Mast Lake Environmental Assessment

December of 2008

Huron-Manistee National Forests

Baldwin-White Cloud Ranger District

FOREST SERVICE
US
DEPARTMENT OF AGRICULTURE

MAST LAKE
ENVIRONMENTAL ASSESSMENT

Huron-Manistee National Forests
Baldwin-White Cloud Ranger District

December of 2008

Lead Agency: USDA Forest Service
Huron-Manistee National Forests

Responsible Official: Leslie E. Russell
District Ranger

For Further Information Contact: Christopher J. Frederick
Interdisciplinary Team Leader
P.O. Box Drawer D
650 N. Michigan Avenue
Baldwin, MI, 49304
(231) 745-4631, ext 3138

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Organization of the Mast Lake Environmental Assessment

Chapter 1 introduces the Purpose and Need for the activities that the Forest Service is proposing, the relevant issues surrounding the project, and other issues and management concerns.

Chapter 2 presents and compares the alternatives for conducting these activities, the activities that would be implemented with the mitigation measures to protect the environment, and activities that would be monitored to document the effectiveness of the treatments and the mitigation measures.

Chapter 3 describes the environmental, social, and economic effects. This includes the direct, indirect, and cumulative effects likely to occur with the implementation of each alternative.

Chapter 4 identifies those involved in preparation of the document, the mailing lists, and the resources utilized to complete the analysis.

Appendix A is a series of maps showing the resulting transportation system within the Project Area by alternative.

Appendix B lists the potential plant species that may be used in the efforts to restore dry sand prairies within the Project Area.

Appendix C provides a list of comments received during the initial scoping.

Appendix D offers specific information relating to the herbicide being proposed for use in this project (glyphosate).

Further information related to this project is included in the Planning Record, which is located at the Baldwin-White Cloud District office.

Chapter 1: Purpose and Need

(1.1) Introduction

Chapter 1 introduces the Purpose and Need for the activities that the Forest Service is proposing, the relevant issues surrounding these activities, and other issues and management concerns for the Mast Lake Project. The proposed activities in the Mast Lake Project Area (Project Area) include aspen, red pine, oak, and jack pine harvests; the restoration of dry sand prairie; wildlife habitat improvement projects; removal of trash from dump sites; rehabilitation of off-road vehicle (ORV) damage; management of the transportation system; and non-native, invasive plant control.

(1.2) Project Area Location

The proposed activities in the Project Area are located on National Forest System lands on the Baldwin-White Cloud Ranger District of the Huron-Manistee National Forests (HMNF) in:

- T14N, R11W, Sections 13, 14, 16, 21-23, and 25-36 of Goodwell Township, Newaygo County, MI
- T13N, R11W, Sections 5-7, 17-20, 29, and 30 of Big Prairie Township, Newaygo County, MI

The Project Area is located east of the community of White Cloud, south of the community of Woodville, and northwest of the Hardy Dam Pond. All of these are located within 10 miles of the Project Area. Highway M-20 runs east/west and bisects the Project Area. See the Project Vicinity Map at the end of this chapter.

(1.3) Management Direction

The Mast Lake Environmental Assessment (EA) is tiered to the Huron-Manistee National Forests Land and Resource Management Plan (Forest Plan) and Final Environmental Impact Statement, 2006. The Management Prescription Areas (MA) in the Project Area are 4.2, Roaded Natural, and 4.4, Rural. The Project Area consists of ~17,095 acres. Of this, ~4,012 acres (or ~23.5%) are National Forest System lands. Of the National Forest System lands, 1,055 acres (or ~26.3%) are in MA 4.2 and 2,957 acres (~73.7%) are in MA 4.4.

Management Area 4.2 (Roaded Natural Sandy Plains and Hills) – Management activities enhance and increase the variety of wildlife habitats with emphasis given to managing deer, grouse, wildlife, and Kirtland's warbler essential habitat. High volumes of timber products are produced. Emphasis includes reducing life-threatening and property damaging wildfire potential and providing a variety of recreational opportunities (Forest Plan, pp III-4.2-2).

Management Area 4.4 (Rural) – Management activities provide recreational opportunities, sources of firewood close to users, and moderate to high volumes of softwood timber products. Wildlife management is coordinated with adjacent and non-National Forest land management. Some small blocks will be managed to protect isolated, essential areas for endangered, threatened, or sensitive species; while other tracts may emphasize grouse management opportunities (Forest Plan, pp III-4.4-2).

(1.4) Need for Action

The Purpose and Need for a project is arrived at by addressing the differences between the existing condition and the desired future condition. The proposed action serves as one way of moving the Project Area from the existing condition to the desired future condition. The following section describes these by resource area for the management activities identified for this Project Area.

(1.4.1) Timber Management

Aspen

Existing Condition: Some of the aspen stands within the Project Area have reached maturity and are beginning to convert to other forest types. The early-successional (0-10 year) habitat that is provided by regenerating aspen stands is limited throughout the Project Area.

Desired Future Condition: These stands will be maintained as aspen and the conversion to other forest types will not occur. Early-successional aspen habitat will be provided throughout the Project Area.

Purpose and Need: Maintain the aspen component in commercial forest stands and provide younger aspen age-classes.

Proposed Action: Portions of the existing aspen stands would be harvested to promote aspen regeneration, age-class diversity, and improve wildlife habitat for early-successional species. Individual clearcut areas would not exceed 40 acres. In some areas, where there are aspen inclusions within or adjacent to oak-typed stands, cutting would occur to expand the aspen type. In selected lowlands, the aspen component would be retained through selective hand-felling. In these areas, the felled trees would be left on site.

Red Pine

Existing Condition: In the past, red pine plantations were established as a means of land reclamation. In some areas, these trees were planted at high densities. Many of these plantations have not been thinned since the time of planting and tree growth and diversity is limited due to the competition that exists for sunlight, water, and nutrients. The understory vegetation in many of these stands is limited or non-existent.

Desired Future Condition: The number of trees per acre will be reduced to a level that the previously degraded soils can adequately support. Individual tree growth in these stands will increase. The competition for sunlight, nutrients, and water will be reduced. Other vegetation, such as forbs and shrubs, will have the opportunity to become established in the understory.

Purpose and Need: Sustain forest health, individual tree growth rates, and increase vegetative diversity in red pine stands.

Proposed Action: Selected red pine plantations would be thinned to improve individual tree growth and stand diversity, while reducing the competition within these stands for sunlight, water, and soil nutrients.

(1.4.2) Wildlife Management

Existing Condition: The Project Areas currently offers an array of wildlife habitats, ranging from early-successional to late-seral. Upland and lowland openings are present throughout the area. Some of the upland openings are being encroached upon by non-mast producing woody species and currently contain grasses and forbs that are of limited value to upland wildlife species. In portions of the Project Area, suitable habitat exists for interior species. There are scattered lowland openings within these areas, but the surrounding edge habitat is poor or lacking. There is a lack of suitable cavity/den trees and mast bearing shrubs and trees.

Desired Future Condition: The Project Area will continue to provide a diverse combination of forested and non-forested wildlife habitat capable of supporting a variety of upland and interior species. Cavity/den trees will exist throughout the Project Area.

Purpose and Need: Provide suitable habitat to maintain or increase wildlife diversity.

Proposed Action: Manage selected upland openings (through a combination of mowing, discing, seeding, fertilizing, selective tree-felling, prescribed burning, and/or planting) to provide the blend of native grasses, forbs, mast-producing shrubs, and limited large woody vegetation that is necessary to support a variety of upland wildlife species. Manage and expand selected lowland openings (through a combination of snag and den tree creation, selective tree felling, and shrub planting) to encourage their use by a variety of lowland and interior species.

(1.4.3) Fuels Management

Existing Condition: Portions of the Project Area consist of conifer plantations (red pine, jack pine, and Scotch pine) which were historically planted at high densities in order to hold fragile and eroding soils in place. In some of the jack pine stands, there is volatile fuel loading because of the high density of seedlings beneath the mature trees. In these conifer types, it is this regeneration which serves to carry fire into the crowns of the mature and over-mature trees that are still standing. In other areas (red pine, jack pine, and Scotch pine), the density of the tree planting has formed a closed canopy with a thick bed of needles underneath that have been shed over the years. The understory vegetation in these locations is virtually non-existent. In both of these areas, there is risk of a rapidly spreading wildfire.
Desired Future Condition: The density of the trees in the conifer plantations will be reduced to allow for the establishment of native understory species. Fire-dependent tree species will be less dominant in these stands. The risk of wildfires threatening life and property will be reduced.
Purpose and Need: Reduce the threat to adjacent landowners and to public resources that is posed by the accumulation of hazardous fuels within portions of the Project Area.
Proposed Action: Reducing the fuel-loading in the Project Area would occur through a combination of the activities related to timber harvesting (red pine thinning, jack pine regeneration, and Scotch pine removal) and dry sand prairie restoration (tree/stump removal, prescribed burning, site preparation, and the establishment of native ground vegetation).

(1.4.4) Dry Sand Prairie Restoration

Existing Condition: In some areas, the Sparta soil series that historically supported native dry sand prairie now supports extensive conifer (red, white, and jack pine) plantations. These were established by the Civilian Conservation Corps to control the erosion that was brought on through the conversion of the land to agriculture. While these plantations have been successful at holding the soil in place, no further efforts have been made to restore these areas to dry sand prairie. There are other locations within the Project Area that contain the necessary soil requirements for dry sand prairie and that were not converted to pine plantations. These areas have since been maintained as openings. The existing ground vegetation in these open areas is sparse, with the trees being mostly limited to scattered pines that have become established naturally.
Desired Future Condition: The characteristics of dry sand prairie habitat will be enhanced within the Project Area.
Purpose and Need: Identify and develop selected areas for restoration to provide habitat for dry, open sand Regional Forester Sensitive Species (both wildlife and plant).
Proposed Action: The proposed sequence of restoration activities would be variable by location and be dependent on site-specific vegetative monitoring. The activities occurring in the conifer plantations would involve a sequence of timber and stump removal, site preparation (including the necessary control of non-native invasive plant species), prescribed burning, and the planting of native prairie forbs and grasses over a period of several years. The occurrence of treatments would be based on the response of the area to preceding treatments. The activities occurring in the existing openings would be similar to those of the currently forested stands, though the necessary removal of trees and stumps in these areas would be limited. Under both alternatives, the area restored to dry sand prairie would be changed from Land Suitability Class 500 (commercial forest) to Land Suitability Class 200 (non-forested).

(1.4.5) Trash Dumping

Existing Condition: The combination of high road densities and fragmented land ownership throughout the Project Area are contributing to the dumping of trash on National Forest System lands. These dump sites are scattered throughout the Project Area and vary in size. There are ~20 dump sites that have been identified within the Project Area. A portion of these sites are located on roads that have been previously closed.

Desired Future Condition: The trash that has been dumped on National Forest System lands will be removed and properly disposed of. The potential for illegal dumping and illegal hunting stands will be reduced.
Purpose and Need: Reduce the quantity of trash currently located on National Forest System lands and reduce vehicle access to historic dumpsites.
Proposed Action: Identified trash dumps would be cleaned up. In some locations, the spur roads leading to these sites would be blocked. On roads previously closed, the closures would be re-enforced after trash clean-up occurs.

(1.4.6) Recreation

Existing Condition: The Project Area is used for dispersed recreation activities (such as camping and hunting). In addition to these, ORV use occurs in the area and is the cause of extensive damage in two locations on National Forest System lands that are in close proximity to each other. Both of these areas are on light, sandy soils which were historically degraded and severely eroded prior to becoming part of the National Forest. The topsoil and vegetation at both of these sites is sparse to non-existent.
Desired Future Condition: The exposed soils will become stabilized and the continued erosion at these sites will cease. Native vegetation will become established. These areas will no longer be open to ORVs.
Purpose and Need: Rehabilitate the resource damage related to ORVs.
Proposed Action: These sites are located in Compartment 570 Stand 8 (Site 1) and Compartment 572 Stand 28 (Site 2). In both locations, there are proposed red pine treatments that would occur in adjacent stands. A portion of the red pine from these stands would be used for barrier posts and erosion control structures within the damaged sites. Both areas would be seeded with native grasses. While follow-up tree planting would occur at Site 1, the focus of Site 2 would be either the maintenance of the opening (Alternative 3) or the re-establishment of dry sand prairie species (Alternative 2).

(1.4.7) Road Management

Existing Condition: The current road density within the Project Area is 6.1 miles of public-use roads per square mile of National Forest System lands. There are approximately 38.2 miles of roads within the Project Area. These include county roads (adjacent to National Forest System lands), classified Forest system roads, and unclassified roads.
Desired Future Condition: As a result of changes in the road system, there will be a reduced potential for: erosion; the expansion of user-developed roads associated with vehicle use; impacts on wildlife; and the dumping of trash. The road density in the Project Area will be closer to the Forest Plan Guideline of 3.0 miles of road/square mile.
Purpose and Need: Manage the Forest Service roads to bring the Project Area closer to the road density Standards and Guidelines of the Forest Plan (Forest Plan, pp II-39 and 40).
Proposed Action:* Some dead-end spur roads, roads that serve as duplicates (lead to the same location as another road), and roads that are no longer needed for administrative purposes or are causing resource damage would be eliminated. This would reduce the current road density. All other roads would be left open to become part of the transportation system in this area. Road/stream crossings would be upgraded as needed. Temporary roads would be established and some currently closed roads would be re-opened to provide access to harvest units. These would be closed after harvesting activities are completed. Where necessary, improvements would be made on the existing roads to accomplish the proposed activities.
***These actions apply only to the roads that are on National Forest System lands and are under the jurisdiction of the Forest Service. No actions are being proposed on roads under the jurisdiction of Newaygo County, the State of Michigan, or private landowners.**

(1.4.8) Control of Non-native and/or Invasive Plant Species

Existing Condition: The non-native invasive plant species that have been identified within the Project Area include: Japanese barberry (6 sites), leafy spurge (12 sites), honeysuckle (16 sites), autumn olive (9 sites), marsh thistle (1 site), garlic mustard (3 sites), bull thistle (1 site), hoary alyssum (5 sites), smooth brome (1 site), spotted knapweed (11 sites), St. Johnswort (7 sites), sweetclover (2 sites), and white sweetclover (1 site) . These plants occupy an approximate area of 9.4 acres.
Desired Future Condition: Selected non-native and/or invasive plant species will be suppressed. The further spread of these species will not occur, or will be reduced, as a result of the management activities proposed in this project.
Purpose and Need: Prevent the spread of non-native invasive species caused by Forest Service activities.
Proposed Action: Treat identified areas of infestation of selected non-native and/or invasive species. Treatment would include mechanical removal, spot burning, and/or systemic spot treatment with herbicide (glyphosate).

(1.5) Decision to be Made

Based on the analysis of the environmental effects in this EA, the Responsible Official (the District Ranger), must decide whether or not to implement the proposed management activities. This would include deciding on the amount, type, and location of these activities. These activities would be implemented within approximately ten years of the Responsible Official signing the Decision Notice for this project.

(1.6) Scoping and Public Involvement

The Forest Service uses public involvement and an Interdisciplinary Team (ID Team) of resource specialists to determine the issues of concern and develop possible solutions. Scoping is a process that is used to gather comments about a site-specific proposed federal action to determine the scope of issues to be addressed and for identifying unresolved issues related to the proposed action (40 CFR 1501.7). Opportunities for comments enable concerned citizens, resource specialists from other agencies, and local governments to express their ideas and viewpoints. Public involvement for the project included listing in the HMNFs' Schedule of Proposed Actions and a direct mailing on January 8, 2008 to approximately 331 individuals, organizations, and adjacent landowners. During the scoping period, 31 responses were received. The following table summarizes the general comments received during this period. Some responses contained more than one comment.

Table 1.1: Comments Received During the Initial Scoping Period

Issue or Concern	Number of Comments
Timber	
Effects of logging on the road system	3
The mix of tree species, types of treatments, and the age-classes of the proposed timber treatments	5
Opposed to timber treatments	1
Support of timber treatments	4
Ground Flora	
Effects on the ground flora	2
Interest in NNIS	4
Wildlife	
Effects of the proposed activities on wildlife	5
Change in hunting regulations	1
Roads	
Opposed to road closures	2
Support specific road management recommendations	6
Support ORV projects	2
Oppose ORV projects	1
Trash	
Support removal of trash	7
Social	
Who does the work	2
Trespassing	3
General	
General support of the project	10
Delay scoping until snow is gone	1
Open some areas for ORV use	1

(1.7) Relevant Issues

Issues result from discussion, debate, or disagreement regarding the effects of the proposed activities. They are developed from comments received from within and outside of the Forest Service. In order to provide concise analysis, the agency distinguished between those issues that were used in the analysis for formulating alternatives, developing mitigation measures, and tracking effects. Issues that drove the development of alternatives were identified as relevant issues. Other issues and management concerns are addressed in the Environmental Effects section of Chapter 3 of the EA, but were not used to develop alternatives. Alternatives considered, but eliminated from detailed study, are also addressed in Chapter 2 of the EA. The relevant issues identified for this project are:

(1.7.1) Management of the Transportation System for Motorized Access

Issue: This issue reflects several different concerns related to the management of the transportation system in the Project Area.

Comments: The comments that were received relating to this resource area included: not closing any of the roads, closing only the roads that were necessary, support of road closures, recommendations for specific road actions, and the impacts to the roads related to the proposed management activities.

Measurement: The number of miles of road per square mile of National Forest System lands that are left open to public vehicle use.

(1.7.2) Management for the Restoration of Dry Sand Prairie

Issue: This issue relates to the locations and area of adaptive treatments that would occur in the restoration of dry sand prairie habitat within the Project Area.
Comments: Historically, dry sand prairie existed throughout portions of the Project Area, located exclusively on the Sparta soil series. The Forest Plan gives direction for the restoration of these areas. In reviewing the portions of the Project Area with Sparta soils, the level of historical site erosion, and the comments received from scoping, the IDT determined that offering a range of alternatives relating to the restoration of these areas was appropriate.
Measurement: The number of acres receiving restoration treatments.

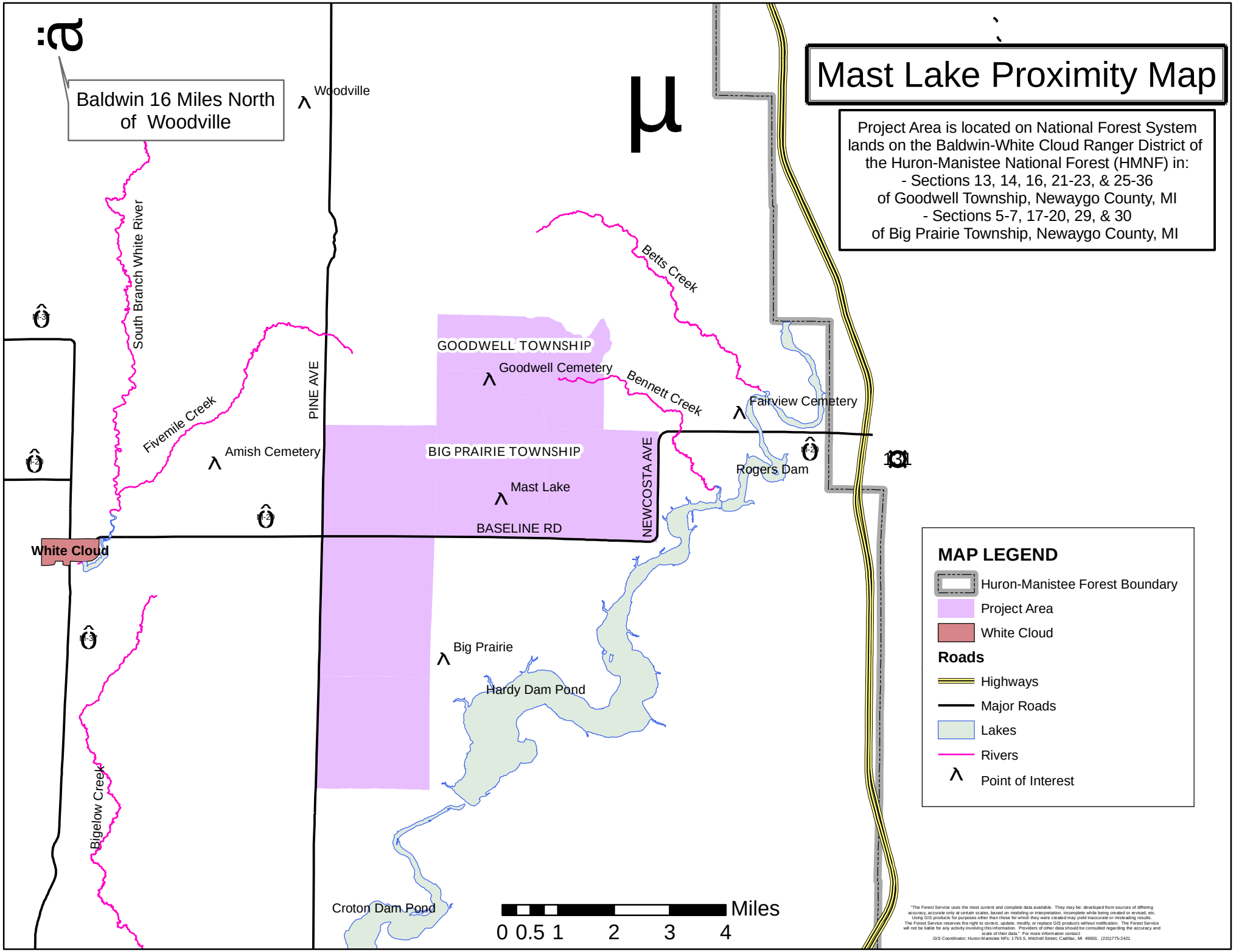
(1.8) Resource Areas of Analysis

Giving consideration to the relevant issues, in conjunction with the proposed actions, the IDT developed the following list of resource areas for analysis in this project.

Vegetation
    Timber, Woodland, and Fuels Management
    Herbaceous and Understory Vegetation
Transportation
Recreation/Visual Quality
Fisheries and Watershed
Wildlife
Soils
Air Quality
Heritage Resources
Environmental Justice
Economics
Irreversible and Irretrievable Commitment of Resources

(1.9) Availability of the Planning Record

An important consideration in preparation of this EA has been the reduction of paperwork as specified in 40 CFR 1500.4. The objective is to furnish enough site-specific information to demonstrate a reasonable consideration on the environmental impacts of the alternatives and how these projects might be mitigated. The Planning Record contains detailed information used in the analysis and is available at the Baldwin-White Cloud Ranger Station.



Chapter 2: Alternatives

(2.1) Introduction

This chapter describes the different alternatives for management activities that would accomplish the Purpose and Need for this project. This includes the No-Action Alternative (Alternative 1) and two action alternatives (Alternatives 2 and 3). The Mast Lake Project is displayed on the vicinity map at the end of Chapter 1. Maps at the end of Chapter 2 display the proposed activities for each alternative.

(2.2) Developing a Range of Alternatives

To prepare this analysis, the ID Team first met and reviewed all of the comments and concerns expressed by the public and internal sources during the initial Scoping Period. These comments and concerns were then consolidated into relevant issues. Once the relevant issues were identified, the ID Team developed a range of alternatives to address these issues while responding to the objectives of the Purpose and Need. The ID Team also identified measurements used to compare how each alternative responded to the issue for which it is developed. The National Environmental Policy Act (NEPA) regulations mandate consideration of all reasonable alternatives for a proposed action, including the identification and discussion of alternatives eliminated from detailed study.

As a result of this process, a modified version of the original proposed action and one other action alternative have been developed to meet the objectives and to address the identified issues. Each alternative represents a site-specific mix of proposals that responds to these issues. The District Ranger will use this range of alternatives as a basis for determining the trade-offs between implementing the different alternatives. This comparison includes the No-Action Alternative, which is used as a baseline.

The alternative development process is guided by concepts of sound resource management. Each action alternative follows the direction of the Forest Plan. The ID Team concentrated on providing a range of alternatives by varying the amounts, locations, and types of treatments.

The concepts guiding the analysis of these alternatives and the anticipated effects on the landscape are based on the best available science, as described by the regulation at 36CFR 219.35 (2000) and the Interpretative Rule of September 29, 2004. This is tracked throughout the document by specific material references and through the compiling of the Mast Lake Project Record. The Project Record contains relevant scientific information, consideration of responsible opposing views, and, where appropriate, the acknowledgment of incomplete or unavailable information, scientific uncertainty, and risk.

(2.3) Alternatives Considered in Detail

This assessment will evaluate the No-Action Alternative (Alternative 1) and the two action alternatives, which are described below. All of the action alternatives are consistent with the standards and guidelines of the Forest Plan. Table 2.4 on pages 2-20 through 2-21 displays a summary comparison of alternatives by issue and activity.

(2.3.1) Alternative 1: No-Action

Alternative 1 is the No-Action Alternative. Under Alternative 1, no management activities would occur in the Project Area on National Forest System lands. Some activities, such as minor road improvements and resource protection would continue within the Project Area. Selection of Alternative 1 does not preclude future analysis or implementation of on-going management proposals within the Project Area.

