider all activities for the next 10 years which is the reasonably expected timeframe for these activities to be completed and socioeconomic impacts would occur.

3.18.4 Affected Environment

The percent of people whose income is below the poverty level for the state of Michigan is 15.7% (US Census Bureau 2011). If the below poverty percentage is greater than twice the state percentage (31.4%), the case should be identified and addressed as a potential environmental justice case (Council on Environmental Quality 1997). If the below poverty population percentage is less than twice but greater than the state percentages, and if there are community-identified environmental justice issues, the

case should be identified and addressed as a potential environmental justice case. If the low-income population percentage is equal to or less than the state percentage, the case should not be considered an environmental justice case.

A comparison of Quickfacts for Mackinac and Chippewa Counties and Michigan shows the percentage of minorities for the state of Michigan is 19.8% (US Census Bureau, 2011). If the minority population percentage is greater than twice the State percentage (39.6%), the case should be identified and addressed as a potential environmental justice case. If the minority population percentage is less than twice but greater than the state percentages, and if there are community-identified environmental justice issues, the case should be identified and addressed as a potential environmental justice case. If the minority population percentage is equal to or less than the state percentage, the case should not be considered an environmental justice case.

3.18.5 Proposed Action and Alternative 1

3.18.5.1 Direct and Indirect Effects

Table 3-55 shows the median income and percentage of the population below the poverty level for the state of Michigan in Chippewa and Mackinac counties. The population percentage for Chippewa County is higher than the state of Michigan; however, it is less than twice the state percentage and there are no known community-identified environmental justice issues. Therefore, this project has not been identified as a potential environmental justice case.

Table 3-55 Environmental Justice Analysis

	Percentage of population below poverty	Percentage of minority population
State of Michigan	15.7%	19.8%
Twice the State %	31.4%	39.6%
Chippewa	17.7%	27.3%
Mackinac	14.7%	23.8%

Also according to the 2010 US Census data, minorities make up approximately 27.3% and 23.8% of the populations of Chippewa and Mackinac counties, respectively. Because this is less than the State of Michigan minority threshold, this project has not been identified as a potential environmental justice case.

Management of HNF supports people of a variety of backgrounds directly and indirectly through employment in timber and recreation-related industries as well as through the provision of forest products and recreation opportunities. In addition, access to lands in the Rudyard project area is available to everyone, regardless of race, color, national origin, sex, religion, age, disabilities, political beliefs, sexual orientation, or marital or family status. Therefore, there is no reason to believe that any of the proposed alternatives would involve environmental justice issues.

3.18.5.2 Cumulative Effects

Since an environmental justice case has not been identified and there are no direct or indirect effects, no cumulative effects to Environmental Justice are expected.

3.18.6 No Action

3.18.6.1 Direct and Indirect Effects

Because no activities are proposed under the No Action, there are no direct or indirect effects.

3.18.6.2 Cumulative Effects

Because there are no direct or indirect effects, no cumulative effects are expected.

CHAPTER 4 – CONSULTATION AND COORDINATION

The Forest Service consulted the following agencies, tribes, and individuals.

4.1 Agencies Consulted

4.1.1 Federal, State, and Local

US Fish & Wildlife Service

4.1.2 Tribes

Bay Mills Indian Community, THPO

Lac Vieux Desert Tribe

Keweenaw Bay Indian Community

Sault Ste. Marie Tribe of Chippewa Indians

4.1.3 Other

4.2 Persons Consulted

4.3 List of Preparers

Rudyard Interdisciplinary Team			
Name	Contribution	Degree(s)	Years of Experience
Marjorie Allmaras	Vegetation, Socioeconomics	BS-Forest Ecosystem Management	15 years
Stephanie Blumer	NNIP, TES Plants	BS-Plant Biology	5 ½ years
Steve Christiansen	District Ranger	BS-Forestry	35 years
Brad Cooper	Team Leader, NEPA Coordinator, Environmental Justice	BS-Natural Resources	2 ½ years
Brenda Dale	Fuels/Fire Ecology, Air Quality	BA-Biology	20 years