Summary of Alternative 1

- None of the proposed vegetative treatments or other management activities would occur in the Project Area on National Forest System lands.
- Provides a baseline against which to describe the environmental and social effects of the action alternatives.
- Responds to those who would like no management activities to take place, such as timber harvesting and road closures.
- Does not achieve the Purpose and Need of the Mast Lake Project.
- Does not achieve the Forests Plan desired condition for vegetative, transportation, and wildlife habitat management.

(2.3.2) Alternative 2: Modified Proposed Action

Alternative 2 is a modified version of the Proposed Action that was described during the scoping process. The timber harvesting proposed under this alternative would include a combination of commercial red pine thinning, aspen clearcutting, jack pine clearcutting, and Scotch pine removal. In addition, there would be treatments of forested stands targeted specifically at the creation of wildlife habitat. These treatments would include the selective cutting and girdling of trees in a mixed oak stand to create den and nest habitat. Early-successional habitat creation would occur through the non-commercial felling of isolated aspen and the expansion of the aspen cover type in some areas where aspen is a component, but not the dominant cover type. Selected open areas within the Project Area would be managed based on their current individual characteristics. Treatments of the lowland openings would be focused on reducing the encroachment of larger diameter trees through felling a portion of them into the openings. The creation of edge habitat around these openings would occur through the subsequent planting of mast- and fruit-bearing shrubs. Selected upland openings would be maintained through a combination of tree-pruning, the selective felling of larger diameter trees, mowing, prescribed burning, and the planting of native grasses, forbs, and mast- and fruit-bearing shrubs.

Under this alternative, the management of the transportation system would be consistent with what was described during the scoping process. All of the roads (and the related maintenance) that are currently under the jurisdiction of the Newaygo County Road Commission would remain as such. Actions related to the transportation system within the Project Area would be limited solely to classified Forest Roads and unclassified, user-created roads that exist on National Forest System lands. This alternative would offer the maximum amount of road closures, while still providing reasonable access throughout the area to accommodate public use and management activities. Closures would be focused on the prevention of ORV damage, protecting areas that contain erosion-prone soils, and re-enforcing the closures that have occurred in the past and have since been breached. Methods of closure would include a combination of berms, felled trees, stumps, boulders, and barrier posts. Gates would be installed in locations where future access would be needed for management activities. At some locations, closures would occur in a way that would provide limited parking areas to accommodate visitors to the forest.

Under Alternative 2, non-native and/or invasive species would be treated in selected areas through a combination of mechanical spot-treatment (i.e. hand-cutting or pulling), burning, and herbicide application (glyphosate). The method and the timing of the treatments used would be determined based on the species and site characteristics and the other management activities occurring in the area.

The restoration of selected areas within the Project Area to dry sand prairie would be maximized under this alternative. Activities would occur in locations containing the Sparta soil series, with the majority taking place on areas that have been identified as not being severely eroded. The restoration of these areas would occur through an adaptive management approach that would include a combination of the following: 1) tree removal, 2) prescribed burning, 3) stump removal, 4) balancing the soil pH and nutrient

levels (if necessary), 5) establishing an annual cover crop, and 6) establishing native grasses and a mix of dry sand prairie plant species. The sequence of activities would occur over a period of several years and be dependent on the response of the area to previous treatments. It is anticipated that different locations would show different responses to these treatments, therefore, the areas selected for treatment would likely be at different stages of restoration over time. The Land Suitability Class for the areas identified for restoration would change from 500 (forested) to 200 (non-forested).

Also included in this alternative would be the restoration of two sites that have been impacted from high levels of ORV traffic. Both locations consist of light, sandy soils that are currently vulnerable to increased levels of human-caused and natural erosion. Restoration activities at one of these sites (Site 1) would include the grading of existing slopes to conform with the natural landscape, the placement of water bars, the acquisition and strategic placement of felled red pine trees, the seeding of an annual cover crop and native warm season grasses, and the planting of native tree seedlings. Activities at Site 2 would also include the acquisition and placement of felled red pine trees and the seeding of an annual cover crop. At Site 2, prior to the establishment of warm season grasses, attempts would first be made to establish a mix of dry sand prairie species. This would be done to determine if this suite of species could be successfully established in severely eroded areas.

This alternative would also include the cleaning up of trash sites that occur on National Forest System lands within the Project Area. These sites have been identified through a combination of field reviews by the ID Team and through the identification of potential and historic sites by private landowners.

Summary of Alternative 2

- ~286 acres of commercial red pine thinning;
- ~116 acres of commercial aspen clearcutting;
- ~40 acres of commercial jack pine clearcutting;
- ~23 acres of Scotch pine removal;
- ~35 acres of wildlife habitat creation cutting in mixed oak;
- ~44 acres of opening maintenance;
- ~63 acres of opening expansion;
- ~24 acres of non-commercial aspen felling;
- ~38 acres of aspen expansion;
- ~17.8 miles of road closures;
- ~9.4 acres of non-native and/or invasive species treatment;
- ≤ 177 acres of dry sand prairie restoration;
- 145 acres of Land Suitability Class changes;
- restoration of two sites damaged by ORVs; and
- the clean-up of ~20 dump sites.

(2.3.3) Alternative 3: Limited Prairie Restoration with Reduced Road Closures

The timber harvesting proposed under Alternative 3 would vary slightly from that proposed under Alternative 2. There are two red pine stands that would be restored to dry-sand prairie under Alternative 2 that would be managed to provide habitat for the American pine marten under Alternative 3. In one of these stands (Compartment 572, Stand 18 - 63 acres), a red pine thinning would be conducted. The other stand (Compartment 572, Stand 35 - 23 acres) would be clearcut and allowed to naturally regenerate. Treatments would also occur within these two stands to provide increased ground cover. There would be no change in the Land Suitability Class for these two stands under Alternative 3 and they would remain in the commercial timber base. The remaining vegetative treatments would be consistent with Alternative 2.

This alternative would also offer a change in the management in one of the upland openings (6 acres). While under Alternative 2 this opening would be restored to dry-sand prairie, Alternative 3 would manage this opening to promote the characteristics of an upland opening. This would occur through a combination of tree-pruning, the selective felling of larger diameter trees, mowing, prescribed burning, and the planting of native grasses, forbs, and mast- and fruit-bearing shrubs. This change would be compatible with the existing condition of the soil (highly eroded) in this stand.

Under Alternative 3, there would be fewer road closures than Alternative 2, affecting two distinct areas.
Area 1 (See Appendix A, Compartment 565, Alternative 3): Described as the classified and unclassified roads located on National Forest System lands east of Hemlock, west of Elm, and south of Two Mile roads. Under Alternative 2, all of the roads in this area would be closed, with small entrances left in place to provide parking areas for forest visitors. Under Alternative 3, all of the roads in this area would be left open.
Area 2 (see Appendix A, Compartment 572, Alternative 3): Described as the unclassified roads located on National Forest System lands east of Locust, west of Elm, south of 28th, and north of 36th Roads. Under Alternative 2, a single thru-route would be provided from 28th Road to 36th Road utilizing portions of the existing unclassified roads. All roads that are not a part of this single thru route would be closed to motor-vehicle traffic. Under Alternative 3, all of the roads occurring on National Forest System lands in the described area would remain open for use.

The management of the remaining roads within the Project Area would be consistent with Alternative 2.

Under Alternative 3, with the exception of the two areas of red pine and the upland opening (described above) dry-sand prairie restoration activities would occur similarly to Alternative 2, except on fewer acres. Under both of the action alternatives, the activities related to non-native and/or invasive species, ORV damage restoration, and the cleaning up of trash sites would be the same.

Summary of Alternative 3

- ~349 acres of commercial red pine thinning;
- ~23 acres of red pine regeneration;
- ~116 acres of commercial aspen clearcutting;
- ~40 acres of commercial jack pine clearcutting;
- ~23 acres of Scotch pine removal;
- ~35 acres of wildlife habitat creation cutting in mixed oak;
- ~52 acres of opening maintenance;
- ~63 acres of opening expansion;
- ~24 acres of non-commercial aspen felling;
- ~38 acres of aspen expansion;
- ~12.8 miles of road closures;
- ~9.4 acres of non-native and/or invasive species treatment;
- ≤ 85 acres of dry sand prairie restoration;
- 59 acres of Land Suitability Class changes;
- restoration of two sites damaged by ORVs; and
- the clean-up of ~20 dump sites.

(2.4) Mitigation

Mitigation measures are designed to counteract environmental impacts or to make impacts less severe. These may include: avoiding an impact 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. Some mitigation measures are common to all action alternatives, while others may apply only to specific treatment unit(s). Each Treatment Unit Card (Project File) lists the mitigation measures that are applicable to the actions that are prescribed for the unit. The following categories have been developed: Cultural Resources, TES Species, General Timber, Aspen Regeneration, Roads, and Herbicides.

(2.4.1) Cultural Resources (CR)

The following measures would be applied to Treatment Units that contain known cultural resource sites:

1. Known heritage resource sites will be protected. A buffer of 20 meters (66 feet) will be established around sites identified during the survey period. Cultural Resource Reserve Areas consist of high probability locations that were not adequately tested for cultural resources. Until adequately tested, the Reserve Areas will be protected as heritage resource sites. The Reserve Areas will be buffered areas extending 60 meters (200 feet) from terrace/slope breaks or 30 meters (100 feet) from the edge of streams or creeks. If additional heritage resource sites are found during project implementation, the Zone Archaeologist will be informed and work will be suspended until adequate protection measures are undertaken.

(2.4.2) General Timber (GT)

The following measures would be applied to all Treatment Units that are prescribed for any type of harvest treatments:

2. Recommendations included in the Water Quality Management Practices on Forest Land (MDNR 1998) and Forest Service Handbook 2509.18 will be incorporated to provide protection of soil and water resources.

3. Commercial timber harvesting activities will be excluded from riparian areas by a distance of approximately 100 feet. These areas are identified by the presence of water, vegetative composition, and soil type.

4. Some stands typed as openings will be used for landings and skid trails. Whether or not slash is left in these openings will be determined on a site-by-site basis. Site-specific characteristics of individual openings will be maintained. Rehabilitation of these openings will occur as needed.

5. On slopes of 15-35%, trees will be processed at the stump retaining slash at the individual tree felling site. Skid trail gradients should not be greater than 15%, with the exception of short, steep gradients not to exceed 20%. Skidding on slopes of 15-20% should be dispersed. No mechanical harvesting on slopes greater than 35%.

6. Skid trails, temporary roads, and other areas throughout the Project Area will be rehabilitated, to reduce soil erosion and restore herbaceous and woody vegetation after harvest activities are completed. Landings will be rehabilitated after the harvest activities are completed to reduce erosion potential and compaction and to promote re-vegetation. Slash will be redistributed at landings throughout the units so as to not exceed 3 inches in depth to promote re-vegetation. Landings will be treated to a minimum depth of 12 inches (where stumped), planted immediately with a cover crop, and reseeded with native seed.

7. Logging slash will be removed within 25 feet of adjacent Newaygo County roads.

8. Only native species or non-persistent non-native species will be planted in areas where re-vegetation is needed.

9. In all regeneration treatment units, commercial harvest operations will occur between October 1 and March 30.

(2.4.3) Aspen and Jack Pine Regeneration and Red Pine Removal (AJPRP)

The following measures would be applied to all Treatment Units that are prescribed for aspen and jack pine regeneration and red pine removal.

10. In aspen regeneration units, retain all stem wood ‹ 4"; in jack pine regeneration and red pine removal units complete stem removal is desired.

11. Non-commercial operations will occur from July 1 to August 31 in units with high-water tables and/or with an organic soil horizon greater than 3 inches.

12. Residual trees (not shrubs) 1-5" dbh will be felled in the regeneration units, except reserve trees, to promote natural regeneration. Non-invasive shrubs and apple trees will be protected, where possible, in all units.

13. Surveys will be done in all regeneration units to insure that desired stocking levels have been obtained. Tree planting may be done in units that have not obtained 60% stocking following the third growing season after harvest.

(2.4.4) Threatened, Endangered, and Sensitive Species (TES)

The following measures apply to Treatment Units where threatened, endangered, or Regional Forester's Sensitive Species could occur:

14. Project activities will not occur within U.S. Forest Service Compartment 572 Stands 4, 5, 6, 7, 10, and 13 between May 1 and August 31 to protect dispersing Karner blue butterflies.

15. The conservation measures described for unoccupied Karner blue butterfly habitat will be followed within the Project Area.

Table 2-1: Karner Blue Butterfly Conservation Measures

Karner Blue Butterfly Conservation Measures	Occupied Habitat	Unoccupied Habitat
Implement The Karner Blue Butterfly Recovery Plan (USDI Fish and Wildlife Service 2003).	√	√
Trail Management, Vehicle and ORV Traffic, and Camping and Recreation		
Road construction, trail construction, and vegetation management activities will be designed to protect and improve potential Karner blue butterfly habitat.	√	√
Roads and trails will be managed and maintained in a manner to protect or maintain areas with wild lupine. Where this is not feasible and damage is occurring, trails and roads may be relocated or decommissioned.	√	√
Maintenance and use of existing roads and trails will be managed in a manner to protect or maintain occupied habitat and areas with wild lupine. Where this is not feasible and damage is occurring, trails and roads will be relocated or decommissioned.	√	√
Prohibit ORV use with woodland strips or brush piles along trails and roads.	√	
Direct camping to areas outside occupied habitat. Where posted, camping will be prohibited in occupied sites.	√	
Post signs along roads and trails within or adjacent to Karner blue butterfly habitat requesting recreationists to stay on designated roads and trails. If damage from human use is noted within Karner blue butterfly habitat, implement signs and road closures, barricades, or otherwise block public access using a variety of methods such as forest service gates, woven-wire fencing, wind-road slash, rocks, stumps, barrier posts, or cross bucks. Passage for wildlife will be provided regardless of the method used. If closers are needed, a Forest Supervisor's closure order would be written to facilitate enforcement of this protection measure.	√	√
Development		
Oil and gas development will contain a "no surface occupancy" stipulation and will exclude road building.	√	
Habitat Management and Protection		
Conduct annual surveys of proposed treatment units to determine presence/absence of the Karner blue butterfly. These will serve as pre-activity surveys. If the species is found, the Huron-Manistee National Forests will follow the conservation measures for occupied habitat.	√	√
Conduct annual pre- and post-treatment monitoring of habitat conditions (i.e., wild lupine cover, cover of other Karner blue butterfly nectar plants, savanna plant species presence, presence of non-native invasive species, canopy cover) and occurrence or abundance of Karner blue butterflies at selected treatment sites to determine treatment effectiveness and whether measures of restoration success have been accomplished.	√	√
Monitor activities at the project level.	√	√

Table 2-1 (continued): Karner Blue Butterfly Conservation Measures

Karner Blue Butterfly Conservation Measures	Occupied Habitat	Unoccupied Habitat
Maintain or restore Karner blue butterfly habitat using prescribed burning, timber harvest, manual or mechanical vegetation removal, chemical vegetation removal, soil scarification, and seeding/planting methods as outlined in the Forest Plan, Chapter II, and the Final Recovery Plan for the Karner Blue Butterfly, Appendix G.	√	√
Within treatment units managed for Karner blue butterfly, provide savanna-like conditions with an average of 25-50% crown closure and openings with an abundance of wild lupine and other Karner blue butterfly first and second flight nectar plant species.	√	√
Within treatment units managed for Karner blue butterfly, maintain savanna-like conditions by removing woody encroachment and promoting the growth of savanna plant species.	√	√
Within treatment units managed for Karner blue butterfly, provide dispersal corridors in order to facilitate dispersal between occupied and unoccupied areas (suitable habitat sites).	√	√
The application and use of herbicides or pesticides is prohibited in and adjacent to occupied Karner blue butterfly habitat between April 1 and August 15, except when the wind is not blowing toward the habitat and there is a minimum buffer of 100 feet (30 m) between the habitat and the treatment area. Avoid wild lupine during application.	√	
Cutting of trees is prohibited between March 15 and August 15 in occupied sites. Cutting is restricted to a four-year frequency. Allow cutting of trees that pose a safety hazard.	√	
Cutting trees with non-mechanized equipment such as chainsaws is preferred in occupied sites. Other mechanized tree cutting equipment may be allowed by exception. If possible, mechanical and hand pruning of shrubs and tress should be done under frozen ground conditions.	√	
Pile slash not to exceed 20 percent of an occupied site, burning slash piles during the winter and avoiding piling slash in areas containing concentrations of wild lupine.	√	
Locate logging roads, skid trails, and log yards to avoid or minimize impact to occupied sites. Where possible, place landings ≥ 200 m from historically or recently occupied sites.	√	
Mowing and/or brush hogging activities are prohibited between March 15 and August 15 and on a four-year frequency in occupied sites. If possible, mow after August 31 under frozen ground conditions with the mower blade set at 6-8 inches above the ground.	√	
When mowing in occupied sites, divide areas into at least 2 units, each of which supports lupine and nectar sources. At least one unit will remain untreated each season unless there is colonization source within ¼ mile that has the capability to re-colonize the area. Leave cut vegetation on site that may contain eggs, unless the cut vegetation is collected and placed in another suitable habitat site.	√	

Table 2-1 (continued): Karner Blue Butterfly Conservation Measures

Karner Blue Butterfly Conservation Measures	Occupied Habitat	Unoccupied Habitat
When conducting prescribed burns in occupied sites, divide sites into at least three burn units based on numbers of butterflies and burn no more than 1/3 of a site in any one year. If there are less than 10 individual butterflies during the first flight survey, then the entire site can be burned. Create firelines between areas to burned and unburned to protect against wildfire or other chance events. When possible, minimize soil disturbance when constructing firelines by using rotovated or disced breaks.	√	
Keep unburned occupied patches within ¼ mile (0.5 km) of burned occupied sites to aid re-colonization.	√	
Use patchy burns in occupied sites. Design burn areas with irregular shapes and small-scale unburned vegetation-skips.	√	
In occupied sites, use an approximate four-year burning frequency.	√	
Site scarification is prohibited within occupied sites between March 15 and August 15 and on a four-year frequency. Expose mineral soil to aid seeding of native nectar plants. Leave 25 to 50 percent of an occupied site undisturbed. Protect concentrations of wild lupine or other nectar plants.	√	
Propagate wild lupine, nectar plants, and savanna plant species by using seeds with a locally-based genotype when possible. If collected from the site, limit the collection to no more than 25 percent of available seeds and collect after July 1.	√	√
Apply treatments to no more than 1/3 of any particular occupied habitat patch within a calendar year. Treatment will be conducted first on the most degraded third of a patch. This approach will reduce take of Karner blue butterfly and facilitate re-colonization of recently treated portions.	√	
Treatment of more than 1/3 of any particular occupied habitat patch within a calendar year may be conducted when: • Treatment of a larger area is necessary to prevent the spread of invasive species and disease outbreaks which threaten the viability of Karner blue butterfly. • A large viable Karner blue butterfly metapopulation is identified, expanding the focus for treatment from the level of individual habitat patches to the level of the metapopulation complex as a whole. • An occupied habitat patch is less than 1 hectare. A patch this size may be treated in its entirety within a single calendar year if a suitably connected source population exists within 1 kilometer. • Experimental management techniques require testing.	√	
Avoid spreading seeds of weedy exotic plants via equipment. Monitor for invasion of aggressive exotic plants and remove them.	√	√
Activities will be scheduled and completed when they are least likely to impact any life stage of the butterfly.	√	
Watershed management activities that are incompatible with Karner blue butterfly will be excluded.	√	

Table 2-1 (continued): Karner Blue Butterfly Conservation Measures

Monitoring and Evaluation		
Monitoring for Karner blue butterfly and habitat including: - Annual sampling each of the Brohman Metapopulation Area during the first or second flight period to determine population size. Preference should be given to the second flight period because this is when the greatest number of butterflies would be present. - Determining and tracking the amount and condition of habitat maintained and restored annually. - Identifying threats and disturbance factors affecting the Brohman Metapopulation Area and habitat a minimum of every three years. - Assessing the connectivity of subpopulations every three years to confirm that subpopulations remain connected.	√	
Implement recovery measures: inventories, management plans, information and education, restoration, and studies as appropriate.	√	

16. To protect the 2 historically occupied Karner blue butterfly sites that occur adjacent to stands proposed for treatment, herbicide application will be prohibited in U.S. Forest Service Compartment 572 Stands 4, 5, 6, 7, 10, and 13 between April 1 and August 15, except when the wind is not blowing toward the occupied habitat and there is a minimum buffer of 100 feet (30 m) between the occupied habitat and the treatment area.

17. Implement the conservation measures for species viability for the dusted skipper, Ottoe skipper, red-headed woodpecker, whip-poor-will, eastern massasauga rattlesnake, and eastern box turtle outlined in the Programmatic Biological Evaluation for the Huron-Manistee National Forest (USDA Forest Service 2005) on sites where these RFSS are documented or found within the Project Area. The conservation measures outlined for the dusted skipper and Ottoe skipper will be implemented where hill-prairie spittlebug and Sprague's pygarctia are documented or found. Hill-prairie spittlebug and Sprague's pygarctia are documented to occur within or adjacent to U.S. Forest Service Compartment 572 Stands 4, 5, 6, 7, 10, 13, 20, 21, 22, and 29. To protect sites occupied by the hill-prairie spittlebug, project activities within U.S. Forest Service Compartment 572 Stands 4, 7, 10, and 29 are prohibited between May 1 and August 31. In addition, herbicide application will be prohibited in these stands between April 1 and August 15, except when the wind is not blowing toward the occupied habitat and there is a minimum buffer of 100 feet (30 m) between the occupied habitat and the treatment area.

18. Implement the conservation measures described in the Management Recommendations for the Northern Goshawk on the Huron-Manistee National Forests (USDA Forest Service 1993), The Northern Goshawk (*Accipiter gentilis atricapillus*) in the Western Great Lakes Region: A Technical Conservation Assessment (Roberson et al. 2003), the Conservation Assessment for Red-Shouldered Hawk (*Buteo lineatus*) (USDA Forest Service 2002a), and the Programmatic Biological Evaluation for the Huron-Manistee National Forest (USDA Forest Service 2005) on sites where nesting northern goshawks or red-shouldered hawks are documented or found within the Project Area. Active northern goshawk nests are documented to occur and/or were found during field surveys within U.S. Forest Service Compartment 563 Stand 1, and Compartment 572 Stands 34 and 35. Primary and secondary buffers around these active nests, as directed by The Management Recommendations for the Northern Goshawk on the Huron-Manistee National Forests (USDA Forest Service 1993), incorporate the following stands proposed for treatment: U.S. Forest Service Compartment 565 Stands 1, 7, 8, 9, 10, 11, and 12; Compartment 572 Stands 24, 34, 35, and 36; and Compartment 570 Stands 1, 2, 4, and 34.

19. In areas with documented occurrences of active northern goshawk nests or where active northern goshawk or red-shouldered hawk nests are found during project activities, management activities will be prohibited between March 1 and August 31 within primary buffers (660 feet) of active nests. Active nests and at least two alternate nest sites within a 660 foot radius of active nests will be retained. Management activities will not reduce the crown closure within a 660 foot radius of active nest sites below 60%. Activity on Forest Service local roads within secondary buffers (960 feet) of active nest sites will be seasonally restricted or closed. At least 2 large (>10 inch DBH, >10 feet tall) snags per acre and at least 3 large (>10 to 12 inch diameter mid-point, >10 feet long) downed logs per acre will be retained or created within a 0.5 mile radius of active nests. Only management activities with minimal human presence will be permitted within the 0.5 mile radius from March 1 through August 31.

20. Implement the conservation measures described in the Bald Eagle Management Plan for the Huron-Manistee National Forests (USDA Forest Service 2006c), the Northern States Bald Eagle Recovery Plan (USDI Fish and Wildlife 1983), and the Forest Plan's standards and guidelines (USDA Forest Service 2006b) on sites where nesting bald eagles are documented or found within the Project Area. The closest active bald eagle nest is documented approximately 0.5 miles from the Project Area on Croton Dam Pond.

21. Implement the conservation measures outlined in the Marten Conservation Strategy (HMNF 1996), and the conservation measures for species viability for the American marten outlined in the Programmatic Biological Evaluation for the Huron-Manistee National Forest (USDA Forest Service 2005) on sites where the American marten is documented or found within the Project Area.

22. Implement the conservation measures described in the Conservation Approach for Eastern Massasauga (*Sistrurus C. Catenatus*) (USDA Forest Service 2002b) on sites where eastern massasauga rattlesnakes are documented or found within the Project Area.

23. Implement the conservation measures outlined in the Programmatic Biological Evaluation for the wood turtle and Blanding's turtle (USDA Forest Service 2005), the R9 Species Conservation Assessment for Wood Turtle – *Glyptemys insculpta* (USDA Forest Service 2004b), and the Conservation Assessment for Blanding's Turtle (*Emydoidea blandingii*) (USDA Forest Service 2002c) on sites where Blanding's turtles, wood turtles, or spotted turtles are documented or found within the Project Area. Blanding's turtle and spotted turtle were observed within U.S. Forest Service Compartment 566 Stand 34 during field surveys.

24. In areas with documented occurrences of Blanding's turtles or spotted turtles or where Blanding's turtles, spotted turtles, wood turtles, eastern box turtles, or eastern massasauga rattlesnakes are found during project activities, use a firing prescription during the growing season that allows only a flanking and/or backing flame so animals have a greater chance of escape from lower intensity flames. In addition, prior to burns in late spring and summer, these areas will be walked in a transect fashion, and individuals would be removed to safe areas immediately adjacent to the sites during the burn activities. These individuals can be extremely cryptic necessitating that transects be spaced close together. Results of the searches/surveys for reptiles and actions taken if species are found will be recorded and copies given to the District Wildlife Biologist. Management activities within 0.5 miles of occupied waterbodies will occur between Sept. 15 and May 15 to avoid migrating RFSS reptiles.

25. Implement the Standards and Guidelines for Watershed Management described in the Forest Plan (USDA Forest Service 2006b: pages II-17 – II-22) on sites where wood turtles, spotted

turtles, Blanding's turtles, or eastern massasauga rattlesnakes are documented or found within the Project Area.

26. To protect areas of savanna creation and opening restoration from increased recreational use, install signs explaining the benefits of restoring native plant communities and requesting recreationists to stay on designated roads and trails, and implement mitigation techniques that would limit access to managed savannas and openings such as piling brush around the perimeter of treatment areas.

27. Flag or mark the locations of nests, roosts, burrows, or dens of rare or sensitive wildlife species, and carefully perform management activities to avoid physical injury to such structures and less mobile wildlife. If RFSS reptiles are encountered during project implementation, inform the District Wildlife Biologist, and avoid harming or harassing individuals. Individuals will be moved to a nearby safe area.

28. If nesting activities are noted from any RFSS species, inform the District Wildlife Biologist so that appropriate protection can be administered.

29. The botanical staff will pre-survey areas of proposed treatment for herbicide treatment to minimize negative effects to RFSS in prairie remnants.

30. The botanical staff will clearly mark the location of purple milkweed prior to Forest management activities being implemented.

31. The botanical staff will field review areas not previously surveyed prior to wildlife opening management activities prior to implementation of ground-treatment.

32. If other endangered, threatened, or sensitive species are found during project implementation, the project would stop until the District Wildlife Biologist or Botanist is informed and adequate protection measures applied to avoid potential impacts.

(2.4.5) Herbicides (H)

The following mitigation measures refer to the use of herbicides in Treatment Units to prevent the spread of non-native invasive species:

33. All guidelines and mitigation measures presented in the Forest Service Manual 2150, *Pesticide Use Management and Coordination*, and in the Forest Service Handbook 2109.14, *Pesticide Use Management and Coordination Handbook*, will be adhered to in herbicide application on the Huron-Manistee National Forests. Also, compliance with all federal, state, and local regulations regarding herbicide use will be met.

34. In general, all treated areas will be identified on the ground, notifying visitors of the herbicide treatment; the signs will be removed when the risk of direct exposure has passed. In areas that may be difficult to close (such as trailheads), applicators/helpers will stay at the treated location until the treated foliage is dry and the risk of direct exposure has passed.

Table 2-2: General Guidelines for Re-entry into Treated Areas

Herbicide	Non-Worker Protection Standard Used	Restricted Entry Interval (REI) **
Glyphosate	Keep people and pets off treated areas until spray solution has dried.	Minimum of 12 Hours

Data obtained from herbicide product labels.

** The Baldwin-White Cloud Districts of the Huron-Manistee National Forest does not meet the criteria for 40 CFR part 170. 40 CFR part 170 applies to occupational exposures to pesticides used in the production of agricultural plants on farms, nurseries, greenhouses, and forests. Agricultural plant means any plant grown or maintained for commercial or research purposes (USEPA, Office of Pesticide Programs).

35. Notices will be posted near all treated areas and will contain the following information:
    Notice that the area has been, or will be, treated,
    Name of herbicide used,
    Appropriate precautions, and
    Date and time when re-entry is safe.

36. Notices will be removed by Baldwin-White Cloud District personnel when the treated area is considered safe.

37. To minimize herbicide drift, herbicides will be applied only when wind speeds are less than 10 mph. Where possible, the low nozzle pressure and large droplet size will be used as permitted by the label (Forest Service Handbook [FSH] 2109.14, 52.22).

38. Herbicides will be applied in complete compliance with the product label (FSH 2109.14, 52.11).

39. Herbicide application will be performed by certified personnel (FSM 2154.2).

40. Applicators or operators must wear all protective gear required on the label of the herbicide they are using (FSH 6709.11).

41. Herbicide containers will be recycled or disposed of per guidelines in FSH 2109.14, 43.

42. Herbicides will be stored in appropriate buildings or facilities according to label specifications, state, and federal laws, and Forest Service regulations. Containers will be labeled with the following: contents, date mixed, and approximate volume remaining when placed in storage (Pesticide Use Management and Coordination Handbook; FSH 2109.14, 41.11).

43. Material Safety Data Sheets (MSDS) for herbicides will be kept on site (FSH 2109.14, 41.11).

44. To prevent application prior to extreme rain events and prevent runoff to adjacent sites and aquatic systems, herbicide applicators will obtain a weather forecast of the treatment area prior to initiating a spraying project.

45. Temporary covers may be used to protect individuals or populations of threatened, endangered, or sensitive plant species during nearby application of herbicides.

46. Herbicide treatment will not occur near active nest sites for threatened, endangered, and sensitive bird species.

47. Mechanically removed specimens of non-native invasive specie(s) having reproductive parts will be placed in containers and disposed of in a manner that reduces the spread of that species.

48. Displaced soil from mechanical removal of non-native invasive species will remain on-site.

(2.4.6) Equipment Cleaning (E)

The following mitigation measures refer to the use of use of herbicides in Treatment Units to prevent the spread of non-native invasive species:

49. Equipment shall be cleaned between treatment stands if there is a difference in the composition of NNIS species that are Species of Concern.

(2.5) Monitoring

Monitoring is a means of measuring the effects of actions on the Forest. Monitoring would be conducted to determine if resource management objectives of the Mast Lake Project have been met. Monitoring results would be used to verify the implementation and effectiveness of selected mitigation and protective measures in a timely manner. The following monitoring needs were recognized and are described below.

(2.5.1) Implementation Monitoring

Contract Administration

Objective: Ensure that mitigation measures in Treatment Units are implemented.
Desired Results: All contract requirements are met.
Methods: District personnel will visit all Treatment Units and roads. Reviews will be documented in inspection reports regarding contract compliance.
Responsiblility: District Assistant Ranger for Implementation

(2.5.2) Effectiveness Monitoring

Reforestation

Objective: Ensure that reforestation occurs within five years of treatment.
Desired Result: Adequately reforested stands.
Methods: Stocking surveys within the first five years after the treatment of a unit.
Responsibility: Shared-Services Silviculturist.

Dry Sand Prairie Restoration

Objective: Ensure that revegetation of a diverse suite of dry sand prairie plants occurs within five years of treatment.
Desired Result: Stands being restored to dry sand prairie are revegetated with a suite of prairie plants and that the presence of invasive plant species is limited to <5%.
Methods: Conduct meandering plant surveys annually for 5 years after conducting restoration activities.
Responsibility: Shared-Services Botanist

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Invasive Plants/Noxious Weeds

Objective: Ensure that the presence and spread of invasive plants and noxious weeds is minimized through NNIS treatment.
Desired Result: A reduced presence of invasive plants and noxious weeds would result from the project activities.
Methods: Ocular inspection for the first two years after the treatment of a unit.
Responsibility: Shared-Services Botanist

Road Closures

Objective: Ensure that the road closures are maintained throughout the Project Area.
Desired Result: Roads closed are not re-opened by the public.
Methods: Ocular inspection within the first five years after the road closures occur.
Responsibility: District Assistant Ranger for Implementation

Heritage Resources

Objective: Ensure that there are no negative impacts to heritage resources as a result of treatments.
Desired Result: No damage to recorded archaeological sites within the Project Area.
Methods: Ocular inspection within the first five years after the treatments of the units will occur.
Responsibility: Shared-Services Archaeologist

Erosion

Objective: Ensure that erosion does not occur as a result of mechanical harvesting equipment on slopes.
Desired Result: No erosion would occur.
Methods: Ocular inspection during operations and continuing periodically for five years after a unit is treated.
Responsibility: District Assistant Ranger for Implementation

Raptor Nests

Objective: Ensure that existing raptor territories were protected.
Desired Result: No adverse effects to the existing raptor territories.
Methods: Ocular inspections of territories periodically for five years after the units are treated.
Responsibility: District Wildlife Biologist

(2.6) Alternatives Not Considered in Detail

Federal agencies are required by the National Environmental Policy Act to explore and evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). A number of alternatives were considered, but dismissed from detailed consideration for reasons summarized below.

(2.6.1) Original Proposed Action

The Mast Lake Project Public Scoping Letter, dated January 9, 2008, identified a series of proposed treatments. Based on the findings from ID Team field reviews and the input received during the scoping process, some of these treatments were dropped from consideration, modified, or incorporated into one of the action alternatives. New treatments were also identified during this time. The following table displays the differences between the treatments that were originally proposed and the alternatives that are being carried through this analysis.

Table 2.3: Comparison of the Action Alternatives and the Original Proposed Action

		Measure	Initial Proposed Action	Alternative 2	Alternative 3
Objective: Vegetative Treatments					
Type	**Treatment(s)**				
Red Pine	Thinning	Acres	396	286	349
Red Pine	Regeneration	Acres	0	0	23
Aspen	Clearcut	Acres	140	116	116
Jack Pine	Regeneration	Acres	0	40	40
Jack Pine	Shaded Fuelbreak	Acres	78	0	0
Scotch Pine	Removal	Acres	0	23	23
Total		**Acres**	**614**	**465**	**551**
Objective: Wildlife Habitat Creation					
Type	**Treatment(s)**				
Mixed Oak	Habitat Creation Cut	Acres	50	35	35
Opening	Maintenance	Acres	73	44	52
Opening	Expansion	Acres	0	63	63
Aspen	Non-commercial	Acres	0	24	24
	Expansion	Acres	38	38	38
Total			**161**	**204**	**212**
Objective: Roads Management					
Roads Left Open in the Project Area (County, Forest Service, Unauthorized User-Created)		Miles	20.4	20.4	25.4
Classified Road Closures (Forest Service Roads)		Miles	5.9	5.9	5.3
Unclassified Road Closures (Unauthorized User-developed Roads)		Miles	11.9	11.9	7.5
Resulting Road Density (County, Forest Service, Unauthorized User-developed)		Miles	**3.3 mi/mi²**	**3.3 mi/mi²**	**4.1 mi/mi²**
Objective: Non-native/Invasive Species Treatment		**Measure**	**Initial Proposed Action**	**Alternative 2**	**Alternative 3**
Type					
Marsh Thistle		# of Sites	1	1	1
Barberry		# of Sites	3	6	6
Autumn Olive		# of Sites	2	9	9
Leafy Spurge		# of Sites	2	12	12
Garlic Mustard		# of Sites	1	3	3

Table 2.3 (continued): Comparison of the Action Alternatives and the Original Proposed Action

Objective: Non-native/Invasive Species Treatment	**Measure**	**Initial Proposed Action**	**Alternative 2**	**Alternative 3**
Type				
Honeysuckle	# of Sites	0	16	16
Bull Thistle	# of Sites	0	1	1
Hoary Alyssum	# of Sites	0	5	5
Smooth Brome	# of Sites	0	1	1
Spotted Knapweed	# of Sites	0	11	11
St. Johnswort	# of Sites	0	7	7
Sweetclover	# of Sites	0	2	2
White Sweetclover	# of Sites	0	1	1
Total Number of Sites		**9**	**75**	**75**
Total Acres		**0.9**	**9.4**	**9.4**
Objective: Prairie Restoration				
Complete Tree/Stump Removal, Prescribed Burning, Site Preparation, and Seeding	Acres	77	≤177	≤83
Herbicidal Treatment of NNIS	Anticipated Acres	0	≤17.7	≤8.3
Other Activities				
Trash Removal	# of Sites	22	20	20
ORV Restoration	# of Sites	2	2	2
Change in Land Suitability Class	Acres	77	145	59
Easements Required	Yes/No	No	Yes	Yes

The Initial Proposed Action included prairie restoration efforts in areas that were identified during the initial field reviews within the Project Area. During the scoping period, additional efforts were made by the team to specifically identify the locations where successful restoration could occur. The selection criteria for these areas was based on the locations of the historic Newaygo prairie, existing remnant prairie habitat, and the location of the appropriate soils (Sparta), both non- and heavily- eroded. Based on this information, the team modified some of the vegetative treatments.

Some red pine stands (~100 acres) that were originally proposed for thinning, were changed to dry-sand prairie restoration. An additional red pine stand (~23 acres) was added for restoration under Alternative 2 and for red pine regeneration under Alternative 3. Other areas that are included for dry-sand prairie restoration in at least one action alternative, but were not part of the Initial Scoping letter include: white pine (7 acres), openings (26 acres), and mixed oak (4 acres). The acres that are shown for changes in the Land Suitability Class are representative of the acres of currently forested stands that would change to non-forested as a result of prairie restoration efforts.

The Initial Scoping Letter also proposed the creation of a shaded fuelbreak (72 acres) in a jack pine stand. In an effort to create suitable habitat for the American pine marten in this area, while still reducing the existing fuel hazard, the team opted to shift this to a 40 acre regeneration harvest in the western portion of the jack pine stand. Scotch pine (23 acres) was identified within the Project Area after the scoping

letter had been sent out to the public. All of the Scotch pine areas identified in the Project Area were included in the analysis for this project, as Scotch pine is considered to be a NNIS and (in this Project Area) contributes to the fuel loading within the area where it is found.

The acres of wildlife habitat cuts would be reduced from 50 to 35 acres under the action alternatives due to identifying the specific location of the aspen clones within a 30 acre red oak stand. This reduced the treatment area of this stand from 30 to 15 acres. There would also be 24 acres of aspen that were identified in the Initial Scoping Letter for aspen management that would be treated non-commercially under Alternatives 2 and 3.

Changes also occurred in the amount of designated openings that would be maintained and/or expanded throughout the Project Area. While the number of openings to be maintained was reduced, there were increased expansion activities proposed for the openings left in the project in the form of overstory canopy reduction and the planting of fruit- and mast-bearing shrubs. This accounts for the differences that exist in the acreages for these treatments between the Initial Proposed Action and Alternatives 2 and 3.

The increase in the potential areas to be treated for non-native and/or invasive species in this project results from a combination of two factors: 1) an increase in the amount of non-native and/or invasive species that were identified while the team reviewed the Project Area, and 2) the recognition that these species serve as a threat to the successful establishment of dry sand prairie habitat. For the latter, incorporating the potential use of herbicides would limit the ability of NNIS to serve as pioneer species in the restoration areas. As previous restoration work of this habitat type has indicated NNIS establishment of ~10% (Nature Conservancy, 2008), this level of control is the value that has been used for this project.

(2.6.2) Management of the Transportation System

There were two considerations regarding the management of the Transportation System within the Project Area that did not get carried through the analysis.

Consideration 1: Thrush Drive is a Newaygo County road that runs east off of Cypress Road, before turning to the south to connect with Two Mile Road (Appendix A, Compartment 564). There are numerous historic dump sites located along this road. It was brought out during the scoping process that Newaygo County had abandoned, but not yet closed, this road. Upon further investigation, it was found the county had only de-classified this segment of road. De-classification by the county means that the road is still under their jurisdiction, but that they no longer maintain the road. Had this road been abandoned by Newaygo County, the ID Team would have considered the future management of this road in the alternatives of this analysis.

Consideration 2: A portion of Locust Road runs south off of 12th Road before dead-ending at private property (Appendix A, Compartment 570). There is an effective barrier located off of 20th road, at the location where Locust Road historically intersected. The ID Team considered the development of a route that would connect 20th Road in the south to the southern end of Locust Road in the north. Upon further review, the team decided that the focus in this specific area should be in first rehabilitating the area damaged by ORVs before new access connecting the two roads is created.

(2.6.3) Eliminating Dry Sand Prairie Restoration

The Forest Plan (2007) lists as an objective: "Restore and maintain savannahs, prairies, dry grasslands, mesic grasslands, shrub/scrub and oak-pine types in areas where they were known to previously occur, to provide for habitat diversity and to meet species viability needs." More specifically, an objective in Management Area 4.4 is to: "Create dry prairie habitat on Sparta soils series." The ID Team considered whether individual remnant prairie areas (such as those found in the Project Area) should be treated

independently or if all of the historic prairie areas should be treated as a whole and analyzed together at another time. The team agreed to begin the prairie restoration efforts through this project, as the area previously contained the dry-sand prairie habitat, the Sparta soil series was present throughout the area, and the preliminary work (surveys, etc) had been completed.

(2.6.4) Increased Oak Harvesting and Opening Maintenance

When the team began the field reviews for this project, there were 596 acres of the oak cover type and 137 acres of openings that had been surveyed for some type of treatment. The majority of the oak stands were located in Compartments 564, 566, and 567. Upon a further review of these stands, in conjunction with the management that was occurring on the adjacent private lands, the team concluded that the area was currently providing suitable habitat for a suite of interior wildlife species. A habitat type that is atypical on National Forest System lands. As a result, the team shifted the focus of management activities in this portion of the Project Area away from early- successional species. This eliminated the need to carry the oak regeneration harvests and some of the opening maintenance through the analysis process.

(2.7) Treatment Summary by Alternative

The following table displays the treatments that would occur under each of the alternatives for the Mast Lake Project.

Table 2.4: Treatment Summary by Alternative

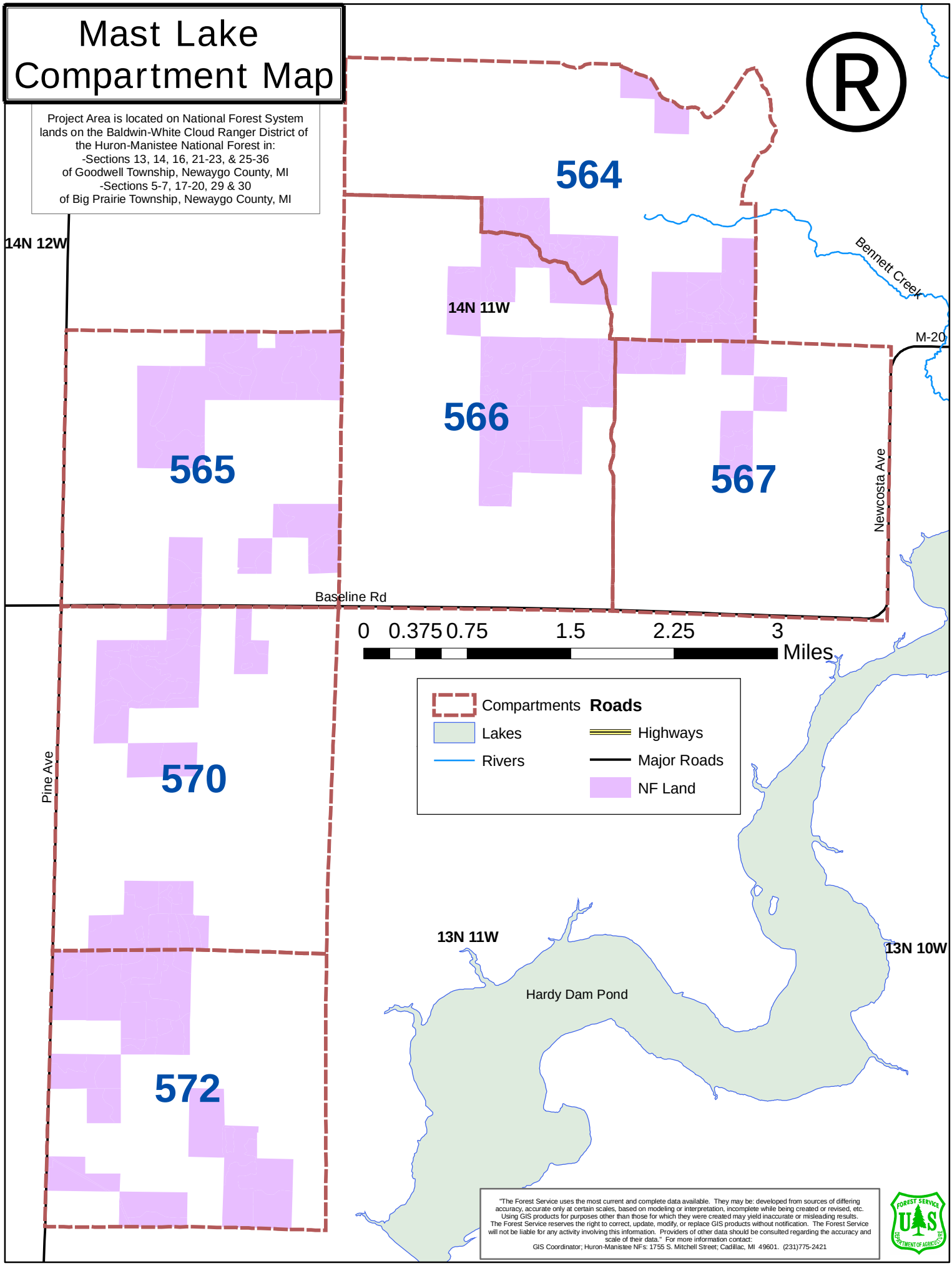
		Measure	Alternative 1	Alternative 2	Alternative 3
Objective: Vegetative Treatments					
Type	**Treatment(s)**				
Red Pine	Thinning	Acres	0	286	349
Red Pine	Regeneration	Acres	0	0	23
Aspen	Clearcut	Acres	0	116	116
Jack Pine	Regeneration	Acres	0	40	40
Scotch Pine	Removal	Acres	0	23	23
Total		Acres	0	465	551
Objective: Wildlife Habitat Creation					
Type	**Treatment(s)**				
Mixed Oak	Habitat Creation Cut	Acres	0	35	35
Opening	Maintenance	Acres	0	44	52
Opening	Expansion	Acres	0	63	63
Aspen	Non-commercial	Acres	0	24	24
	Expansion	Acres	0	38	38
Total			0	204	210
Objective: Roads Management					
Roads Left Open in the Project Area (County, Forest Service, and Unauthorized User-created Roads)		Miles	38.2	20.4	25.4
Classified Road Closures (Forest Service Roads)		Miles	0	5.9	5.3
Unclassified Road Closures (Unauthorized User-created Roads)		Miles	0	11.9	7.5
Resulting Road Density (County, Forest Service, Unauthorized User-created)		Miles	6.1 mi/mi²	3.3 mi/mi²	4.1 mi/mi²
Permanent Forest Road Improvements		Locations	0	9	9
Temporary Road Improvements		Locations	0	6	6
Objective: Herbicide NNIS					
Type	**Number of Sites**				
Marsh Thistle	1	Acres Identified	0	0.1	0.1
Barberry	6		0	0.6	0.6
Autumn Olive	9		0	0.9	0.9
Leafy Spurge	12		0	1.2	1.2
Garlic Mustard	3		0	0.3	0.3
Honeysuckle	16		0	1.6	1.6
Bull Thistle	1		0	0.1	0.1
Hoary Alyssum	5		0	0.5	0.5
Smooth Brome	1		0	0.1	0.1
Spotted Knapweed	11		0	3.0	3.0
St. Johnswort	7		0	0.7	0.7
Sweetclover	2		0	0.2	0.2
White Sweetclover	1		0	0.1	0.1
Total	75		0	9.4	9.4

Table 2.4 (continued): Treatment Summary by Alternative

Objective: Prairie Restoration					
Tree Removal, Stump Removal, Prescribed Burning, Site Preparation, Seeding	Forested Stands	Acres	**0**	**≤145**	**≤57**
	Openings		**0**	**≤32**	**≤26**
Herbicidal Treatment of NNIS	Forested Stands	Acres Anticipated	**0**	**≤14.5**	**≤5.7**
	Openings		**0**	**≤3.2**	**≤2.6**
Other Activities					
Trash Removal		Sites	**0**	**20**	**20**
ORV Restoration		Sites	**0**	**2**	**2**
Change in Land Suitability Class		Acres	**0**	**149**	**57**
Stand Boundary/Area Adjustments					
Number of Stands with Decreased Area		Each	**0**	**5**	**5**
Number of Stands with Increased Area		Each	**0**	**2**	**2**
Number of New Stands Created		Each	**0**	**3**	**3**
Number of Stands Combined		Each	**0**	**7**	**7**
Easements Required		Yes/No	**No**	**Yes**	**Yes**