Eric Drake	Heritage Resources	PhD candidate, MA, BS-Anthropology	16 years
Derek Huebner	Wildlife	BS-Wildlife	8 years
Lyn Hyslop	Recreation, Visual Quality	BS-Natural Resource Management, Post-Grad – Sociology (Recreation courses)	23 years
Colin Nugent	Transportation	BS-Biosystems & Agricultural Engineering, MA- Geography	7 years
Jon Reattoir	Fisheries	BS-Fish/Wildlife Management, A.S. Water Quality technology, A.S. Natural Resources Technology	22 years
Martha Sjogren	Forester	BS-Forestry	25 years
Karen Waalen	GIS	A.S.S-Forest Technology	32 years
Dustin Walters	Soils, Water Quality & Quantity, Wetlands	MS-Natural Resource Conservation	13 years
Additional Support			
Jim Gries	Soils, Water Quality & Quantity, Wetlands Advisor	M.S. Forest Ecology B.S. Natural Resources and Environmental Science	18 years

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GLOSSARY

Definitions for most terminology used in this document may be found in the Forest Plan glossary. A few select terms are described below for easy reference.

Arterial Roads. Road that provides service to large land areas and usually connect with public highways or other Forest Arterial roads to form an integrated network of primary travel routes. The location and standard often are determined by a demand for maximum mobility and travel efficiency rather than specific resource management service. It is usually developed and operated for long-term land and resource management purposes and constant service (FEIS, p. 6-2).

Canopy. The continuous overhead formed from the uppermost spreading branchy layer of a forest.

Canopy Gap. A small opening created in the canopy.

Classified Road. Roads wholly or partially within or adjacent to national Forest system lands that are determined to be needed for long-term motor vehicle access. It includes state roads, county roads, privately-owned roads, NFS roads and other roads authorized by the Forest Service 936 CFR 212.1).

Clearcut / Stand Clearcut (w/leave trees). An even-aged regeneration or harvest method that removes most trees in the stand producing an exposed microclimate for the development of a new age class in one entry. A minor (less than approximately 10% of full stocking) live component is retained for reasons other than regeneration.

Collector Road. Road that serves smaller land areas than an Arterial road and is usually connected to an arterial or public highway. It collects traffic from local roads. Its location and standard are influenced by both long-term multi-resource service needs and travel efficiency.

Commercial Thin An intermediate harvest with the objective of reducing stand density primarily to improve growth, enhance forest health, and other resources objectives. Treatment can recover potential mortality while producing merchantable material.

Compartment. A unit of land with boundaries delineated by geographical features such as rivers, creeks, roads, and property boundaries for administrative purposes. Compartments are approximately 500-2,000 acres in size.

Coppice Cut. A regeneration method in which most trees in the previous stand are cut and the majority of the regeneration is from sprouts or root suckers. A minor (less than approximately 10% of full stocking) live component is retained for reasons other than regeneration.

Decommission Road. Activities that result in the stabilization and restoration of unneeded roads to a more natural state (FEIS, 6-11).

Design Criteria. Site specific application of Forest Plan or other required standards or guidelines that are incorporated into the design of the project activity.

Desired Condition. A goal, as stated in the Forest Plan, as to what a specific area should look like in the future.

Ecological Landtype (ELT). A framework that allows natural resource managers to identify, describe and map units of land with similar physical and biological characteristics at scales suitable for natural resources planning and management. (FEIS, Appendix I).

Fire Regime. Description of the patterns of fire occurrences, frequency, size, severity, and sometimes vegetation and fire effects as well, in a given area or ecosystem. A fire regime is a generalization based on fire histories at individual sites. Fire regimes can often be described as cycles because some parts of the histories usually get repeated, and the repetitions can be counted and measured, such as fire return interval.
see also: Fire Regime Groups

- FR3W – Landscape ecosystems historically experiencing relatively infrequent stand-replacing fires. Average fire rotations reported in the literature ranged from 100 to 190 years (Cleland 2004).
- FR3 – Landscape ecosystems historically experiencing infrequent stand-replacing fires. Average fire return interval reported in the literature for white pine-hemlock forests was 250 years.
- FR4 – Landscape ecosystems historically experiencing very infrequent stand-replacing or community maintenance surface fires. Average fire return intervals reported in the literature ranged from 400 to 700 years.
- FR4W – Landscape ecosystems historically experiencing very infrequent stand-replacing or community maintenance surface fires. Average fire return intervals reported in the literature ranged from 400 to 1,700 years.

Fire Regime Condition Class (FRCC). A landscape classification that determines departure of the current landscape conditions from the historic landscape conditions using vegetation type and fire dynamics. The three classes describe low (FRCC1),

moderate (FRCC2), and high (FRCC3) departure from historic conditions. Note – This is NOT the same as Fire Regime.

Fire Rotation (FR). The length of time necessary for an area equal to the entire area of interest to burn. Size of area of interest must be clearly specified. This definition does not imply that the entire area will burn during a cycle; some sites may burn several times and others not at all. In the Lake States, fires are generally more infrequent than those described by the national Fire Regimes. Cleland (2004) calculated replacement fire rotations at a scale more appropriate to Lake States landscapes. (FEIS, H-3)

Forest Type Groups. A group of forest cover types used to define seral classes. The forest type groupings differ by ecological land types.

Fuel Breaks. A break in the vegetation (Primarily the canopy) designed to stop, or slow a wildfire. A road corridor can be considered a fuel break because it has a wide corridor void of vegetation.

Improvement Cut An intermediate harvest which removes the less desirable trees of any species in a stand of poles or larger trees, primarily to improve the composition and quality.

Initiate Natural Regeneration. The use of natural regeneration to establish a new age class from natural seeding, sprouting or suckering.

Intermediate Harvest. Any treatment or tending designed to enhance growth, quality, vigor, and composition of the stand after establishment or regeneration and prior to final harvest.

Intermittent Streams. A watercourse that flows in a well-defined channel for 20-90% of the year during normal rainfall conditions.

Issue. A point of discussion or debate related to the proposed action.

Landtype Association (LTA). An ecological unit that describes areas of common ecosystem characteristics and generally (but not always) numbering in the thousands of acres. Landtype associations are defined by similarities in general topography, geomorphic process, geology, soil and potential plant communities (FEIS, 6-7).

Liberation Cut An intermediate harvest intended as a release treatment in a stand not past the sapling stage to free the favored trees from competition with older, overtopping trees.

Local Road. Connects terminal facilities (resources) with a Forest collector, arterial, or state highway. Its location and standards are usually controlled by a single specific resource activity rather than travel efficiency.

Maintenance Levels (Roads). Each Forest System road is to be maintained to a level commensurate with the planned function and use of the road. The intended level of maintenance to be received by each road is termed the Objective maintenance level (OML), which are divided into five levels of maintenance intensity. OML-1 is the lowest level and OML-5 is the highest level (FEIS, 6-7).

Management Area. A specific geographic location on the HNF where specific management direction will be applied. The HNF is divided into 21 potential management areas (FEIS, 6-7).

Management Indicator Species (MIS). Species whose presence in a certain location or situation, at a given population, indicate a given environmental condition. Their population changes are believed to indicate effects of management activities on a number of other species.

Mitigation Measure. Includes avoiding an impact altogether by not taking a certain action or part of an action; minimizing an impact by limiting the degree or magnitude of an action and its implementation; rectifying the impact by repairing, rehabilitating, or restoring the affected environment; reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; or compensating for the impact by replacing or providing substitute resources or environments.

Modification. A VQO meaning human activity may dominate the characteristic landscape but must at the same time utilize naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in the foreground.

Monitoring. The collection of information over time, generally on a sample basis by measuring change in an indicator or variable, to determine the effects of resource management treatments in the long term.

New Road Construction. Activity that results in the addition of forest classified or temporary road miles (36 CFR 212.1).

Overstocked Stand. Any stand having more trees per acre or basal area higher than the average stocking as shown on stocking charts for Northern Hardwoods and Red Pine.

Partial Retention. A VQO which, in general, means human activities may be evident but must remain subordinate to the characteristic landscape (Forest Plan, E-13).

Plant Trees. The establishment or re-establishment of forest cover artificially by planting seedlings with or without site preparation.

Retention. A visual quality objective which, in general, means human activities are not evident to the casual forest visitor (Forest Plan, E-13).

Road (Forest). A motor vehicle travelway over 50 inches wide, unless classified and managed as a trail. A road may be classified or unclassified (FEIS, 6-11).

Road Closure. Process of closing a road to public vehicle traffic. Closures are used on system roads (roads intended for future use) to limit or prohibit particular types of travel (FEIS 6-11).

Road Maintenance. The ongoing upkeep of a road necessary to retain or restore the road to the approved road maintenance objective (FSM 7712.3).