Mast Lake Compartment Map

Project Area is located on National Forest System lands on the Baldwin-White Cloud Ranger District of the Huron-Manistee National Forest in:
-Sections 13, 14, 16, 21-23, & 25-36 of Goodwell Township, Newaygo County, MI
-Sections 5-7, 17-20, 29 & 30 of Big Prairie Township, Newaygo County, MI



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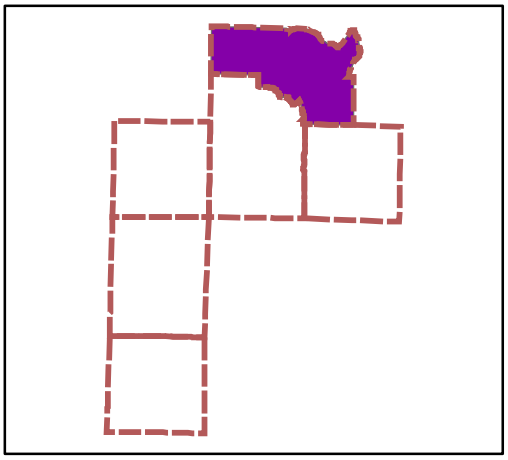
Mast Lake Project

Proposed Activities

Compartment 564

Alternatives 2 & 3



Roads
Aspen Expansion
Prescribe Burn
Aspen Final Harvest
Opening Maintenance
Opening Expansion
Compartments
NF Land

0 0.125 0.25 0.5 0.75 1 Miles

4_MILE
4 MILE
JACKSON
CYPRESS
COTTONWOOD
3_MILE
THRUSH DRIVE
UCD
UC25
FR9026O
UC24
UC26
ELM
UC40
FR9026-T
UC39
FR5900
UC33
FR9617
UC37
UC32
UC38
TWO_MILE

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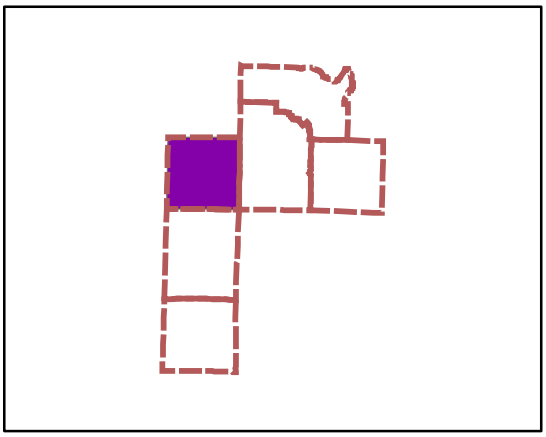
Mast Lake Project
Proposed Activities
Compartment 565
Alternatives 2 & 3



3_MILE

TWO_MILE

UC19

UC21

UC23

ELM

FR9634

FR9610

HEMLOCK

ONE_MILE

Miles

0 0.1 0.2 0.4 0.6 0.8

Aspen Noncommercial

Roads

Compartments

NF Land

LOCUST

PINE

MI-20

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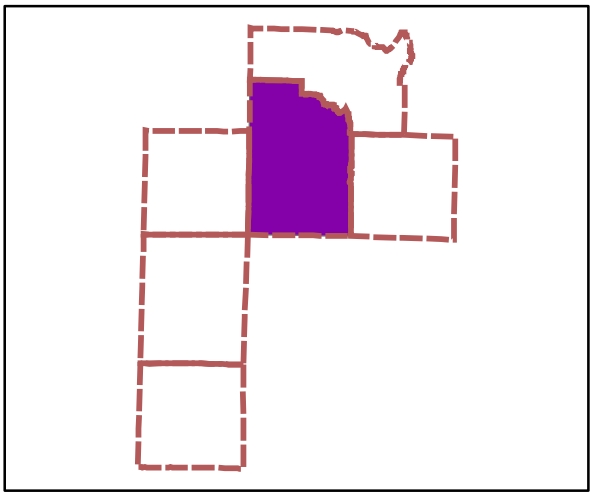
Mast Lake Project
Proposed Activities
Compartment 566
Alternatives 2 & 3



- Prescribe Burn
- Roads
- Aspen Final Harvest
- Aspen Expansion
- Opening Maintenance
- Opening Expansion
- Wildlife Habitat Improvement
- Compartments
- NF Land

Miles
0 0.04 0.08 0.16 0.24 0.32

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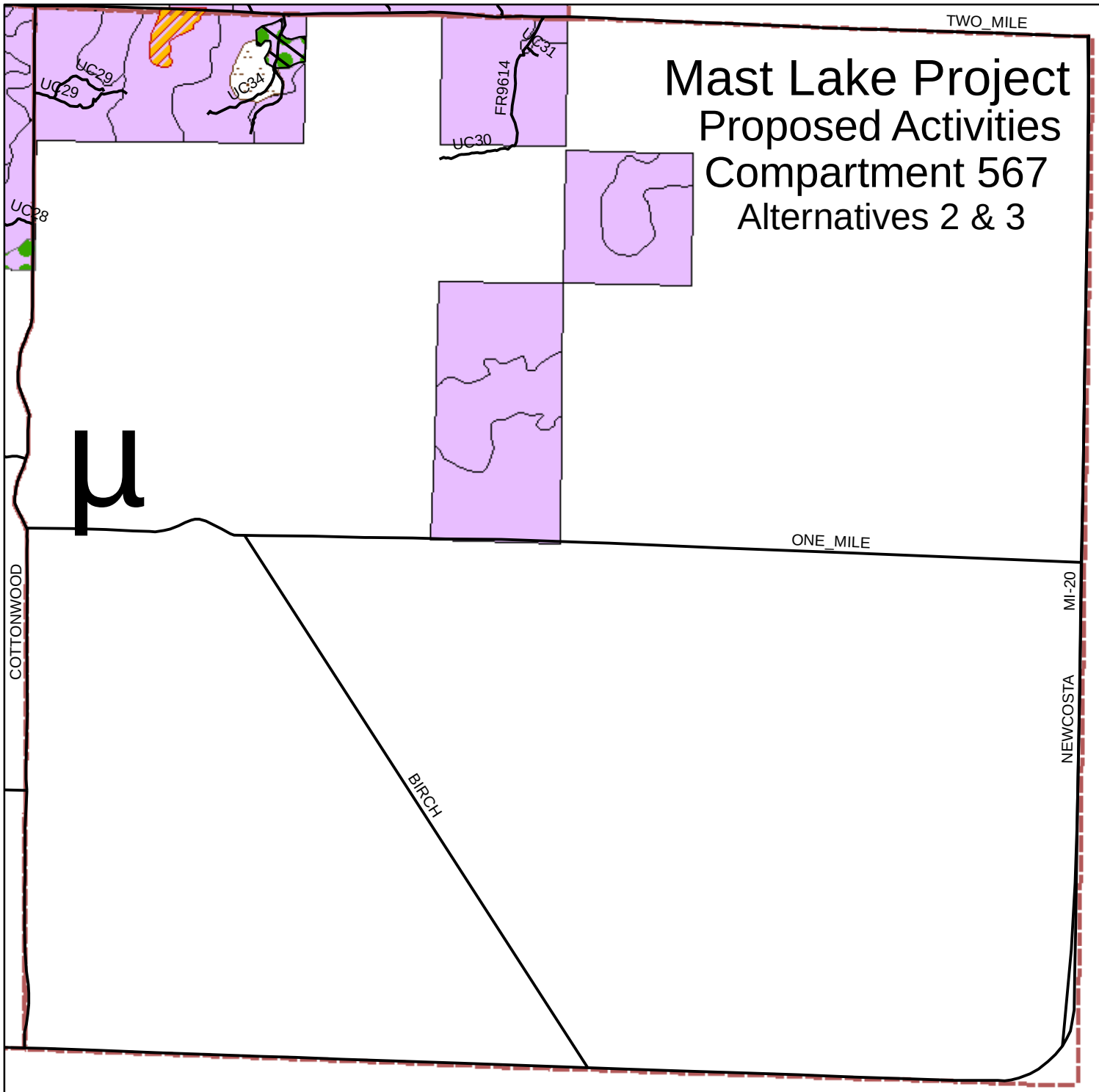
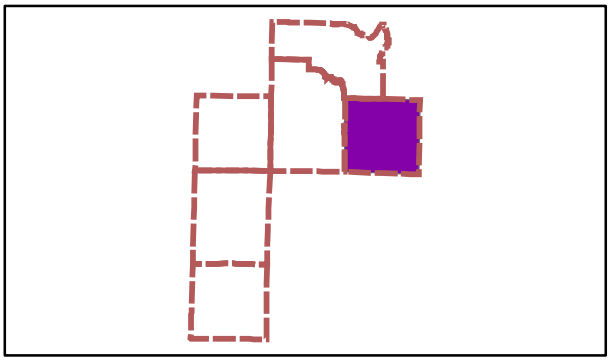
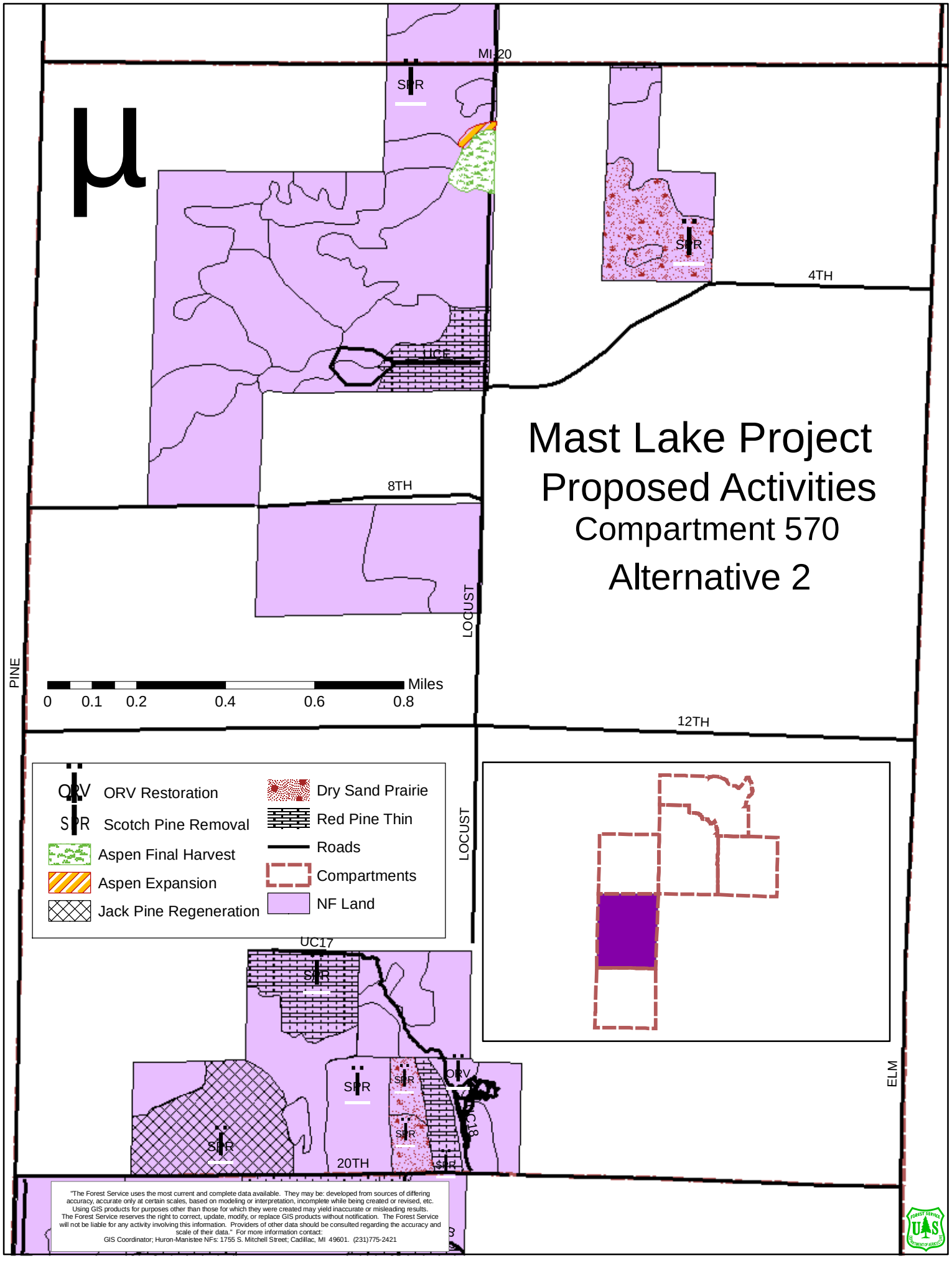


Mast Lake Project
Proposed Activities
Compartment 567
Alternatives 2 & 3

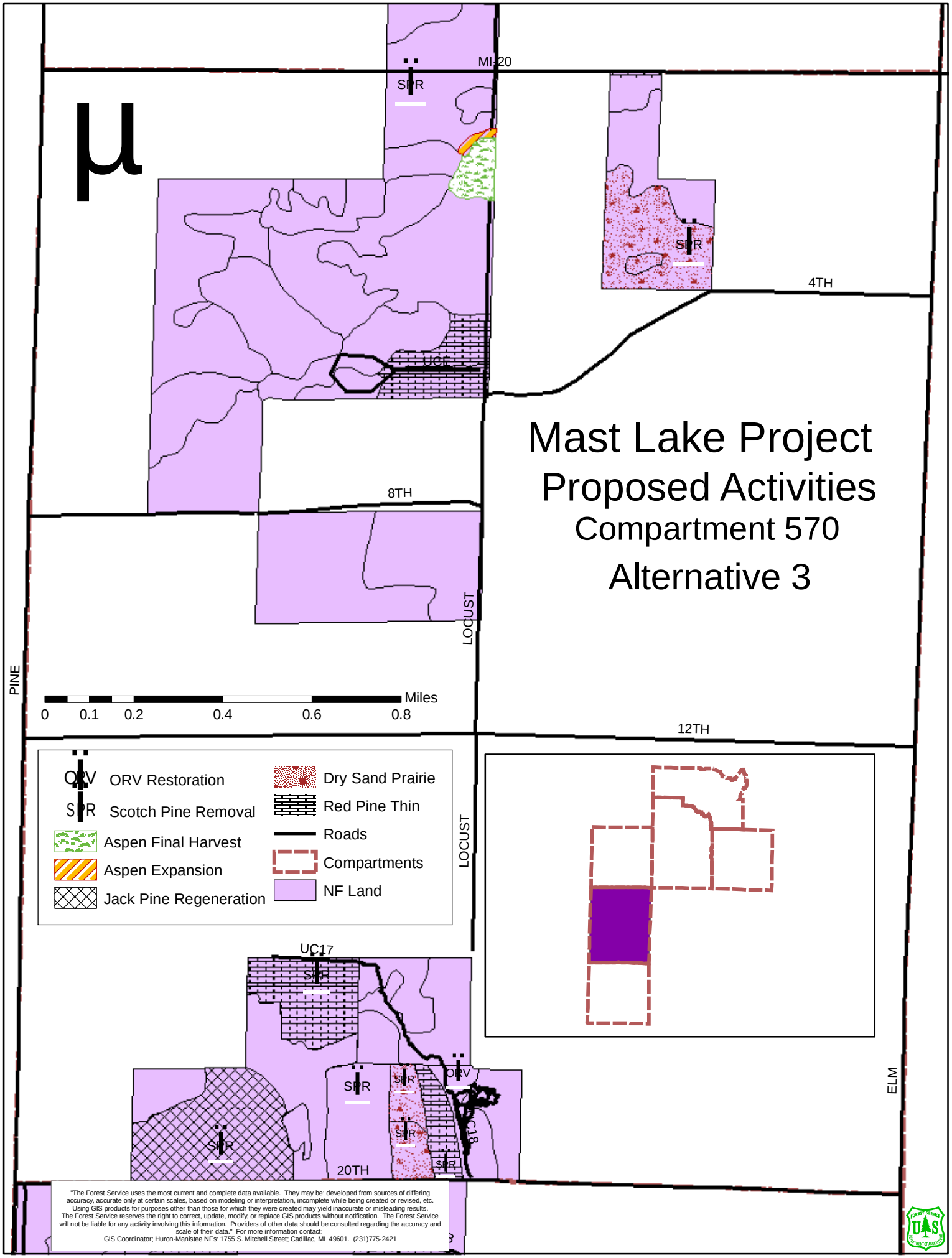
- Prescribe Burn
- Roads
- Aspen Final Harvest
- Aspen Expansion
- Opening Maintenance
- Wildlife Habitat Improvement
- Compartments
- NF Land

0 0.1 0.2 0.4 0.6 0.8 Miles





Mast Lake Project
Proposed Activities
Compartment 570
Alternative 2



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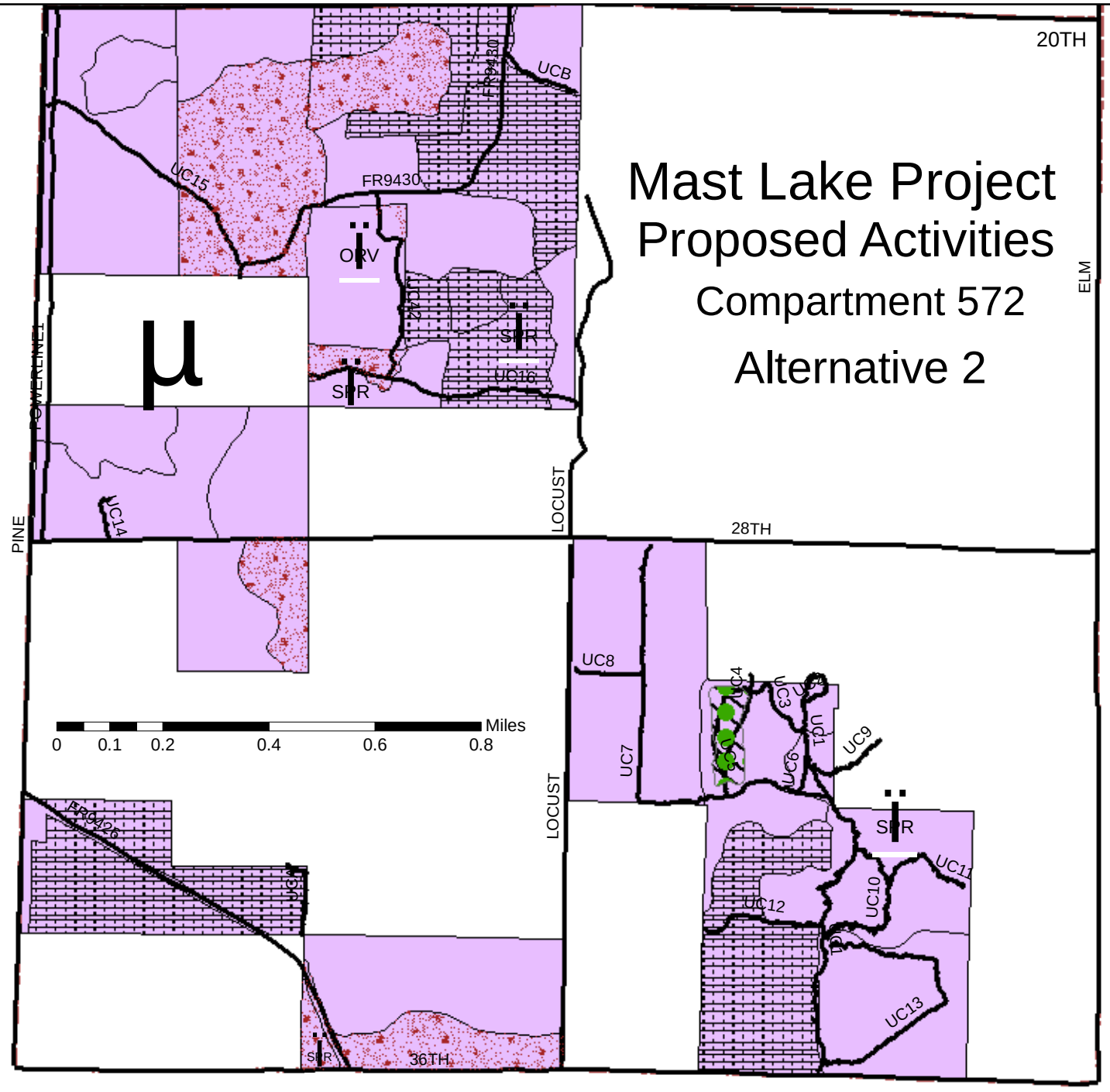
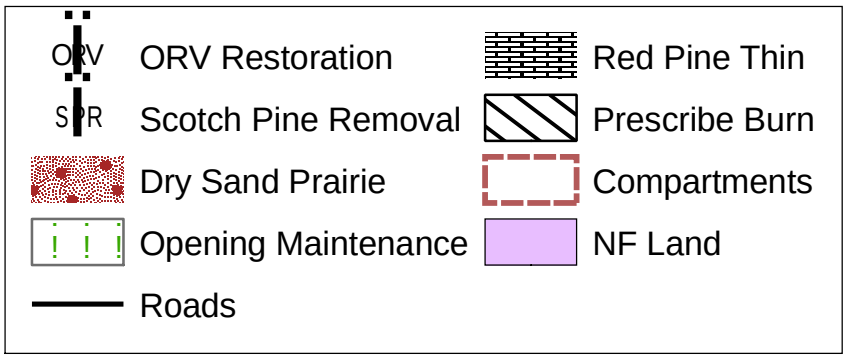
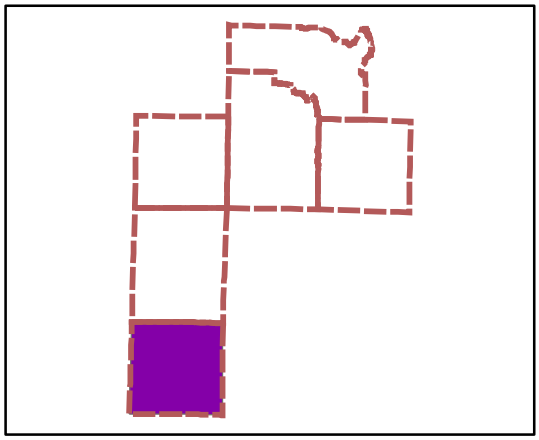
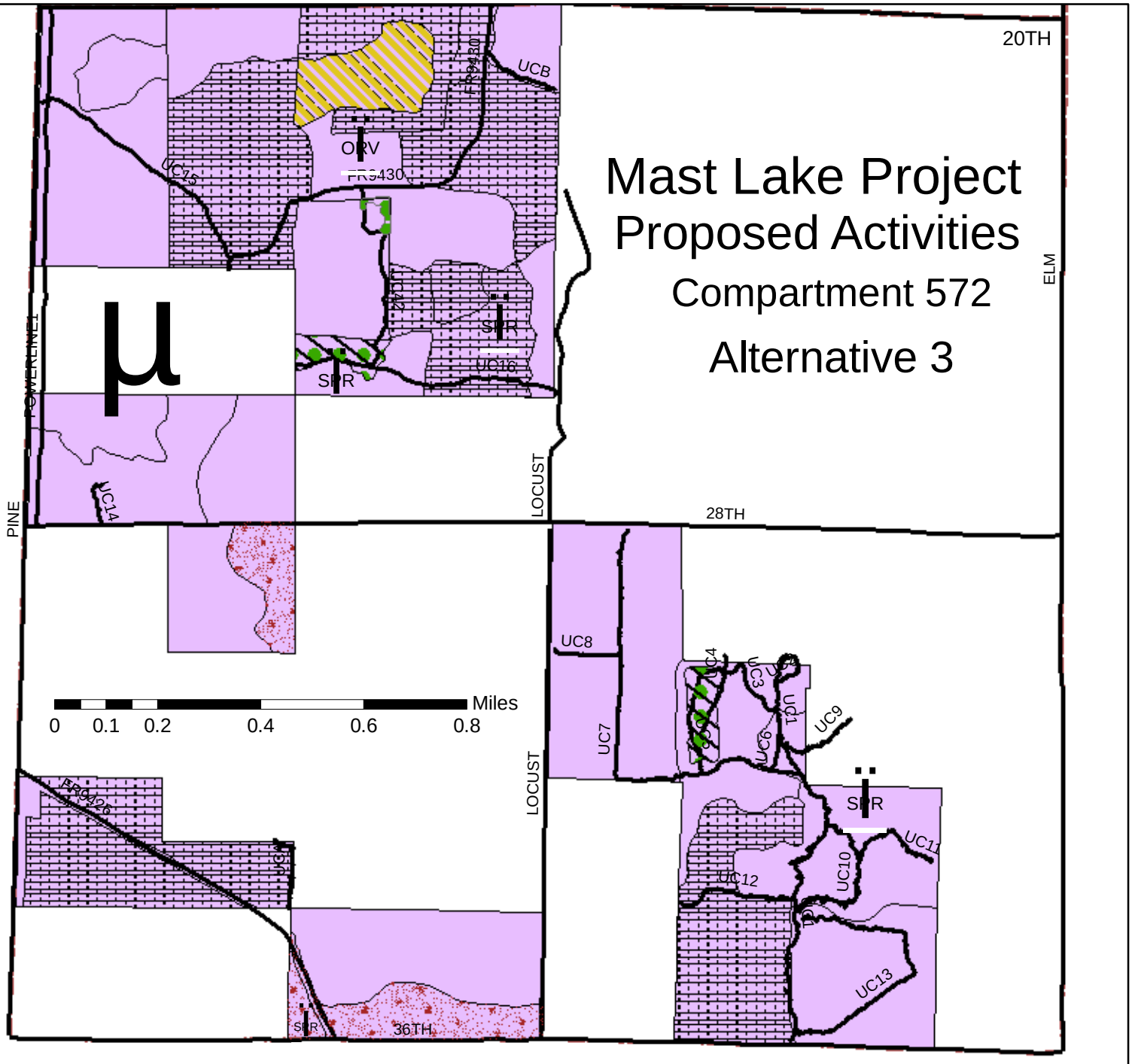
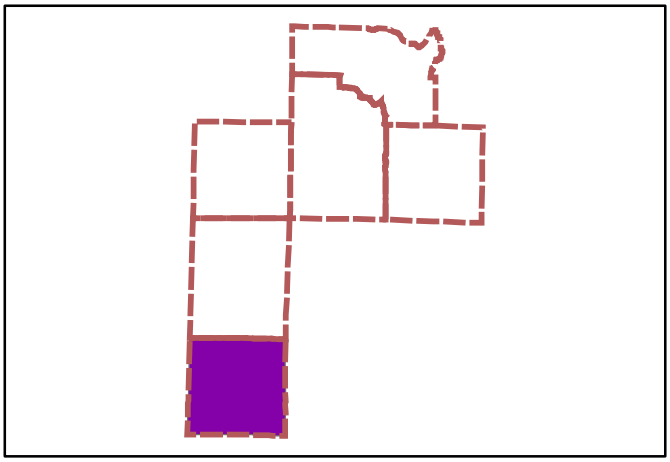
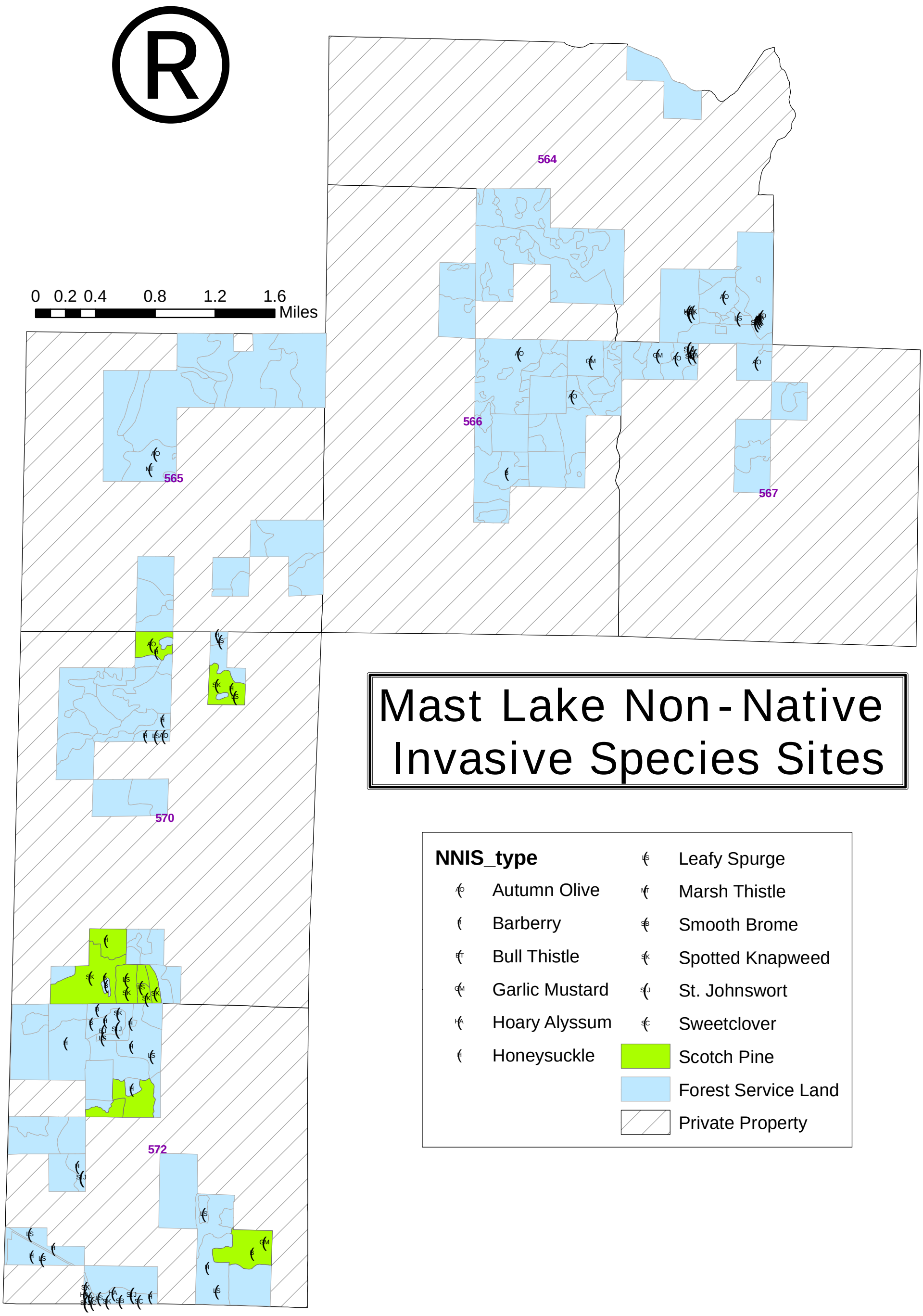












Mast Lake Non-Native Invasive Species Sites

NNIS_type

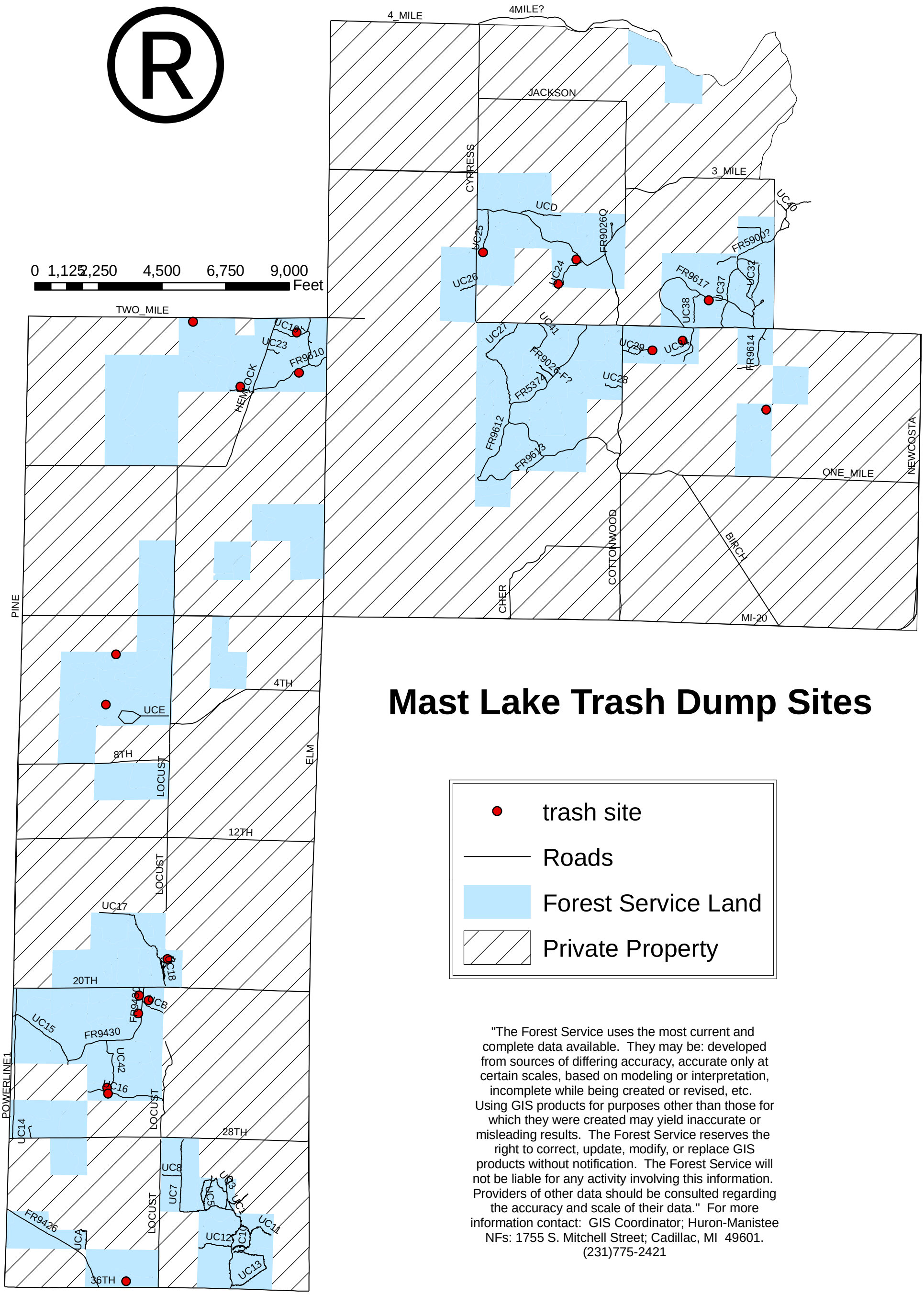
- AO Autumn Olive
- B Barberry
- BT Bull Thistle
- GM Garlic Mustard
- HA Hoary Alyssum
- H Honeysuckle
- LS Leafy Spurge
- MT Marsh Thistle
- SB Smooth Brome
- SK Spotted Knapweed
- SJ St. Johnswort
- SC Sweetclover

Scotch Pine

Forest Service Land

Private Property

Mast Lake Trash Dump Sites



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Chapter 3: Affected Environment and Environmental Effects

(3.1) Introduction

This chapter presents information on the existing conditions in the Mast Lake Project Area (Project Area) and an analysis of the effects that the proposed actions would have on the environment under each alternative. The existing condition and environmental effects are discussed together under each resource area. This chapter presents a summary of the analysis and the data utilized in completing the analysis. Supporting documentation used to complete the analysis is in the Planning Record. The Planning Record is available for review at the Baldwin-White Cloud Ranger District.

(3.2) Timber, Woodland, and Fuels Management

(3.2.1) Area of Analysis

The area of analysis for the direct and indirect effects on timber, woodland, and fuels management is the National Forest System lands where treatments would occur, and adjacent National Forest and private lands within ¼ mile of treatment sites. The area of analysis for the cumulative effects is the Manistee National Forest, including State of Michigan and private lands, within its proclaimed boundary. This large area allows for a comparison to be made on current and future vegetative patterns on similar forest ecosystems, in response to market and non-market forces.

(3.2.2) Resource Information and Existing Condition

Age Classes, Species, and Structure

The vegetation of the Project Area is dominated by aspen, pine, and oak species, with individual areas assigned a cover type based on which species dominate the overstory. Most of the forest stands were established 35 to 110 years ago by natural regeneration (oak and aspen) or planting (pine). Non-forested areas, especially upland openings, have declined during this period because of tree planting and tree encroachment (natural succession), in conjunction with fire suppression. The current age class distribution by forest type is displayed in Table 3.1, Acres of Forest Types by Age Class, 2008. The vertical structure of the existing vegetation is predominantly even-aged, with most trees having similar diameters, heights, and ages in any particular stand. Seedlings and saplings are numerous, but a dominant canopy layer is typical. The shrub and herbaceous layers are described in the Herbaceous and Understory Vegetation portion of this document.

Table 3.1: Acres of Forest Types by Age Class, 2008 - (National Forest System Lands Only)

Forest Type	Age Class												
	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+	No Age	Total
Jack Pine & Jack Pine-Oak			20				124						144
Red & White Pine			69		173	53	608	42	48	33	43		1,069
Northern Hardwoods		6			51								57
Mixed Lowland Conifers											21		21
Long Rotation Oak		1						110	204	264	415		994
Short Rotation Oaks				47	43			127			128		345
Mixed Lowland Hardwoods			107			11				54	79		251
Quaking & Bigtooth Aspen		147	84	400	6	7		154	17				815
Upland Opening & Lowland Brush												311	311
Total		154	280	447	273	71	732	433	269	351	686	311	4,007

Groups of Similar Vegetation

The Forest Plan gives vegetation composition objectives for the desired amount of each forest type, based on the natural capability of the land, for all of the Manistee National Forest lands. This natural capability of the land to grow trees is measured by the site index. The site index measures the productivity of a particular site by relating the age and height of co-dominate trees and comparing that to compiled charts of the same species. These charts produce a prediction of growth for a stand of similar species. For this analysis, oak stands having a site index value ≤ 55 are short rotation oaks. Oak stands having a value > 55 are long rotation oaks. Long rotation conifers are the red and white pine group. The vast majority of pine stands in the project area are red pine plantations, established for land reclamation. Many of these plantations occur on the highly eroded Sparta soils series where historic prairies once existed. Short rotation pine for this analysis includes Scotch and jack pines. The long and short rotation designation for pines is based on the species longevity, not site index.

The Forest Plan gives objectives for the amount of each major vegetation type found on the Forest. Similar forest cover types are grouped together using biological and silvicultural criteria. These are displayed in Table 3.2, Manistee National Forest Desired, Existing, & Project Area Vegetative Type Composition. These objectives serve as guidance for the desired vegetative composition on the Forest as a whole and should not be implied to fit any given smaller sections of the Forest at a specific time. Based on these objectives, some of the red pine plantations in the Project Area are proposed for thinning or regeneration. In addition, some of the red pine plantations are proposed to be converted back to dry sand prairie. This will lower the percentage of long-rotation conifer in the Project Area and increase the percentage of the critical dry sand prairie habitat (listed as Barrens and Savannas in Table 3.2).

Aspen is common within the Project Area and would be managed through clearcutting and natural regeneration to prevent the conversion of individual stands to oak and maple forest types. The majority of oak stands in the Project Area would not be actively managed through timber harvesting activities,

allowing these stands to continue to provide habitat for a variety of interior wildlife species. Some of the designated openings are proposed for maintenance by cutting or burning of woody vegetation to maintain the desired mix of shrubby and herbaceous species. There is a proposed reduction in the canopy cover for portions of the forested stands that are immediately adjacent to some of these openings. The existing forest type in these areas is predominantly oak and would not change through the proposed activities. The other vegetation types that are present throughout the Project Area are not proposed for management.

Table 3.2: Manistee National Forest Desired, Existing, & Project Area Vegetative Type Composition

Vegetation Type	Forest Plan Desired in 2016	Manistee NF Plan Existing	Project Area Existing
Short Rotation Conifer	2-8%	5%	3.6%
Long-Rotation Conifers	17-23%	21%	26.8%
Lowland Conifers	0-5%	2%	0.5%
Aspen/Birch	10-16%	13%	20.3%
Short Rotation Oaks	13-19%	16%	8.6%
Long Rotation Oaks	15-21%	18%	24.8%
Northern Hardwoods	8-14%	10%	1.4%
Lowland Hardwoods	4-10%	8%	6.2%
Managed Openings < 10 acres in size	4-10%	7%	7.8%
Barrens & Savannas	1-5%	0%	0%

Forests' Transportation System

Existing Forest roads allow for unregulated vehicle use. Many of these roads have not been designed to provide for vehicle use during periods of wet weather or spring thaws, to reduce erosion and sediment delivery to adjacent vegetated areas, and are too narrow for some vehicle types. This results in damage to the adjacent vegetation through the rutting and widening of roadways when the surface and sub-surface soils are saturated, sediment deposition from eroding roadbeds onto the herbaceous and young woody vegetation, and a widening of the existing roadbeds when vehicles drive around naturally occurring obstacles.

Dry-Sand Prairie

Some of the Project Area contains soils from the Sparta series. Historically, these soils supported open grasslands, containing few to no trees. Efforts to convert these lands to agriculture resulted in various degrees of erosion. To prevent further soil loss, many of these areas were then planted to red, white, jack and Scotch pines. Some of the red and white pine plantations have since been thinned and are still dominated by conifers. Other areas containing the Sparta soil series currently consist of oak forest types and upland openings. A 40 acre tract owned by Big Prairie Township that is adjacent to National Forest System lands was cleared of Scotch pine trees in 2008 to facilitate the restoration to native grassland species. This parcel is located in Section 18 of T13N, R11W. In addition, two private land conservation groups own and manage ~510 acres in the adjacent Brooks Township for prairie and savanna habitats.

ORV Use

Off-road vehicle riders utilize the existing road system within the Project Area and have created several large open areas. The loose sand created by the constant traffic does not allow vegetation to become established. The increased amounts of ORV use in these areas add to the existing erosion problems.

Wildlife Habitat

Upland and lowland openings provide unique habitat for a variety of vertebrate and invertebrate species. These habitats may be compromised or eliminated by natural succession of tree species, reducing both open space and edge cover. The benefits of forested wildlife habitats arise from the variety of ages, cover types, and vertical structure within small and larger forest areas.

(3.2.3) Alternative 1: The Effects of No Action on the Timber, Woodland and Fuels Resources

(3.2.3a) Direct and Indirect Effects

Structure, Age Classes, and Species

Under Alternative 1, no action would be taken to thin, regenerate, or non-commercially harvest any of the timber resources within the Project Area. Individual tree growth, survival, and stand succession would be subject to environmental and biological factors. The projected 2018 age class distribution by forest type is displayed in Table 3.3, Alternative 1: Projected Acres of Forest Types by Age Class, 2018. Immediate changes in the predominant forest cover type would be minor due to the longevity of most species. The longer-lived species (red pine and high-site oaks) would tend to persist as even-aged. Short-rotation oaks over 100 years old would experience a decline in the overstory as individuals and small groups of oaks die. In these areas, the sunlight pockets created by dead and dying trees would allow a mix of understory species to develop that would consist primarily of oak species. On the sites having lower soil productivity, natural regeneration of oak itself would likely be limited. Without a major disturbance, such as a fire, oak seedling recruitment on these sites would be difficult. Moderate and higher oak sites tend to have red maple and beech in the understory, which would slowly advance into the overstory on these sites. In contrast, aspen and jack pine stands would trend towards uneven-age red maple, white, or red pine forests as the aspen and jack pine trees decline and die out. The younger jack and Scotch pine plantations, having some large oaks currently in the overstory, would remain relatively stable. However, on the highly-eroded Sparta sands, jack and Scotch pine and some oaks would naturally succeed the existing plantations.

Red pine is able to maintain high numbers of trees per acre in plantations. As a result, the canopy closes and a thick layer of needles forms on the soil surface, preventing establishment of ground flora and tree seedlings. Tree diameter growth is greatly reduced due to the site's capacity for vegetative growth being spread over a high number of stems per acre. Height growth is not as adversely effected as diameter and

older plantations that have not been thinned tend to have more wind damage associated with the tall, skinny pine.

The sirex woodwasp, *Sirex noctilio* F., is a recently discovered invasive pest to Michigan. Although not currently located within the Project Area, the potential exists for it to become established in this area in the future. The wasp larvae kill pine tree species by creating feeding tunnels under the bark. The most economical practice to reduce damage from this pest is to maintain healthy larger diameter stems, which can withstand more feeding tunnels than trees having a smaller diameter. This is based on the surface area of the bark. Research shows that *S. noctilio* caused higher rates of mortality to smaller-diameter trees than larger-diameter trees and promoting the growth of healthy, vigorous trees reduces plantation-level mortality (Dodds et al. 2007). The mechanical pine thinnings required to promote individual stem growth and vigor would not occur under Alternative 1, increasing the susceptibility of the area's forested stands to attack by invasive pests.

Aspen naturally regenerates by producing shoots from the roots after a disturbance, such as a windstorm or wildfire. Aspen stands of advanced age tend to have fewer aspen trees per acre and the root systems of the remaining aspen are weak. These weakened root systems produce fewer and less aggressive sprouts. If the aspen sprouts cannot compete against other trees (such as stump sprouts from red maple), the less shade tolerant aspen dies out. Aspen is also the predominant species in several high-site oak stands in the Project Area. The population of red maple would increase in aspen stands greater than age 90, especially in areas of high water tables; red maple would also increase in the understory of high-site oak stands. Aspen greater than age 90 would be considered converted to a different vegetation type. This alternative, with no management of forested stands, would effectively convert some aspen to non-aspen cover and vegetation types.

The Project Area contains upland openings that tend to be small. These typically have a higher percentage of edge, when compared to interior space. Under Alternative 1, these openings would decrease modestly in both size and abundance. This would be due primarily to the encroachment of oaks and pines. The shade tolerant herbaceous species (blueberry, witchhazel, carex spp.) would persist, with little opportunity for early seral species (rubus and prunus species) to become established. Lowland openings would continue to be influenced by high water tables and acidic conditions that favor leatherleaf, willow, alder and dogwood shrubs and cattails, carex sp., and bulrush sp. Despite no net change in acres under this alternative, these wetlands would infrequently be affected by natural hydrological cycles that alter woody growth patterns within (and on the edges of) bogs and ponds.

Table 3.3: Alternative 1: Projected Acres of Forest Types by Age Class, 2018 (NFS Lands Only)

Forest Type	Age Class											
	0-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+	No Age	Total
Jack Pine & Jack Pine-Oak			20				124					144
Red & White Pine			69		173	53	608	42	48	76		1,069
Northern Hardwoods		6			51							57
Mixed Lowland Conifers										21		21
Short Rotation Oaks	***10***			47	43			127		128		***355***
Long Rotation Oaks	***38****	1						110	204	679		***1,032***
Mixed Lowland Hardwoods			107			11				133		251
Quaking & Bigtooth Aspen		147	84	400	6	7		154				***798****
Upland Opening & Lowland Brush											***280***	***280***
Total	48	154	280	447	273	71	732	433	252	1037	280	4,007

Note: Bold italic indicates a net change in acres of a forest type. An asterisk and underlining tracks changes between forest types, as compared to Existing Condition, Table 3.1.

Groups of Similar Vegetation

The composition of the vegetation, projected in 2018, for the Project Area and the Manistee National Forest are displayed in Table 3.4, Alternative 1: Change in Manistee National Forest Vegetation Type Composition. Oak groups would increase through encroachment into the openings, while the amount of upland openings and aspen would decline. Short-rotation oak and short-rotation conifer stands of advanced age would start shifting towards younger age classes of the same types and change vegetation types. The other vegetative groups would remain at current levels or fluctuate slightly, limited mainly by the physical capability of the land to grow and sustain these groups.

Table 3.4: Alternative 1: Change in Manistee National Forest Vegetative Type Composition

Vegetation Type	Forests' Plan Desired in 2016	Project Area 2018	Net% Change 2008 - 2018
Short Rotation Conifer	2-8%	3.6%	0%
Long Rotation Conifers	17-23%	26.8%	0%
Lowland Conifers	0-5%	0.5%	0%
Aspen/Birch	10-16%	**19.9%**	**-2.1%**
Short Rotation Oaks	13-19%	**8.9%**	**+2.8%**
Long Rotation Oaks	15-21%	**25.7%**	**+3.8%**
Northern Hardwoods	8-14%	1.4%	0%
Lowland Hardwoods	4-10%	6.2%	0%
Managed Openings < 10 acres in size	4-10%	**7%**	**-10%**
Barrens & Savannas	1-5%	0%	0%

Note: Bold font represents a change from the existing condition.

Forests' Transportation System

Existing Forest road policy would continue to allow vehicle use on all locations and road segments that are not closed to motor vehicles. Vehicle use during periods of wet weather or spring thaws would result in the continued damage to the roots of trees and shrubs. This would also contribute to the creation of new ruts, the deepening of existing ruts, and/or the widening of the roadways when the surface and sub-surface soils are saturated. Sediment from unstabilized roadbeds would be deposited onto herbaceous and young woody vegetation. Over time, vehicles avoiding natural obstacles would increase the width of roadbeds, damaging stems and roots of plants.

Prairie Restoration

The restoration of dry sand prairie would not occur under this alternative. The pine plantations would persist, barring a major disturbance event. Openings occurring on Sparta sands would continue to succeed with woody vegetation.

ORV Restoration Sites

ORV use on National Forest System lands within the Project Area would increase proportionally with that of the surrounding population and be relative to any changes that occur in the legal use of some ORV's (Michigan Public Act 240 2008). The damage that is currently present would persist in the areas of high-use. The amount of area impacted at these sites would expand over time, compounding the loss of vegetation.

Wildlife Habitat

Early-successional habitats would decline as larger trees begin to dominate the designated openings. Later- succession habitats would be favored, especially with the addition of snags and large woody debris within undisturbed areas of the mature forests.