Roaded Natural (RN). A classification of the Recreation Opportunity Spectrum that characterizes a predominantly natural environment with evidence of moderate permanent alternative resource and resource utilization. Evidence of the sights and sounds of human is moderate but in harmony with the natural environment. Opportunities exist for both social interaction and moderate isolation from sights and sounds of humans (Forest Plan, E-9).

Scoping. Involving the public in order to identify and focus attention on important matters early in an environmental analysis, resulting in informed decisions, cost-effective analysis and decision making, and increased credibility.

Selection Cut. An uneven-aged regeneration cutting method where the objective is to maintain a multi-aged structure by removing some trees in all size classes either singly, in small groups or in strips (FEIS A-3).

Semi-Primitive Motorized (SPM). A classification of the Recreation Opportunity Spectrum that characterizes a predominantly natural or naturally appearing environment of moderate-to-large size. Concentration of users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present but are subtle. Motorized equipment is permitted (Forest Plan, E-9).

Seral Stage. The stage of succession of a plant community that is transitional. If left alone, the seral stage will give way to another plant community that represents a further stage of succession (climax) (FEIS 6-12).

Shelterwood Cut. A method of regenerating an even-aged stand in which a new age class develops beneath the partially-shaded microenvironment provided by residual trees. The residual trees also serve as seed trees. The sequence of treatment can include three distinct types of cutting: 1) an optional preparatory cut (prep. cut) to enhance conditions for seed production, 2) an establishment harvest (seed cut) to prepare the seed bed and to create a new age class, and 3) a removal cut (final removal cut) to release established regeneration from competition with overstory trees (FEIS A-3).

Silviculture. A combination of actions whereby forests are tended, harvested, and replaced.

Single Tree Selection Cut. A method of regenerating uneven-aged stands in which individual trees of all age classes are usually cut throughout the stand to establish new age classes and achieve desired stand structure characteristics. Regeneration is usually achieved by natural seeding or by coppice method.

Site Preparation. Preparation of the ground surface before planting and seeding or preparing a seedbed for regeneration, including removal of unwanted vegetation, slash, stumps, and roots from a site.

Size Class. Classification of tree stand size based on the dominate trees in the stand.

- Size class 0: Open lands
- Size class 1: Less than 4.5 feet in height
- Size class 2: From 4.5 feet to 4.9” diameter at breast height (DBH)

- Size class 3: From 5” to 8.9” DBH
- Size class 4: From 9: to 17.9” DBH
- Size class 5: Greater than 18” DBH (FEIS, 6-12)

Snag Tree. A standing dead tree, used by birds for nesting, roosting, perching, courting, and/or foraging for food and by many mammals for denning and foraging for food.

Stand. An aggregation of trees occupying a specific area and sufficiently uniform in composition, age arrangement, and condition to be distinguished from the forest on adjoining areas (Forest Plan, 6-13).

Stewardship Contract. A type of contract that focuses on produces desirable results on the ground that improve forest health and provides benefits to communities. Stewardship contracts allow forest products to be exchanged for ecological restoration services, such as thinning or removing brush (www.forestsandrangelands.gov).

Suited Land. Land that is to be managed for timber production on a regulated basis (FEIS, 6-13).

System Road. Permanent managed roads that provide Forest access. They are located and built for long-term though not necessarily continuous use. System roads are inventoried and include arterial, collector, and local roads (FEIS, 6-11).

Temporary Road. Roads authorized by contract, permit, lease, other written authorization, or emergency operation, not intended to be a part of the forest transportation system and not necessary for long-term resource management (FEIS, 6-11).

Thinning. An intermediate cut designed to enhance the growth and quality of the remaining trees (FEIS, 6-6).

Unclassified Road. Roads on NFS lands that are not managed as part of the forest transportation system. It includes unplanned roads, abandoned travelways, off-road vehicle tracks that have not been designed and managed as a trail; and roads that were once under permit or other authorization and were not decommissioned upon the termination of the authorization (36 CFR 212.1) (FEIS, 6-11).

Viewshed. Total visible area from a single observer position (e.g. an overlook), or the total visible area from multiple observer positions (e.g. a corridor). Viewsheds are accumulated seen areas from highways, trails, campgrounds, towns, cities or other viewer locations.

Visual Quality Objective. A desired level of excellence based on physical and sociological characteristics of an area, and refers to degree of acceptable alteration of the characteristic landscape in five levels: Preservation, Retention, Partial Retention, Modification, and Maximum Modification (FEIS, 6-14).