(3.2.3b) Cumulative Effects

Structure, Age Classes, and Species

The principle effect of taking no action would be to slowly shift the structure of individual and aggregate forested stands from even-aged to uneven-aged canopies. This would occur as the number of long-lived species such as red and white pine, red maple, beech, and red, black and white oaks increase, and the number of jack pine, northern pin oak, and aspen decrease. Pines and oaks would continue to encroach upon the upland, non-forested areas. Gradually, these areas would attain forest qualities as the species mature and continue to regenerate in open areas. Infrequent insect, fire, and wind-induced mortality events would interact with this natural process, and result in succession at a local scale (i.e. one to several acres, and less frequently, at scales larger than 10 acres), especially in lowland and riparian forests. The long-term exclusion of fire disturbance would enhance these effects, and favor accumulating those species tolerant of less frequent fires (white pine, red maple, and beech) over those species adapted to more frequent fire events (jack pine, oaks, and aspen).

District records show that between 1979 and 2008, a variety of vegetation treatments on National Forest System lands within the Project Area have occurred. These treatments are summarized in Table 3.5, National Forest Vegetation Treatments 1979 – 2008.

Table 3.5: National Forest Vegetation Treatments 1979 – 2008

Vegetation Types	Thin	Regenerate by Clearcut	Regenerate by Shelterwood	Reduce Encroaching Trees by Hand Tools, Mowing, Prescribed Fire	Improve by Seeding, Planting, Tilling
Forested, All	843	261	41	n/a	6
Non-Forest, All	n/a	n/a	n/a	47	10

The expected amounts of vegetation treatment on National Forest System lands in future decades would likely increase over historic treatment levels for the development of barrens/savannah, which includes dry sand prairie restoration. The amount of pine thinnings, mature oak and aspen forest regeneration, and dead tree salvage treatments would likely remain static. The vegetative composition on National Forest System lands is expected to be dominated by oaks and aspen in a variety of age classes, pine plantations and lowland hardwoods in mature age classes, and barrens/savannahs and managed openings.

Forest products would also likely be harvested on private lands within the Project Area, although at levels less than in the past. The most common activity would be the removal of trees > 11" in diameter and

dead tree salvage harvesting. Township and land conservancy management treatments will provide some restored prairie and savanna habitats. New residential and commercial structure building will continue to reduce the amount of total forest cover on private lands. As a result, a mix of age classes would remain. Management for young and mature oak, lowland hardwoods, and agricultural uses (pasture, crop lands, idle) would dominate this ownership class.

Conclusion: The duration and magnitude of taking no action would incrementally add to past, present and reasonably foreseeable vegetation patterns within the Manistee National Forest, primarily by allowing the existing vegetation to mature or be replaced by late-seral stages of forest vegetation. This effect would be most pronounced on National Forest System lands. Other public and land conservancy parcels would provide for areas of restored prairie and savanna habitats. Private forest lands would be expected to be further subdivided for housing development. This fragmentation would reduce the likelihood of private forest management on a large scale. NNIS and their potential negative impacts on native vegetation would become more widespread and pronounced.

(3.2.4) Alternative 2: The Effects of the Proposed Actions on the Timber, Woodland, and Fuels Resources

(3.2.4a) Direct and Indirect Effects

Under this Alternative, vegetative treatments would occur, as displayed in Table 2.4. Many red pine stands, with stocking levels exceeding 95%, would be thinned using commercial harvests and pre-commercial thinning. Numerous aspen areas would be either commercially or non-commercially clearcut to promote the regeneration of quaking and big-tooth aspens. There are some areas where aspen inclusions occur within oak stands. These areas would be clearcut to promote the regeneration of the aspen. Scotch pine would be removed in several timbered stands where it occurs as inclusions or as the main cover type. A portion of one jack pine plantation would be regenerated and ~141 acres of pine plantations would be restored to dry sand prairie. Stands to be regenerated would have site preparation completed with hand tools to promote natural regeneration. These would be replanted if natural regeneration is not adequate.

Existing upland, non-forested areas would be maintained using non-commercial mechanical and hand tool methods. Prescribed burning would occur in some upland openings. The purpose of these treatments would be to reduce the overall amount of woody vegetation encroaching into these areas by directly killing seedlings and saplings and to prepare these sites for the direct seeding of grasses and forbs.

Age Classes, Species, and Structure

Reducing the number of trees per acre would improve residual tree vigor and growth rates, modify structural diversity, and promote the understory diversity by opening up the tree canopy. This would also reduce the competition between the remaining trees for water, nutrients, and sunlight (USDA-Forest Service 1983). Commercial harvests would reduce the number of trees per acre based on the objectives of:

- maintaining adequate growing conditions (thinning);
- increasing individual tree health (thinning); and
- stimulating aspen root suckering (clearcut).

Thinning red pine plantations to 80% of full stocking would satisfy the requirements for individual tree growth for 15-20 years, and perpetuate the dominance of red pine in an even-age structure. Many of the mature oak and maple that exist in these stands would be retained and provide some species and structural diversity. The current average spacing between rows in the plantations of pine is

approximately five feet. Initial thinning activities consist of removing whole rows of trees to enable harvesting equipment room to operate and protect residual pine stems from damage. Previously thinned plantations have stems individually selected to retain the most desired and healthy trees.

A clearcut (removing 95% of all trees › 5" in diameter) would be used to regenerate aspen. Prior to the aspen root suckers appearing, this treatment would alter the existing species composition by reducing the numbers of non-aspen woody species and promoting numerous shade intolerant shrub and herbaceous species. The canopy layer would either be reduced to scattered individuals/groups or reduced to the herbaceous layer. Trees 1-5" in diameter would be non-commercially treated with hand tools to promote natural regeneration. The supplemental planting of white pine or oaks would be used where adequate natural seedling densities are not obtained within three years of the harvest. In the first decade after the harvest, a single-layered canopy would form. These areas would enter the 0-9-age class immediately after the clearcut treatment. Table 3.6, Alternative 2: Projected Acres of Forest Types by Age Class, 2018, displays the forest types by age classes after the next ten growing seasons. Non-commercial treatments would be used where other conditions preclude commercial harvesting.

Clearcutting, hand tool site preparation, and supplemental jack pine planting will also be used to regenerate a portion of one jack pine stand.

Clearcutting was determined to be the optimum method for regenerating aspen and jack pine because:

- both species are very shade intolerant;
- clearcutting stimulates the root suckering of aspen and the opening of the serotinous jack pine cones, resulting in better regeneration and early growth of both species;
- early-successional woody and herbaceous species and communities can be maintained simultaneously;
- conditions for wildlife species that use these habitats result from clearcutting;
- visual variety is increased through the design, timing, size and location of the clearcuts;
- costs are lower and revenues higher when compared to other harvest methods, due to the lower management costs and greater harvesting efficiency; and
- motorized access needs are minimized.

Removal cutting would occur on the pine plantations being restored to prairie conditions. Options for prairie restoration to be used include: removing residual stumps, prescribed fire and mechanical/fertilizer site preparation, and direct seeding of the desired herbaceous seed mix.

Removal cutting was determined to be the optimum method for converting pines to barrens and savannas because:

- dry sand prairies contain few trees;
- removal cutting stimulates germination of the remnant seedbank;
- habitat conditions for wildlife species that use these grassland habitats results from removal cutting;
- visual variety is increased through the design, timing, size and location of the removal cutting;
- pine cover types can be naturally converted to this community type;
- costs are lower and revenues higher when compared to other harvest methods because of lower management costs and greater harvest efficiency; and
- motorized access needs are minimized, thus reducing user conflicts.

Table 3.6: Alternative 2: Projected Acres of Forest Types by Age Class, 2018 (NFS Lands Only)

Forest Type	Age Class											
	0-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+	No Age	Total
Jack Pine & Jack Pine-Oak	**40**		**17***				**84**					**141**
Red & White Pine			69		**159**	**17**	**520**	42	48	76		**931**
Northern Hardwoods		6			51							57
Mixed Lowland Conifers										21		21
Short Rotation Oaks				47	43			127		128		345
Long Rotation Oaks		1						**100**	**194**	**661**		**956**
Mixed Lowland Hardwoods			107			11				133		251
Quaking & Bigtooth Aspen	**178**	147	84	400	6			**38**				**853**
Upland Opening & Lowland Brush											**452***	**452**
Total	218	154	277	447	259	28	604	307	242	1019	452	4007

Note: Bold indicates a net change in acres of a forest type. Increased font size, underlining, and asterisks tracks changes between forest types, as compared to Existing Condition, Table 3.1.

Groups of Similar Vegetation

The vegetation composition, projected in 2018, for the Project Area and the Manistee National Forest are displayed in Table 3.7, Alternative 2: Change in Manistee National Forest Vegetation Type Composition. The major change is the re-establishment of 177 acres of dry sand prairie represented in the barrens and savannas group. The managed openings would show a loss due to some acres of stands currently typed as openings being restored to a dry sand prairie condition. Prairie acres are also reflected by a loss in the two pine types, with the majority being long rotation red pine plantations. Additional acres of aspen would be created by expanding the aspen pockets found in several oak stands, thus reducing the acres in a portion of the stands typed as long rotation oak.

Table 3.7: Alternative 2: Change in Manistee National Forest Vegetative Type Composition

Vegetation Type	Forests' Plan Desired in 2016	Project Area 2018	Net % Change 2008 – 2018
Short Rotation Conifers	2-8%	**3.5%**	**-2%**
Long Rotation Conifers	17-23%	**23.3%**	**-12.9%**
Lowland Conifers	0-5%	0.5%	0%
Aspen/Birch	10-16%	**21.3%**	**+4.7%**
Short Rotation Oaks	13-19%	8.6%	0%
Long Rotation Oaks	15-21%	**23.9%**	**-3.8%**
Northern Hardwoods	8-14%	1.4%	0%
Lowland Hardwoods	4-10%	6.2%	0%
Managed Openings (< 10 acres)	4-10%	**6.9%**	**-11.5%**
Barrens & Savannas	1-5%	**4.4%**	**+177 Acres**

Note: Bold font represents a change from the existing condition.

Prescribed Fire

In the managed openings, prescribed fire would be used separately, or in conjunction with, commercial/non-commercial treatments, to generate or maintain herbaceous and low woody vegetation species diversity and structure. Seeding of native grass species would be used to supplement and/or re-introduce native grasses into the managed openings. Prescribed fire would also affect non-tree species diversity, promoting herbaceous and woody vegetation favored by fire disturbance, such as rubus and cherry species.

In restored prairies, prescribed fire would initially be used to reduce conifer litter, alter the surface soil pH, and stimulate germination of the remnant seedbank. Prescribed fire would also be used to maintain the desired herbaceous cover, primarily by discouraging woody plant growth and by assisting with the natural reseeding of warm season grasses and annual and perennial forbs.

Forests' Transportation System

There would be a net reduction of the detrimental physical effects to vegetation (compared to Alternative 1). Vehicle use of the road system during periods of wet weather or spring thaws would still result in the continued damage to the roots of the trees and shrubs. On the portion of the system left open to motor vehicles, new ruts would occur and existing ruts would deepen when the surface and sub-surface soils are saturated. Roadbeds that are on slopes greater than 2%, not stabilized with gravel surfacing, and/or not having diversion ditches, would be a source of sediment deposited onto adjacent herbaceous and young woody vegetation. Vehicles avoiding natural obstacles would increase the width of roadbeds, damaging the stems and roots of plants. NNIS would continue to be introduced into the Project Area, though there would be a reduction in the spread of the plants due to the reduction in the roads left open under this alternative.

Prairie Restoration

The restoration of the dry sand prairie would require a complete removal of the existing overstory trees. The successful establishment of this habitat would require ≤ 4 leave-trees/acre; therefore, the majority of trees in the pine plantations and openings would be cut and stumped. In addition, sprouts or trees that may seed into these sites into the future would be periodically removed. Prescribed fire would be the preferred method of accomplishing the removal of new tree establishment.

ORV Restoration Sites

Under this alternative, the two sites damaged by ORVs would be rehabilitated and access to these areas would be blocked. The soils in these areas would be stabilized through the placement of woody debris and the seeding of native grasses. At one of the sites, native tree seedlings may be planted if seeding-in does not occur naturally. The focus of the other site would be in the establishment of native grasses and/or dry sand prairie species, depending on what the disturbed site is capable of sustaining.

Wildlife Habitat Creation

Proposed activities for wildlife habitat enhancement include the non-commercial aspen clearcuts and the cutting of individual trees in and around existing openings. Aspen would be cut and left on site in areas that are not accessible by commercial logging equipment. These cuts would allow aspen areas to regenerate instead of being converted to other species. In and along both upland and lowland openings, individual trees would be selected for either removal or girdling. Removing the vegetation from around opening edges would allow for the planting of thermal shelter or mast bearing trees and shrubs, create den trees, and increase foraging and hiding cover.

Culmination of Mean Annual Increment

The stands proposed for regeneration treatments (clearcut, removal, and shelterwood) would comply with the National Forest Management Act of 1976, Section 6 (m). This requires that stands of trees shall generally have reached (95%) of the culmination of mean annual increment (cubic foot measurement) prior to harvesting activities, unless there is a project-specific exception to this requirement. Except for the stands listed in Table 3.8, Project Specific Exceptions to CMAI, this requirement would be met. This is documented on the silvicultural prescriptions in the individual Treatment Unit Cards (Project Record) and the Forest Vegetation Simulator analysis.

Table 3.8: Project Specific Exceptions to CMAI for Alternatives 2 and 3

Compartment	Stand	Species Group	Current Age	CMAI Age	Reason
564	30	Aspen	84	99	Wildlife Habitat
564	31	Aspen	84	89	Wildlife Habitat
564	32	Aspen	84	94	Wildlife Habitat
565	4	Aspen	73	87	Wildlife Habitat
566	24	Oak	95	110	Wildlife Habitat
566	30	Aspen	78	93	Wildlife Habitat
566	45	Aspen	78	83	Wildlife Habitat
566	47	Aspen	78	108	Wildlife Habitat
566	61	Aspen	78	103	Wildlife Habitat
566	68	Aspen	78	82	Wildlife Habitat
570	1, 2	Jack Pine	66	91	Convert to Non-Forest
570	24/26	Oak/Aspen	58	73	Wildlife Habitat
570	35	Red Pine	55	70	Convert to Non-Forest
572	13	Red Pine	47	62	Convert to Non-Forest

(3.2.4b) Cumulative Effects

The expected level of vegetation treatments on forested lands in future decades would likely increase over the historic treatment amounts (1972-2005). This would occur in the form of red pine thinnings, tree planting, mature forest regeneration, dead tree salvage, and NNIS treatments. Few acres of private lands in the Project Area would receive identical vegetation treatments. Similar activities on private lands would include mature tree harvesting, dead tree salvaging, and the conversion of land to a non-forested type. Township and land conservancy management treatments would provide some restored prairie and savanna habitats. New residential and commercial structure building on the private land base would reduce the amount of total forest cover. On other than agricultural lands, treatments to NNIS on private lands would not likely occur due to the costs of the associated treatments and the tolerance or ignorance of infestations.

Alternative 2 would retain the even-age structure of individual and aggregate forested areas where the timber cutting treatments in Table 2.4 would occur during the period 2008 – 2018. Individual tree growth would increase in the stands receiving thinnings and historic prairie habitat would be re-established. Where no treatments would occur, the infrequent insect, wildfire, and wind induced mortality events would interact with natural succession, and result in succession at a local scale. This would likely occur most frequently on one to several acres, and less frequently at scales larger than 10 acres. In effected areas, uneven-aged canopy structures would develop.

The use of fire in managed openings and prairies would reduce the pine and oak encroachment and promote the establishment of a diverse, herbaceous flora consisting of native species. These herbaceous species would become established through seed bank stimulation and/or direct seeding. Over time, these would become self-sustaining. Existing NNIS plants would not measurably increase within the Project Area, and would be confined to utility and road rights-of-way. New introductions of NNIS plants would have less opportunity to become established on open lands frequently disturbed by prescribed fire; however, new introductions would still likely occur adjacent to the roads and open areas on both public and private lands.

Conclusion: The duration and magnitude of Alternative 2 would incrementally add to past, present, and reasonably foreseeable vegetation patterns within the Manistee National Forest, primarily by increasing forest health through the thinning of existing pine plantations and aspen stand regeneration. Other public and land conservancy parcels would provide for areas of restored prairie and savanna habitats through the conversion of existing forest vegetation to prairie, or by maintaining and enhancing established herbaceous cover. NNIS would be controlled or reduced in the areas where they currently exist. Private lands would be expected to be further developed and fragmented. Private forested lands would mature and shift towards uneven aged species mixes, or be converted to other non-forested uses.

(3.2.5) Alternative 3: The Effects of the Proposed Actions on the Timber, Woodland, and Fuels Resources

(3.2.5a) Direct and Indirect Effects

Under this alternative, vegetative treatments would occur as displayed in Table 2.4. A 52% difference exists in the management of red pine related to the restoration of dry sand prairie with aspen and NNIS management remaining the same. Two stands of red pine would be deferred from the prairie restoration and, instead, one would be thinned and one would be regenerated. One additional opening would receive maintenance.

Age Classes, Species, and Structure

The main difference between Alternatives 2 and 3, in terms of vegetative management, would be the reduction of dry sand prairie restoration acres. Under Alternative 3, two red pine stands would not be restored to dry sand prairie and would remain forested. This would reduce the restoration efforts to approximately half of what is proposed under Alternative 2. Both alternatives would allow for an adaptive management approach to be applied to future prairie restoration work. Under Alternative 3, one of the offset pine acres would receive a thinning treatment, allowing the protected soils to remain stable while the restoration efforts would be evaluated. The other red pine stand would be regenerated to red pine and oak, producing habitat targeted at the American pine marten. The resulting age class diversity after the next ten growing seasons is shown in Table 3.9, Alternative 3: Projected Acres of Forest Types by Age Class, 2018.

Table 3.9: Alternative 3: Projected Acres of Forest Types by Age Class, 2018 (NFS lands only)

Forest Type	Age Class											
	0-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+	No Age	Total
Jack Pine & Jack Pine-Oak	**40**		**17***				**84**					**141**
Red & White Pine	**23**		69		**159**	**17**	**583**	42	48	76		**1017**
Northern Hardwoods		6			51							57
Mixed Lowland Conifers										21		21
Short Rotation Oaks				47	43			127		128		345
Long Rotation Oaks		1						**100**	**194**	**661**		**956**
Mixed Lowland Hardwoods			107			11				133		251
Quaking & Bigtooth Aspen	**178**	147	84	400	6			**38**				853
Upland Opening & Lowland Brush											**366***	366
Total	241	154	277	447	259	28	667	307	242	1019	366	4007

Note: Bold indicates a net change in acres of a forest type. Increased font size, underlining, and asterisks track changes between forest types, as compared to Existing Condition, Table 3.1

Groups of Similar Vegetation

The vegetation composition, projected in 2018, for the Project Area and the Manistee National Forest are displayed in Table 3.10, Alternative 3: Change in Manistee National Forest Vegetation Type Composition. The major change between Alternatives 2 and 3 would be the re-establishment of 83, compared to 177, acres of dry sand prairie represented in the barrens and savannahs group. The managed openings would show a loss, due to some of the designated openings being treated as prairies. These new prairie acres are reflected by a loss in the two pine types, with the majority occurring in the long rotation red pine plantations. Additional acres of aspen would be created by expanding the aspen pockets found in several oak stands. This would reduce the acres of long-rotation oaks.

Table 3.10: Alternative 3: Change in Manistee National Forest Vegetative Type Composition

Vegetation Type	Forests' Plan Desired in 2016	Project Area 2018	Net % Change 2008 – 2018
Short Rotation Conifers	2-8%	**3.5%**	**-2%**
Long Rotation Conifers	17-23%	**25.4%**	**-4.8%**
Lowland Conifers	0-5%	0.5%	0%
Aspen/Birch	10-16%	**21.3%**	**+4.7%**
Short Rotation Oaks	13-19%	8.6%	0%
Long Rotation Oaks	15-21%	**23.9%**	**-3.8%**
Northern Hardwoods	8-14%	1.4%	0%
Lowland Hardwoods	4-10%	6.2%	0%
Managed Openings (<10 acres)	4-10%	**7.1%**	**-9.6%**
Barrens & Savannahs	1-5%	**2.1%**	**+85 Acres**

Note: Bold font represents a change from the existing condition.

Prescribed Fire

Under this alternative, the effects on the vegetation related to the use of prescribed fire within the Project Area would be similar to Alternative 2; however, this treatment would occur on approximately 36% fewer acres. This would be due primarily to the reduction in the amount of red pine proposed for conversion to dry sand prairie.

Forests' Transportation System

The effects of motorized use on the Forests' transportation system relative to vegetation would be similar between Alternatives 2 and 3. Approximately 30% fewer miles of the system would be closed under Alternative 3. There would be an expected proportional decrease in the amount of root and stem damage occurring to individual trees and in the amount of sediment effecting the smaller vegetative components.

Prairie Restoration

In comparison to Alternative 2, the amount of restoration work under this alternative would be reduced by 50%. This would be due to two red pine stands proposed for conversion to dry sand prairie under Alternative 2, that would be either thinned or regenerated under this alternative.

ORV Restoration Sites

The effects to the vegetation under this alternative, relative to the ORV restoration, would be similar to those of Alternative 2.

Wildlife Habitat

Retaining the selected red pine areas as mature and regenerating cover types would favor the American pine marten and other species that favor general forested habitats. This would also decrease the habitat available for grassland vertebrate and invertebrate species.

Culmination of Mean Annual Increment

The stands that are proposed for the regeneration treatments (clearcut, removal, and shelterwood) would comply with the National Forest Management Act of 1976, Section 6 (m). This requires that either the majority of the trees in a stand selected for harvest have reached (95%) of the culmination of mean annual increment (cubic foot measurement) or there are project-specific exceptions to this requirement. Except for the stands listed in Table 3.8, Project Specific Exceptions to CMAI, this requirement would be met. This is documented on the silvicultural prescriptions in the individual Treatment Unit Cards (Project Record) and in the Forest Vegetation Simulator analysis.

(3.2.5b) Cumulative Effects

The cumulative effects under Alternative 3 would be similar to those of Alternative 2.

(3.3) Herbaceous and Understory Vegetation

(3.3.1) Area of Analysis

Direct and Indirect Effects: Project Area
Cumulative Effects: Big Prairie Township for Invasive Plants and Newaygo County for Regional Forester Sensitive Plant Species

(3.3.2) Resource Information and Existing Condition

A number of plant community types occur within the Project Area, ranging from dry forested to wet forested, wetlands, upland openings, and prairie remnants. Plant surveys for the project occurred primarily in the 2006 field season with some follow-up and add-on surveys conducted in 2008. These findings are maintained at the Baldwin/White Cloud Ranger District in the Project Record. Surveys include an inventory of all plants observed during intuitive meandering surveys taken in the spring, early summer and late summer/fall. In addition, data was gathered on the locations of non-native invasive plant species (NNIS) and plant Regional Forester Sensitive Species (RFSS). RFSS for the Huron-Manistee National Forests are found on the Region 9 website for the US Forest Service *(http://www.fs.fed.us/r9/wildlife/tes/docs/rfss_plants.pdf)*.

Typically, the ground cover found in the coniferous forest types (red, white, and jack pine forests) was of low diversity and low productivity/abundance. Sub-canopy cover in the oak forest communities are dominated by: blueberry, black cherry, oak, and pine saplings, viburnum, Juneberry, and witch hazel. Herbaceous ground cover species are dominated by Pennsylvania sedge and bracken fern.

The Project Area occurs in areas of former dry sand prairies. This area is known historically as Big Prairie, one of 4 major prairies formerly existing in Newaygo County. This habitat type and the activities proposed for the dry sand prairies are discussed in greater detail in a separate sub-section of this analysis.

In addition, there are numerous small wetlands within the Project Area. Many of these are dominated by leatherleaf or by a combination of cattails and sedges. Several of these wetlands had infestations of invasive species such as marsh thistle or Canada thistle. In addition, some of the wetland areas are currently forested with aspen and/or hardwood species. There is one seasonally wet hardwood area that is infested with garlic mustard.

In addition, the Project Area also contains openings within or adjacent to forested areas that were created as either wildlife openings or used as landings for previous timber sales. Many of these habitats have invasive species such as St. Johnswort, Queen Anne's lace, spotted knapweed, leafy spurge, hoary alyssum, smooth brome, Morrow's honeysuckle, and autumn olive present.

The impacts of the activities proposed in this project on rare and sensitive plant species were analyzed in the Biological Assessment and Biological Evaluation, a separate analysis document for the Mast Lake Project Area. A summary of that analysis follows the NNIS analysis in this herbaceous vegetation section. That analysis is broken up into analysis of the major habitat types: upland forest, lowland forest, dry-mesic openings, and open wetlands.

Dry-Sand Prairie

The Project Area contains areas of Sparta sands soil type. Historically these lands were open grasslands or prairies and savanna/barrens with no or very few woody species. Two prairie remnants remain in the Project Area. However, these areas have some invasive species present and do not represent high quality prairie habitat as represented by higher biodiversity and low abundance of invasive plants. The Forest Plan calls for the management of non-highly eroded Sparta sands as prairie. This project calls for the restoration of some of these former prairies that are currently forested (Alternative 2, ≤177 acres; Alternative 3, ≤83 acres). These activities would comply with the guidelines set forth in the Forest Plan to restore these areas to prairie. In addition, the prairie remnants would undergo the management actions of prescribed burning, NNIS suppression, and selected native plantings to improve prairie quality and diversity. In addition to the restoration activities proposed in this project, the restoration of 40 acres of former prairie has been started by Big Prairie Township on the corners of Pine Avenue and 20th Avenue. Other prairie restoration may also occur under the powerline corridor along Pine Avenue by Consumers Energy.

The dry sand prairies and savannas are typically composed of a mosaic of prairie warm season grasses (big blue stem, little bluestem, and Indian grass), with other cool season grasses (such as Junegrass, hair grass, and poverty oat grass) also present. A suite of flowering forbs are also present to varying degrees and include: prairie smoke, flowering spurge, prickly pear cactus, common milkweed, beardstongue, lupine, pussytoes, frostweed, bushclover, sweetfern, winterberry, trailing arbutus, racemed milkwort, and hawkweed. Less commonly found native forbs include: hairbell, blazing star, sweet everlasting, horsemint, wild bergamot, goat's rue, wild strawberry, cudweed, asters, hoary puccoon, jointweed, spreading dogbane, goldenrods, butterfly weed, fleabane, Carolina rose, black-eyed susan, woodland sunflower, tick trefoil, buttercups, bunchberry, Canadian lousewort, speedwell, and Virginia dwarf dandelion.

Non-Native Invasive Plant Species and Vegetation Management

NNIS are common in the Project Area, although generally in low coverage amounts. With a few exceptions, they occur primarily along all public roadways, in National Forest managed openings, and on private lands. These species have the capacity to transform or dominate native plant communities and

reduce plant biodiversity. NNIS tend to invade areas of high disturbance, such as clearcut areas, roads, and landing sites. The most common invasive plants found in this project include: St. Johnswort, Queen Anne's lace, spotted knapweed, leafy spurge, hoary alyssum, Scotch pine, Morrow's honeysuckle, and autumn olive. Leafy spurge has recently expanded in presence in the general area of the project, with a heavy infestation occurring along Pine Avenue, which is a major travel corridor. Other NNIS plants that are present in the Project Area include: Canada thistle, bull thistle, marsh thistle, and smooth brome, A complete list of the invasive plants found for each of the treatment units (by surveyed stand) is filed in the Planning Record and noted on the Treatment Unit Cards.

The Huron-Manistee National Forests maintains a list of invasive plants *(http://www.fs.fed.us/r9/hmnf/pages/invasive_species.htm)*. This list provides a priority ranking for treatment, from Level 1 through Level 5:

- Level 1 species have not been found or are new to the Forest and are to be eradicated as soon as they are found;
- Level 2 species are not commonly found on the Forest and populations and individuals are to be eradicated wherever they are found;
- Level 3 species are more prevalent, but do not have widespread Forest occurrence. Level 3 source populations and outlier occurrences are treated based on perceived threats to Forest's resources, preventing the establishment of new populations by reducing the existing populations;
- Level 4 species are only targeted for high priority lands due to the widespread distribution of the species on the Forest; and
- Level 5 species are thought to be a concern, but information is lacking and needs to be gathered for future management decision regarding threat, impacts, and control.

The species name, Forest priority ranking level, and the locations of the twelve NNIS species that pose the greatest risk to native vegetation within this project are displayed in Table 3.11, NNIS, Rank, and Locations of Greatest Risk. These are considered to be treatable from a biological, ecological, and economic perspective. Scotch pine, also proposed for treatment, is covered in the Timber, Woodland, and Fuels Management section of this document.

Table 3.11: NNIS, Rank, and Locations of Occurrence for Treatment in the Project Area

Scientific Name	Common Name	Rank	Compartment	Stand
Alliaria petiolata	Garlic Mustard	2	566	17
			567	13
			572	2
Berberis vulgaris & *Berberis thunbergii*	Non-native Barberries	2	566	47
			570	1
				34
			572	2
				34
				35
Berteroa incana	Hoary Alyssum	4	564	20
				21
			567	6
			572	4
				7
				10
Bromus inermis	Smooth Brome	4	572	7

Table 3.11 (continued)

Scientific Name	Common Name	Rank	Compartment	Stand
Centaurea Biebersteinii (maculosa)	Spotted Knapweed	4	564	20
				21
			567	6
			570	1
				2
				3
				4
				35
			572	4
				7
				10
				13
				35
Cirsium palustre	Marsh Thistle	1	565	4
Cirsium vulgare	Bull Thistle	4	572	35
Eleaganus umbellatus	Autumn Olive	4	564	21
				29
			565	4
				24
			566	24
				45
			567	4
				5
				6
				13
			570	24
Euphorbia esula	Leafy Spurge	3	564	30
			567	6
			570	2
				4
				20
				37
			572	5
				6
				7
				15
				24
				34
Hypericum perforatum	St. Johnswort	4	564	20
				21
			567	6
			572	4
				7
				10
				13
				35

Table 3.11 (continued)

Scientific Name	Common Name	Rank	Compartment	Stand
Lonicera spp.	Non-native Bush Honeysuckles	2	570	6
				19
				20
				24
				37
			572	3
				5
				6
				7
				13
				18
				20
				24
				34
				35
Melilotus officianalis	Sweetclover	4	564	21
			572	4
				7
				10

Additional NNIS are of concern, but due to their population size, their habitat preferences, or their abundance on adjacent lands, they may not warrant direct suppression or eradication efforts. The Forests' strategy to contain these species includes equipment cleaning prior to use on National Forest System lands to minimize the introduction risk, and reduce the spread of NNIS between infested and non-infested areas. Species that need to be addressed through equipment cleaning and other prevention measures are discussed further in effects of implementing Alternative 2. The need to use prevention strategies is dependant upon the ability of the NNIS species to increase due to the proposed action or to proliferate in the type of habitat which is being developed (e.g. pine forest conversion to prairie). Other invasive species found during survey include: yellow rocket (*Barbarea vulgaris*), Canada thistle (*Cirsium arvense*), orchard grass (*Dactylis glomerata*), and Queen Anne's lace (*Daucus carota*). All invasive species located during field survey are indicated on Treatment Unit Cards. The control methods for the NNIS shown in Table 2.4 are the same under Alternatives 2 and 3 and may include a combination of manual or mechanical removal, herbicide, or burning.

Leafy spurge is a long-lived and aggressive perennial weed that tends to displace all other vegetation in native habitats. It is invasive because of the large number of seeds it produces and because it produces large numbers of underground shoot buds that can each produce a new shoot (Biesboer 1996). Control is very difficult and may be impossible if it is not accomplished before it becomes established. Rapid re-establishment of dense stands may occur, even after an apparently successful management effort, due to the long-lived root systems of the plants (Biesboer 1996). Due to the persistence and reproductive capability of the root system, the most effective control is with the herbicide picloram (Biesboer 1996) or imazapic (Czarapata 2005). Picloram is restricted to non-forested use but there are environmental concerns with regards to groundwater effects and soil persistance. Glyphosate has some control effect. Glyphosate is most effective when applied after seed set (in mid-summer) or after the fall regrowth has started (in late September), but before a killing frost (Lacey et al. 1985 as cited by Biesboer 1996). The prescription for glyphosate use is reported at 0.75 lb/acre, applied from mid-August to mid- September , with 80-90% control. This may require follow up the next spring with 2,4-D at 0.5-1.0 lb/acre (Lacey et al. 1985 as cited by Biesboer 1996). Fire alone would not be an effective control, as the effects would not

harm the root system. Fire, in combination with herbicides, can be effective. It is suggested in Biesboer (1996) that burning can result in a flush of same-age vegetative growth that is then more susceptible to herbicide application later in the same year. An adaptive control approach would be used in this project that may include: torch burning, prescribed burning, glyphosate application, and possible mulch cover for smothering. Control of leafy spurge would be accomplished through hand spray or sponge application of glyphosate, with additional sticker surfactant added. The soil may also be covered to prevent the germination of seeds, if the site is suitable for covering.

The control of non-native honeysuckle, barberry, and autumn olive would be accomplished by several methods. Small shrubs may be pulled out by hand or with a weed wrench. Torch burning at the stem/ground interface may be used to kill NNIS shrubs. In some cases, suppression treatment may occur through the application of herbicide (glyphosate) to cut stems (Batcher et al. 2000). Subsequent treatments would depend on the results of monitoring the initial treatments.

The control of garlic mustard would be accomplished through hand pulling and the application of glyphosate during early spring (prior to the emergence of other native species) or in late fall.

The control of marsh thistle would be accomplished through the use of aquatic formulations (1 to 2% active ingredient solution) of glyphosate. Application would occur when plants are 6-10" tall, during the bud to flowering stage, or when applied to the rosettes in the fall (WI DNR 2006).

The control of upland meadow or roadside invasive weeds (including spotted knapweed, St. Johnswort, hoary alyssum, smooth brome grass, and sweetclover) would occur in areas being restored to prairie or where native plant seeding would occur. Control methods would focus on prescribed burning, mowing, and/or glyphosate application by hand or backpack sprayer.

Table 3.12: Summary of Invasive Plant Control Treatments

Invasive Species	Number of Stands Species Present	Total Estimated Acres of Herbicide Treatment	Mechanical Treatment	Controlled Burn or Torch
Autumn Olive	9	≤.9	May use	May use
Barberries	6	≤0.6	May use	May use
Bull Thistle	1	≤0.1	Yes	May use
Garlic Mustard	3	≤0.3	No	No
Hoary Alyssum	5	≤.5	May use	May use
Leafy Spurge	12	≤1.2	No	No
Honeysuckles	16	≤1.6	May use	Yes
Marsh Thistle	1	≤0.1	No	May use
Smooth Brome	1	≤0.1	No	May use
Spotted Knapweed	11	≤3	May use	May use
St. Johnswort	7	≤0.7	May use	May use
Sweetclovers	3	≤.3	May use	May use

In addition to control of the 12 invasive herbaceous and shrub species, additional invasive species are of concern in the Project Area, but occupy too large of an area and are not considered cost-effective to conduct suppression control treatment. NNIS spread due to proposed treatment actions can be mitigated, however, through measures such as equipment cleaning. The following species and conditions presented in Table 3.13 would require the cleaning of equipment between infested and non-infested

stands of individual NNIS species. The need to use prevention strategies is dependant upon the ability of the NNIS species to increase either due to the proposed action or to proliferate in the type of habitat which is being developed (e.g. pine forest conversion to prairie).

Table 3.13: Species of Concern (SOC) Requiring Equipment Cleaning

NNIS Species	Stand Conditions After Treatment	
	Open and NNIS Species Not Currently Present	Forested
Autumn Olive	Yes	Yes
Barberries	Yes	Yes
Bull Thistle	Yes	No
Canada Thistle	Yes	Yes
Common Burdock	Yes	No
Garlic Mustard	Yes	Yes
Hoary Alyssum	Yes	No
Honeysuckles	Yes	Yes
Leafy Spurge	Yes	Yes
Marsh Thistle	Yes	Yes -forested wet areas
Orchard Grass	Yes	No
Queen Anne's Lace	Yes	No
Smooth Brome	Yes	No
Spotted Knapweed	Yes	No
St. Johns-wort	Yes	No
Yellow Rocket	Yes	No
Sweet Clovers	Yes	No

Various vegetation management actions are proposed in the project: thinning of red pine, clearcut and regeneration of aspen, restoration of dry sand prairie, invasive plant suppression, planting of native grasses, forbs, shrubs and trees for wildlife, and the restoration exposed sand areas caused by ORV activity.

Forests' Transportation System

The current road system would continue to serve as a vector for the spread of NNIS species throughout the Project Area and from the Project Area to other areas on both private and public land (Von Der Lippe and Kowarik 2006). NNIS are rapidly spread when vehicles drive through the area, picking up soil and seed on their vehicles and having the seeds fall off the vehicle in a different location. Spread also occurs on County maintained roads during road maintenance work such as grading. Sites within the Project Area that are currently used for dispersed camping and illegal ORV use provide disturbed areas for NNIS plant species to become established. Many illegal trash dumping sites are also sites of NNIS introduction, through yard waste and weed seeds that are carried to the site on the vehicles. In addition, the illegal use of ORVs occurs within the Project Area, both on and off of the existing road system. As these vehicles are capable of accessing the more remote locations within the Project Area, they also serve as primary vectors contributing to the spreading of NNIS.

(3.3.3) Alternative 1: The Effects of No Action on the Herbaceous and Understory Vegetation

(3.3.3a) Direct and Indirect Effects

Geographic scope of consideration: Project Area.

NNIS would continue to persist where they are currently present and become newly established where natural and human disturbances provide new habitat opportunities. There would be the continued expansion of NNIS within stands where they are already present. Without adequate methods of control, the infestations would go unchecked and the diversity of native plants would likely decline in the area of infestation. NNIS can not only alter or replace native plants, they can also alter natural ecosystems (Westbrooks 1998). At some point during the population increase, the NNIS would populate to a level at which it would no longer be feasible to eliminate the species from the area.

Marsh thistle is not known to be present on National Forest System lands outside of this Project Area. Non-treatment of this species would allow it to act as a potential seed-source for establishment in other locations in the Forest. This species is ranked as a Level 1, with direction to eradicate all individuals once discovered, so as to prevent establishment of a population on the Forest.

Non-treatment of garlic mustard, non-native barberries and bush honeysuckles would result in an increase in the current populations and provide a source for further infestation into new areas. These species are high priority NNIS species for treatment on the HNMF. They are ranked as Level 2, sparsely established on the Forest and to be eradicated where found.

Non-treatment of leafy spurge, ranked Level 3, would allow the existing populations to remain as seed-sources for the continued spread on Forest and private lands. Species ranked as Level 3 are to have outlier populations treated for suppression/eradication, to keep the infestations from expanding. Though the presence of this species has been increasing in the Project Area, it is primarily found along roadside rights-of-way and is not widespread within the stands proposed for treatment.

Non-treatment of autumn olive would also allow current populations to remain as seed-sources for the continued spread on the Forest and onto private lands. This species, ranked as Level 4, is widespread within the Forest, though limited in presence within the Project Area. The policy for treatment of NNIS on the HMNF is to prevent invasion for areas not infested or high priority areas. Since there is not an abundance of autumn olive in the Project Area, a lack of treatment in the near future would result in additional spread into the Project Area and an increase in the existing population size.

Non-treatment of spotted knapweed, sweetclovers, St. Johnswort, smooth brome, hoary alyssum, and honeysuckle in the prairie remnant areas would contribute to a decline in the quality of prairie habitat through competitive and allelopathic effects to native desirable prairie plant species. These NNIS would be expected to expand in population size and would act as infestation sources for other non-infested areas.

(3.3.4) Alternatives 2 and 3: The Effects of the Proposed Actions on Non-Native Invasive Plant Species

(3.3.4a) Direct and Indirect Effects

Geographic scope of consideration: Project Area.

Timber harvesting activities would cause ground disturbance that would make the establishment of NNIS more likely to occur. The cleaning of equipment would reduce the chance of spreading the NNIS species from one treatment area to the next.

Herbicide treatment would serve to reduce NNIS that are not currently well-established throughout the Project Area. Treatments would reduce the timeline for the establishment of the species in the Project Area through the reduction of source populations. They would also reduce the loss of available habitat for native flora and the resulting loss of food chain support for pollinators and other wildlife. Direct effects of herbicide treatment would include the incidental dripping of herbicide on immediately adjacent plants. Since selective spot spraying would be used, it is not expected that many non-target plants would be affected. Mechanical treatment of NNIS would only take place in small areas where practical application could occur, such as in the prairie restoration stands or to smother small areas of leafy spurge. The direct effect would be killing non-target vegetation and would be localized and short-term. Some species may resprout from perennial rootstock. Native reseeding would follow such treatment to re-establish local native flora.

The effects of road closures would result in less opportunity for new NNIS establishment and dispersal along travel corridors. ORV restorations would result in the re-establishment of native plant communities and provide for less openly disturbed areas for NNIS establishment.

The maintenance of designated openings for wildlife would include the native planting of individual plants and the brushing and clearing of openings that have filled in with shrubs and canopy. Equipment cleaning between stands would reduce the potential for the spread of NNIS resulting from these activities.

The effects of dry sand prairie restoration on NNIS depends upon the follow-up monitoring for NNIS treatment effectiveness and new NNIS establishment. As directed in the monitoring portion of this project, plant monitoring would be conducted yearly for five years after restoration treatment begins. Monitoring of both NNIS treatment effectiveness and for the occurrence of new infestations would result in the timely detection of any increase in NNIS in the restored prairie stands and rapid treatment response. Yearly follow-up would be a critical factor for eliminating the risk of creating dense cover of openland NNIS such as is currently present in Compartment 572, Stands 4 and 10.

(3.3.4.b) Cumulative Effects

Geographic scope of consideration: Big Prairie Township.

NNIS infestation would be expected to continue to increase within Big Prairie Township regardless of the alternative chosen. New invasive plants would likely occur, particularly if climate changes show a warming trend. NNIS infestation would be expected to continue to occur on private lands that are adjacent to (and within) the Township. Roads and recreational use areas would be expected to continue to be areas of new NNIS infestation and corridors for their spread. NNIS are considered to be one of the top two factors contributing to loss of ecosystem biodiversity (Tallamy 2007). NNIS generally do not contribute to the food chain as much as native plants do, particularly for insects, the major converter of plant foods into protein sources for birds and mammals (Tallamy 2007). While some NNIS species, such

as spotted knapweed, can serve as a nectar source for insects such as honeybees and the endangered Karner Blue Butterfly, many others contribute to a decline in food support for native insects (Tallamy 2007). NNIS treatment in the Project Area could also occur in the future under the FS programmatic Environmental Assessment (EA) that is expected to be in place by the summer of 2009. This programmatic instrument is designed to treat either high priority NNIS species or high priority lands. Only a portion of the weed species and some of the stands in this proposed project would meet those specifications (e.g. prairie restoration lands and species ranked as Level 1, 2, or 3).

The Project Area has both historical and ecological significance, due to the past occurrence of a large prairie system known as the Big Prairie. This is one of the four historic major prairie systems in Newaygo County. There is little of the original prairie that remains, though some prairie plants may occur sporadically. A 40 acre parcel within the Project Area is currently being restored to prairie by the Big Prairie Township, with the financial and technical assistance of the USDA Natural Resource Conservation Service, the Fremont Area Community Foundation, the Nature Conservancy, and local historical organizations. This parcel is located on land immediately west of National Forest System lands in Compartment 570. Under Alternative 1, there would be no management activities related to the treatment of Scotch pine, spotted knapweed, or leafy spurge. The continued presence of these species would serve as an infestation source for the adjacent Township prairie restoration project.

The proposed treatments would help to keep NNIS out of the treatment stands and help the native vegetation retain a suite of native plant species, particularly in the areas of prairie restoration (as noted above).

Timber harvesting is similar between the action alternatives and the effects are essentially the same for NNIS between the two alternatives. Under Alternative 2 there would be a larger area for the re-establishment of dry sand prairie. This would carry a greater risk for NNIS infestation of the newly opened land. Monitoring and the associated annual follow-up treatment would mitigate this. Alternative 2 also calls for more road closures. This would provide a greater benefit for controlling the spread of NNIS. Both of the action alternatives would have a *positive effect* on native plant habitat through the reduction of NNIS.

(3.4.1) Regional Forester Sensitive Plant Species (RFSS)

No Federally Threatened or Endangered plant species are found, or are expected to occur, within the Project Area. Sensitive plants include other plant species at risk. Regional Forester Sensitive Species (RFSS) are species listed by the Regional Forester that 1) have a national, or state ranking of 1 – 3 (which refers to rareness of the species and risk for becoming extinct), 2) have potential habitat or populations on the Forest, and 3) are shown by Risk Evaluation for the Forest to be at risk.

Field surveys were conducted in the project area during the 2006 field season with some supplemental surveys done in 2008. Survey results, which include habitat descriptions and observed species lists, are filed with the District Botanist at the Baldwin Ranger Station. RFSS found within the project area included prairie smoke *(Geum triflorum)* and purple milkweed *(Asclepias purpurescens)*. Furrowed flax *(Linum sulcatum)*, also a RFSS, was found by MNFI in 2006 in the proposed treatment area.

Table 3.14: RFSS Identified in the Project Area

RFSS Plant Species	Compartment	Stand(s)
Furrowed flax*	572	5, 6
Prairie smoke*	572	7
Purple milkweed	564	30

**Species found recently in the Project Area but not re-located in 2008.*

Two other rare plants or species of concern have been found during other periods of observation within, or close to, the Project Area (MNFI database 2008). These species include: Alleghany plum (*Prunus alleghaniensis var davisii)*; and bald-rush (*Psilocarya scirpoides*). The Michigan Natural Features special habitats located in the area include: former prairie remnants, oak/pine barrens, and Dudgeon Swamp (T14N, R11W, Sections 19 and 30).

In addition to plant RFSS which have been found within, or close to, the Project Area, there are also habitats present that have the potential to support 39 other RFSS species not documented as having been found in the Project Area. These 44 RFSS (those documented in the area and those with likely habitat in the Project Area) are listed and described further in the Biological Assessment and Biological Evaluation, found in the Mast Lake Project Record (Keough and McGhan, 2008).

The following effects analyses are summarized from the Biological Assessment and Biological Evaluation. The RFSS plants were analyzed by habitat types and include: upland forest, lowland forest, wetland openings, and dry openings.

(3.4.2) The Effects of Alternatives 2 and 3 on Plant Regional Forester Sensitive Species (RFSS) in Upland Forest Habitats

(3.4.2a) Direct and Indirect Effects

Proposed vegetative management activities (timber cutting, restoration to prairie, NNIS): *Positive impact.*

Proposed management of the transportation system: *Positive impact.*

Proposed wildlife habitat improvement projects: *No impact.*

(3.4.2b) Cumulative Effects

Area of analysis is Newaygo County, Michigan.

The Project Area was historically oak/pine barren and dry sand prairie habitat. The Project Area and Newaygo County have been heavily impacted since the pre-settlement conditions of the 1800's. Four major prairie systems were located in the County, surrounded by acres of oak/pine savanna and barrens. The Project Area contains some of the historic Big Prairie Dry Sand Prairie. Lack of fire, land development and disturbance, and invasive plants, however, have had a major negative effect on these habitats. In the next 10-20 years, oak/pine savanna/barrens would continue to be encroached upon by woody vegetation. Wildfire is no longer a viable environmental factor for reducing canopy cover, due to the concerns for public safety and the increase in private holdings within the Forest boundaries. Wildfire not only reduces the tree canopy, but also renews the soil nutrients and favors species that are fire-dependent. Lack of fire and canopy closure makes this habitat increasingly unsuitable for more open canopy plants such as Missouri rock cress, side-oats grama, Hill's thistle, upland boneset, prairie smoke, Leggett's pinweed, Alleghany plum, hairy mountain-mint, false pennyroyal, forked bluecurls, and Canadian milkvetch. The prairie habitats were farmed in the past, severe soil erosion occurring as a result. Consequently, most of the former prairie was planted to pine to counteract this loss of soil. The documented occurrences of prairie smoke, Alleghany plum, purple milkweed, and furrowed flax in the past 10 years, indicate that remnant habitat persists. Though most of these occurrences are located in areas with invasive plant issues.

Other prairie and savanna/barrens restorations are occuring in the County. Big Prairie Township is restoring 40 acres of dry sand prairie adjacent to the Project Area in compartment 570. The Nature Conservancy and several other nature associations and possibly Consumer's Energy are, or will be,

restoring prairie habitats throughout the County. The areas of concentration are largely to the south and west of the proposed Project Area. Much of the expected future actions and priority areas will be published shortly by The Nature Conservancy in a planning document for the County (John Legge, personal communication). The Consumer's Energy potential restoration would be along the powerline corridor along Pine Ave, adjacent to and bordering some of the Project Area. All of these restorations would help restore potential habitat for sensitive plant species and help provide a corridor for plant dispersal and genetic flow for sustainable viable populations of rare plants. This proposed project would have a cumulatively positive additive effect of additional prairie/barrens habitat for the county.

From 1990 to 2000, the population of Newaygo County increased by over 25%, making it one of the fastest growing counties in Michigan. This growth rate is 3.5 times the average for Michigan counties. This trend, although at a somewhat reduced pace, continues into this decade with an estimated 4.5% increase from 2000 to 2005 (Nelson et al. 2006). Along with an increase in population, an increase in development on private lands is expected. This would decrease the amount of undeveloped plant habitat and increase likely introduction of non-native and invasive plant species. Increased land development on private lands would create additional problems for rare plants by creating more isolated populations and reducing the genetic exchange needed for healthy populations. Current population levels of NNIS species in the Project Area would continue to spread and act as a source for spread to new areas on both private and public lands. Native plant habitat would continue to be lost due to NNIS plant species.