Watershed Level. Hydrologic Unit Code (HUC): The United States is divided and subdivided into successively smaller hydrologic units which are classified into four levels: regions, sub-regions, accounting units and cataloging units. The hydrologic units are arranged within each other, from the smallest (cataloging units) to the largest (regions).

Each hydrologic unit is identified by a unique hydrologic unit code (HUC) consisting of two to eight digits based on the four levels of classification in the hydrologic unit system.

- Sixth level: HUC are watersheds between 10,000 to 40,000 acres (FEIS 6-6).

Acronyms

Alt.	Alternative
Approx.	Approximate
BA	Biological Assessment
BBS	Breeding Bird Survey
BE	Biological Evaluation
BMP	Best Management Practices
BO	Biological Opinion
CEQ	Council of Environmental Quality
CFR	Code of Federal Regulations
Comp.	Compartment
cRNA	Candidate Research Natural Area
DBH	Diameter at breast height
E	Federal Endangered
EA	Environmental Assessment
EAB	Emerald ash borer
EIS	Environmental Impact Statement
ELT	Ecological Landtypes
EO	Executive Order
EPA	Environmental Protection Agency
EXD	Excessively drained
F	Fall
FEIS	Final Environmental Impact Statement
FH	Forest Highway
FR	Forest Road
FR	Fire Rotation
FRCC	Fire regime condition class
FSH	Forest Service Handbook
FSM	Forest Service Manual
FT	Federally Threatened
Forest Plan	Land and Resource Management Plan for the Hiawatha National Forest
GIS	Geographic Information System
GL	Guideline
GLO	General Land Office
H	habitat
HNF	Hiawatha National Forest
HUC	Hydrologic unit code
ID	Identification
IDT	Interdisciplinary Team
IRA	Inventoried Roadless Area
KW	Kirtland's warbler
LAA	May affect, likely to adversely affect
LT	Federally Listed Species
LTA	Landtype Association

LWD	Large Woody Debris
MA	Management Area
MBF	Thousand Board Feet
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
mi.	mile
MI-E	Michigan Endangered
MI-T	Michigan Threatened
MINLTF	May Impact Individuals but Not Likely to Cause a Trend to Federal Listing or Loss of Viability
MIS	Management Indicator Species
MI SC	Michigan Special Concern (53, plants MI SC)
MNFI	Michigan Natural Features Inventory
MWD	Moderately Well Drained
N	North
NA	Not Applicable
NCT	North Country Trail
NE	No Effect
NEPA	National Environmental Policy Act
NFS	National Forest System
NI	No Impact
NLAA	May affect, not likely to adversely affect
NNIP	Non-native Invasive Plants
NNIS	Non-native Invasive Species
NWI	National Wetland Inventory
OHV	Off-highway Vehicle
PCB	Polychlorinated Biphenyls
PCE	Primary Constituent Elements
PD	Poorly Drained
PL	Public Law
Prep	Preparation
R	Range
RA	Reserve Area
RACR	Roadless Area Conservation Rule
RARE II	Roadless Area Review and Evaluation
Rec.	Recommendation
Regen	Regeneration
RFSS	Regional Forester Sensitive Species
RN	Roaded Natural
ROS	Recreation Opportunity Spectrum
Rx	Prescription
S	Stand
S	Species Present (EA p.63)
S	Standard (BE p. 15)
S	Summer
Sec.	Section
SFSC	Spruce-fir/Swamp Conifer
SHPO	State Historic Preservation Officer (Michigan)
SMU	Soil Management Unit
SOPA	Schedule of Proposed Actions
SP	Spring

SPM	Semi-primitive Motorized
SQ	Square
SQS	Soil Quality Standards
State	State of Michigan
STD	Stand
SWEXD	Somewhat Excessively Drained
SWPD	Somewhat Poorly Drained
T	Township
T	Federal Threatened
TES	Threatened, Endangered, or Sensitive
UP	Upper Peninsula
US	United States
USDA	United States Department of Agriculture
USDI	United States Department of Interior
Vol.	Volume
VPD	Very Poorly Drained
VQO	Visual Quality Objectives
W	West
W	Winter
WD	Well Drained
WO	Winter Only
WQS	Water quality standards

ACRONYMS