Off-road recreational vehicle use has increased in popularity and is evident in the Project Area and other parts of the County. It is expected that such use would continue. While such activity on the Forest is expected to occur on managed trails and roads, illegal usage occurs on the Forest and results in the destruction of plants and erosion damage to plant habitat. Creation of a greater amount of open conditions in dry sand prairie restoration through this proposed action and other prairie restorations would likely contribute additional negative effects to these open canopy sensitive species.

Overall, the restoration of former prairie would result in a *beneficial impact* for the barrens/prairie species. This would have a cumulative positive effect combined with other restoration occurring in Newaygo County.

(3.4.3) The Effects of the Proposed Project on Plant Regional Forester Sensitive Species (RFSS) in Lowland Forest Habitats

(3.4.3a) Direct and Indirect Effects

Proposed vegetative management activities (timber cutting, NNIS): *Positive impact.*

Proposed management of the transportation system: *Positive impact.*

Proposed wildlife habitat improvement projects: *No impact.*

(3.4.3b) Cumulative Effects

Area of analysis is Newaygo County, Michigan.

If the harvesting of aspen were not to occur, the aspen would eventually be replaced by later- seral species. The population of red maple would increase in aspen stands greater than age 90, especially in areas of high water tables. Under Alternatives 2 and 3, there would be no long-term change in the herbaceous vegetative habitat. Aspen management would be expected to continue on private and public lands into the future.

For Alternatives 2 and 3, *No impact* from direct effects is expected for the RFSS/sensitive plant species listed for this habitat. No RFSS species found in this habitat were detected during survey. While there may be short-term negative effects from a reduced canopy, canopy cover is expected to return over time. There would be a positive impact from the reduction of NNIS species in the stands. Overall, the actions under Alternatives 2 or 3 would not effect the trend in RFSS viability.

(3.4.4) The Effects of the Proposed Project on Plant Regional Forester Sensitive Species (RFSS) in Dry-Mesic Openings

(3.4.4a) Direct and Indirect Effects

Proposed vegetative management activities (burning, restoration to prairie, native plantings,NNIS): *Positive impact.*

Proposed management of the transportation system: *Positive impact.*

Proposed wildlife habitat improvement projects: *Positive impact.*

(3.4.4b) Cumulative Effects

Area of analysis is Newaygo County, Michigan.

Openings would continue to be encroached upon by woody vegetation, making them increasingly unsuitable for more open canopy plants such as Missouri rock cress, side-oats grama, Hill's thistle, upland boneset, prairie smoke, Leggett's pinweed, Alleghany plum, hairy mountain-mint, false pennyroyal, forked bluecurls, and Canadian milkvetch. Openings would also continue to become infested with NNIS species, reducing habitat for native and rare plant species. Openings would continue to be impacted by off-road vehicle use, which effect individual plants and reduce habitat through soil compaction, soil erosion, and the introduction of NNIS. Openings located on private lands would also continue to be impacted through land development. These cumulative effects are discussed in greater detail in the Upland Forest cumulative effects as part of the consideration of converting forest habitat to restored dry sand prairie.

The Michigan Natural Features Inventory notes in their database for sensitive species and habitats that NNIS infestation is a major factor impacting the quality of barren and prairie remnant habitat in the Big Prairie Township (MNFI 2008). Alternatives 2 and 3 would help restore some of this habitat, both in terms of quality and quantity. It would be additive to the restoration activities occuring with the Big Prairie Township and others.

Overall, positive impacts for prairie RFSS habitat are expected to occur from Alternatives 2 and 3. This would be due to the reduction of NNIS, restoration of forest to prairie habitat, and the use of wildfire (and other management actions) to improve the current prairie conditions. Likewise, management of non-prairie openings would result in an improved condition for openland RFSS species, such as yellow ladies tresses.

(3.4.5) The Effects of the Proposed Project on Plant Regional Forester Sensitive Species (RFSS) in Wetland Openings

(3.4.5a) Direct and Indirect Effects

Proposed vegetative management activities (NNIS): *Positive impact.*

Proposed management of the transportation system: *Positive impact.*

Proposed wildlife habitat improvement projects: *No impact.*

(3.4.5b) Cumulative Effects

Area of analysis is Newaygo County, Michigan.

Along with other wetland types, small depressional areas (seasonal wetlands) have undergone loss. The total amount of wetland lost within the analysis area is unknown. However, the United States Fish and Wildlife Service reports over 50 percent of Michigan's original wetlands have been drained or filled (Dahl 2000). Comer (1996) estimated a 28% loss of wetlands in the Northern Lower Peninsula of Michigan. The estimates of wetland loss for those counties congruent with the Forests range from 7 to 58 percent. In addition, it is estimated that over 90% of shallow wetlands in Michigan have been lost since pre-settlement conditions (Kashian 1995). Ducks Unlimited estimated a loss of 293 acres in Newaygo County wetlands in an approximate 20 year period from the late 1970s to 1998 (Ducks Unlimited undated circa 2004). Of those remaining wetlands in the northern Lower Peninsula, it is likely that wetland types have changed in vegetative dominance and in physical characteristics, as has been noted for the remainder of the Midwest/Northeast. Wetlands typically occur in discrete patches in a matrix of upland habitat, and consequently, many wetland species must be sustained by avenues of migration within and between metapopulations (Gibbs 2000). The role of shape, size, and spatial dispersion in the wetland mosaic is a highly complex relationship. Changes in wetland composition or wetland types in the mosaic can result in a change or loss of functional value, including habitat roles, which may not be apparent for a number of years (Findlay & Bourdages 2000, Kusler 1983, Kusler & Montanari 1978).

It is not expected that the actions proposed in this project would significantly alter the wetlands in the Project Area with the exception of the eradication/suppression of marsh thistle, an invasive plant species not considered to be common in Newaygo County. The control of marsh thistle would have a positive effect on wetland habitat for the local vicinity of the treated stand. Other NNIS noted in the wetlands are not identified for treatment due to the priority ranking of NNIS treatment on Forest lands and practicable levels of NNIS control given fiscal limits. These other NNIS species, such as Canada thistle would be expected to continue to grow in populations where currently present.

(3.4.6) Botanical Determinations

No federally threatened or endangered plant species are found within the Project Area. Alleghany plum, purple milkweed, furrowed flax, and prairie smoke are the RFSS that were found within the Project Area. The determination of the effects for potential sensitive species based on habitat type is summarized in the following table:

Table 3.15: Determination Table by Habitat Type for Plant RFSS

RFSS Habitat	Alternative 1	Alternative 2	Alternative 3
Upland Forest	MINT	Beneficial Impact	Beneficial Impact
Wet Forest	MINT	MINT	MINT
Dry-mesic Openings	MINT	Beneficial Impact	Beneficial Impact
Wetland Openings	MINT	No Impact	No Impact

MINT = May Impact, Not Likely to Trend

The determination of the project effects for the sensitive species found in the Project Area is summarized in the following table:

Table 3.16: Determination Table for Plant RFSS Found in the Project Area

RFSS in Stands Proposed for Treatment	Alternative 1	Alternative 2	Alternative 3
Purple Milkweed	MINT	Beneficial Impact	Beneficial Impact
Prairie Smoke	MINT	Beneficial Impact	Beneficial Impact
Furrowed Flax	MINT	Beneficial Impact	Beneficial Impact
Alleghany Plum	MINT	Beneficial Impact	Beneficial Impact

MINT = May Impact, Not Likely to Trend

Conclusion: Alternatives 2 and 3 would result in an increase in favorable conditions for barrens and prairie habitat for plant/nectar species, and would reduce NNIS populations and spread. Alternative 2 would provide for the most area of dry sand prairie habitat restoration, with the success of restoration dependent on the devotion of the necessary resources over a 10 year period of time. Alternative 1 would continue to contribute to the disappearance of habitat for barrens and prairie habitat plant species and would not reduce the negative effects related to the establishment and spread of NNIS in native/sensitive/prairie plant habitat.

(3.5) Transportation

The information presented in this document relative to the transportation system of the Mast Lake Project Area is a result of the comprehensive Mast Lake Road Analysis. The proposed management of the transportation system, by alternative, is displayed in Appendix A of this document.

(3.5.1) Area of Analysis

Direct and Indirect Effects: Within the Project Area.
Cumulative Effects: Within and adjacent to the Project Area.

(3.5.2) Resource Information and Existing Condition

In managing the transportation system within the Mast Lake Project Area, the IDT has categorized the roads as: 1) county roads, 2) classified roads, or 3) unclassified roads. For this project, county roads are those roads that are under the jurisdiction of Newaygo County. The management of these roads is carried out by the Newaygo County Road Commission. Classified roads are wholly, or partially within or adjacent to, National Forest System lands and have been previously designated as needed for motor vehicle access. In some cases, they have been designed to meet specifications. Unclassified roads are on National Forest System lands and have not previously been managed as part of the Forest transportation system. These include unplanned roads, abandoned travelways, and off-road vehicle tracks that have not been designated. These may also include roads that were once under a permit or other authorization and were not decommissioned upon the termination of the authorization.

The entire Project Area consists of approximately 17,100 acres. Of this, approximately 4,000 acres are National Forest System lands and 13,100 acres are in private or other public holdings. For the sake of this analysis, road densities are based on the miles of road per square mile of National Forest System lands. County roads are included in this density where they are adjacent to, or run through, these lands. Private roads are not included as part of the road density calculation. The Project Area includes Management Areas 4.2 and 4.4. According to the Forest Plan, both of these Management Areas are to be managed to provide an average road density of 3.0 miles of road/square mile.

County Roads

Within the Project Area, there are approximately 13.7 miles of Newaygo County Road that are adjacent to, or run through, National Forest System lands. The Forest Service makes no management decisions regarding County Roads; however, the portions of these roads that are adjacent to National Forest System lands are used in calculating the road densities for this Project Area.

The determination of the roads under the jurisdiction of Newaygo County has been determined through the most up-to-date Act 51 Map. This map shows all of the roads, within the area, that the county claims and is periodically updated to reflect changes in the county road system. The following table lists the county roads within the Mast Lake Project Area and their respective mileages.

Table 3.17: Project Area County Road Mileages

Road Name	Approximate Mileage
2 Mile	2.6
Thrush	1.1
Cypress	1.0
Elm	1.0
1 Mile	0.5
Locust	2.5
Cottonwood	0.5
20th	1.1
8th	0.7
M-20	0.4
Pine	1.0
28th	0.8
CR 23873	0.5
Total	**13.7**

Classified and Unclassified Roads

There are approximately 9.8 miles of classified Forest Service roads within the Project Area. Typically, these classified roads have been created by the Forest Service, are seasonally open, and receive minimal to no maintenance. Classified Forest Service roads are utilized during the spring, summer, and fall by recreationists and local traffic. Roads are not plowed in the winter and are often used by snowmobiles. Some of these roads existed prior to federal ownership and some have been developed since that time to extract forest products.

There are approximately 14.5 miles of unclassified roads in the Project Area that are on National Forest System lands. These roads have been created through a variety of means. Some were originally developed by the Forest Service to conduct management activities, but were not incorporated into the official road system. Some are roads developed prior to Forest Service ownership by previous landowners. Some have been illegally created by Forest users. Many of these roads are either duplicates (lead to the same location as another road) or dead-ends. A complete listing of the classified and unclassified roads (and mileages) is found in the Mast Lake Road Analysis (January, 2008)

The total combined road density of County, classified, and unclassified roads immediately adjacent to or bisecting National Forest System lands is approximately 6.0 miles of road per square mile.

Existing Condition Relative to the Proposed Activities

The transportation system throughout the Project Area reflects a combination of the history of use of these roads for the extraction of timber and the roads that were necessary in the development of forested stands after the dry-sand prairie areas were planted. Relating to the extraction of timber, most of the classified roads typically served as former haul roads, leading from landing locations to county roads. Those roads developed during reforestation efforts were used primarily as access into the newly established pine stands and have continued to serve as Forest access points for the public. Because of the infrequent use and maintenance of these roads, many of these roads are currently not up to standard and not suited for use by low-clearance passenger vehicles. There is currently not adequate access across National Forest System lands to some of the stands that are proposed for treatment. In these instances, private easements would be necessary to access these stands.

In the northern portion of the Project Area, there are interspersed pockets of lowland areas. In these areas, the roads have been historically designed to allow for access to timbered stands while avoiding the most sensitive areas. This design approach has provided a transportation system that has minimized the road-related resource damage that can be found in other locations on the Forest with similar soil types.

The Sparta soils found in the southern portion of the Project Area have very different characteristics, with some areas having been severely eroded through agricultural practices prior to Forest ownership. In these areas, the soils have little to no binding characteristics and are extremely susceptible to natural and human-induced erosion. The roads in this portion of the Project Area are interspersed with unvegetated areas (on both public and private land) that serve as reminders of how the area may have appeared during the days of the "Big Prairie Desert". These areas currently receive moderate to heavy use by ORVs, which further prevents the re-establishment of vegetation. In addition, many of these roads are currently used as access points to illegally dump trash in the area.

Road traffic has been identified as a vector for the spread and persistence of NNIS. The current road system in the Project Area promotes this spread, but also serves as a means of access for the mechanical and herbicidal control of these species. This system also aids in wildland fire suppression efforts by allowing open access throughout the Project Area. Not only does this allow access to remote areas for suppression efforts, but individual roads also serve as "natural" control lines for both wildland fire suppression and prescribed burning efforts.

The transportation system throughout the Project Area is currently used extensively by those recreating and living in the area. Recreation use includes such activities as hunting, dispersed camping, designated camping, horseback riding, ORV riding, snowmobile riding, hiking, driving for pleasure, wildlife viewing, mushroom gathering, and more. These activities incorporate the use of county roads, classified roads, and unclassified roads. In some locations, roads that were originally developed to service timber management activities are now used exclusively for recreational purposes. Some extensions to these roads have been developed, leading to dispersed campsites and, in some locations, ORV play areas. In other locations these roads dead-end at old landing locations or they are restricted by topographical features. There are portions of these roads that currently show signs of erosion and/or rutting. In some locations, the barricades of blocked roads have been breached by those recreating in the area or in search of firewood.

The current transportation system in the Project Area allows user-access to remote areas. In some instances, this access has been utilized by the public for dumping trash and establishing permanent hunting structures. There are at least twenty-two trash dumping sites and multiple permanent hunting structures that have been identified on National Forest System lands within the Project Area.

See the Road Cards in Appendix A for actions proposed on specific roads by alternative.

(3.5.3) Alternative 1: The Effects of No Action on Transportation

(3.5.3a) Direct and Indirect Effects

The management of the transportation system under this alternative would result in the following (mileages are approximate):

Table 3.18: Alternative 1: Effects to Transportation System

All Roads Left Open in the Project Area (miles)	Classified Road Closures (miles)	Unclassified Road Closures (miles)	Resulting Road Density (miles/square mile)
38.2	0	0	6.1

Under Alternative 1, there would be no changes made to the roads in the Project Area. All classified Forest Service roads that are currently open would remain open. All classified Forest Service roads that are currently closed would remain closed. Roads previously closed, but now breached, would be re-closed. The open roads would continue to receive minimal to no maintenance. No management activities would occur within the Project Area at this time, so the transportation system would not be impacted or improved as a result of treatments.

Indirectly, the management of the transportation system under this alternative would allow for the greatest amount of public access throughout the Project Area. This alternative would offer a decreased sense of displacement for Forest users, in comparison to Alternatives 2 and 3, and promote their use of the area for such activities as firewood gathering, dispersed camping, wildlife viewing, recreational driving, hunting, and gathering. Likewise, future management activities could be conducted in this area with reduced disruption relating to the re-opening of closed roads prior to conducting activities. The roads would allow for maximum access in the event that wildfire suppression would be necessary.

The road network would likely expand with the anticipated increased use related to predicted population increases. This expansion would come in the form of increased unclassified, user-created roads and spurs off of existing classified and unclassified roads. As the maintenance of the Forest road system in this area would not increase proportionately with the use, the unimproved road system would slowly deteriorate as more people utilize them. This would be especially evident in areas of Sparta soils, where severe erosion has occurred in the past. Within the Project Area, it is these areas that are most susceptible to the degrading forces of ORV use. It is also these areas where the most ORV use is occurring. Under this alternative, it would be likely this use would further increase in these areas. This would cause localized "blow-outs" in, and adjacent to, the roads where ORV use is currently expanding. Over time, these areas would become impassable to low-clearance vehicles.

As use increases, the existing closures would likely fail and there would be increased costs to provide a functional transportation system for use in future management activities within the Project Area. With no timber harvesting activities occurring under this alternative, there would be no road widening to permit the passage of haul vehicles. There would also be no improvements made to the existing road entrances or haul routes. Indirectly, this would contribute to the narrowing of some of these roads and would also make portions of some roads impassable by low-clearance passenger vehicles.

The road network would continue to be utilized by those dumping trash. With the predicted increases in population and costs of sanitation disposal, it is likely that trash dumping would increase on National Forest System lands within the Project Area. This would serve to degrade the visual quality of the area and contribute to point and non-point sources of pollution on the Forest.

This alternative would not serve to move the Project Area closer to the Transportation Standards and Guidelines for Management Areas 4.2 and 4.4, found in the Forest Plan.

(3.5.3b) Cumulative Effects

Post-European settlement, the transportation system within and adjacent to the Project Area was developed and used to provide a means of transporting people, timber, and agricultural commodities from place to place. As the land became unproductive for agriculture, or people were financially forced to abandon their farmsteads, much of the land that is now National Forest System lands, was forfeited to the state. During the era of the Civilian Conservation Corps, roads were developed in this area to provide access to the plantations that were being established at that time. Many of these roads are still in place. Since that time, these roads and new roads have been established throughout the Project Area for timber harvesting activities. Within the past couple of decades, attempts have been made at managing the road network in this area. Some roads have been successfully closed to motor vehicles, while other closures have been breached. The roads located on public lands receive variable amounts of use depending on the time of year. This use increases during times associated with high recreation use (spring, summer, and fall seasons).

The majority of the land within the Project Area is in private holdings (76.6%). These parcels range in size, with a general trend of larger, individual parcels occurring in the northern portion of the Project Area. The parcel sizes tend to decrease with closer proximity to the Hardy Dam Pond. As viewed from public lands, the larger private holdings in and around this area are managed primarily as recreation land, homesteads, and for agriculture.

The road systems on active agricultural lands typically consist of access roads leading into and around planted fields. Agricultural activities in and around this area currently consist of limited row cropping, hay production, pasture land, and Christmas tree plantations. The private lands managed for recreation in this area typically contain roads of various maintenance levels that provide access for the activities that occur. These roads may be designed to support motor vehicle traffic, ORV traffic, or foot traffic. Road densities on these lands are variable, related to the associated use, and difficult to estimate. As is common when private holdings in an area are represented by a high frequency of small parcels adjacent to National Forest System lands, the Forest roads within the Project Area receive frequent use by adjacent landowners for both recreation and general travel.

The cumulative effects related to transportation systems are the result of human activities throughout time. History shows that the road networks change in use and design as human needs and activities evolve. It is expected that as human population pressures in rural areas increase, the size of individual landholdings would decrease as the larger parcels are split off and sold. This would cause an overall increase in private land fragmentation and a diversity of private land uses in and around the Project Area. The result of this trend would be an increase in use of the National Forest System lands for recreation.

With the current and anticipated use of motor vehicles and ORVs for recreation, there would likely be an increased amount of use by these vehicles on the road systems of National Forest System lands. In fragmented areas of the Project Area, where boundaries between private and public land are not clearly identified, it is common for those participating in motorized recreation on the Forest to trespass on to private property. Within the Project Area, there are currently areas where private property owners have made failed attempts to prevent this type of trespass. The most notable locations occur in areas with Sparta soils, where the high sand content of the soil is inviting to those who participate in this form of recreation. Due to the low binding properties of this soil, the vegetation that has been planted in these areas (i.e. pine trees) is susceptible to root damage and windthrow. Over time in these areas, these activities promote the loss of this vegetation, the expansion of the existing road system, and the further encroachment of ORV use areas onto private property. Under this alternative, the effects related to this

would be compounded within the reasonably foreseeable future, promoting conflicts between the private property owners and the Forest-users within the Project Area.

In conjunction with this anticipated increase in the use of the roads by the public, there would also continue to be use of these same roads for Forest management activities in the future. These activities would occur both within and adjacent to the Project Area and would include the use of Forest roads and roads under the jurisdiction of the Newaygo County Road Commission. These uses would include: timber havesting and hauling, habitat improvement and restoration projects, wildland fire suppression, prescribed fire activities, recreation patrols, law enforcement, and more.

In the future, the transportation systems on National Forest System lands open to motor vehicles on the Huron-Manistee National Forests will be identified on a Travel Management Motor Vehicle Use Map. This plan will identify roads throughout the Forest that are open for public use; however, currently, Project Areas are analyzed individually.

It would be expected that the road densities within and adjacent to the Project Area would increase, in the reasonably foreseeable future, under this alternative. Factors influencing this would be: 1) the continued expansion of the road system by Forest users on National Forest System lands, 2) the anticipated further fragmentation of private lands and the roads on private lands associated with this fragmentation, and 3) the further development of county and state roads to service the needs of the increasing human population of the area.

(3.5.4) Alternative 2: The Effects of the Proposed Actions on Transportation

(3.5.4a) Direct and Indirect Effects

The management of the transportation system under this alternative would result in the following (mileages are approximate):

Table 3.19: Alternative 2: Effects to the Transportation System

All Roads Left Open in the Project Area (miles)	Classified Road Closures (miles)	Unclassified Road Closures (miles)	Resulting Road Density (miles/square mile)
20.4	5.9	11.9	3.3

Under Alternative 2, the transportation system would be managed to move the Project Area closer to the Standards and Guidelines of the Forest Plan. This would occur through the re-enforcement of existing road closures, reducing the number of dead-end spur roads and unclassified roads, limiting motorized access to areas proposed for dry-sand prairie restoration, and reducing the access to areas of historic trespassing onto private property and the dumping of trash on National Forest System lands. The resulting road density throughout the Project Area under this alternative would be 3.3 miles of road per square mile of National Forest System lands.

The roads selected to remain open would primarily serve as portions of loop systems that would allow access throughout the Project Area. The roads forming these loops have been identified through the Mast Lake Roads Analysis (2008) as those causing minimal resource damage, having appropriate placement, and allowing reasonable public access.

Road closures would occur through the selective placement of berms, rocks, stumps, gates, vegetation (live or dead), or a combination of these methods. Closure types would be site-specific based on the effectiveness of preventing breaches. Closures may have minor impacts to adjacent areas. These impacts

may include soil displacement, felling of live vegetation, tipping and transport of stumps, changes in visual quality, and the displacement of motorized recreationists.

There would be direct effects on the transportation system related to the proposed vegetative treatments. Increased amounts of traffic related to timber harvesting would occur. Associated with the use of the road system for these purposes would be improvements made to some of the Forest Service classified roads and unclassified roads. These would include leveling, road clearing, development of specified entrances, and drainage improvements. There would be temporary disturbances to haul roads, in which rutting, compaction, and soil displacement would occur. These areas would be identified and rehabilitated post-sale. In some instances, user-conflicts may occur in areas where timber harvesting activities overlap with areas used for recreation by the public.

In at least three locations (Unclassified Road 38, Unclassified Road 41, and Forest Road 5374), roads that are currently closed would be re-opened, improved for the use of hauling, and closed after harvesting activities are complete. In another location (north of 4th Road), improvements would be necessary in the development of a haul road that would need to cross private property. This would require consent from the private property owner. In at least three other locations (Forest Road 5900, Forest Road 9430, and Forest Road 9426), road improvements would be necessary to facilitate management activities. These roads would be left open to the public after harvesting activities are completed. In the locations where timber landing-sites are developed adjacent to existing roads, short entrances would be needed for the ingress and egress of the logging trucks and tree processing equipment. These roads would be closed post-sale.

Under this alternative some of the roads would be used to access openings and forested stands for the purposes of wildlife habitat creation. In some instances, this may require traveling on these routes with the heavy equipment necessary for tree cutting, tilling, and planting. There would be no anticipated negative effects to the roads related to this. Some of the roads would also likely be used as control lines for prescribed burning efforts. Depending on the site-specific characteristics of the roads identified for this purpose, some vegetative clearing may need to occur to effectively contain burn activities. This is typically accomplished through the use of a combination of chainsaws and a dozer plow. At these locations, minor soil disturbances may occur to the roadbed. In most cases, the roadbeds in these areas are currently unimproved. Rehabilitation to these areas would occur after burning.

The mechanical and/or herbicidal treatment of NNIS under this alternative would have no direct effects on the transportation system in the Mast Lake Project Area.

The existing roads would serve as the main access points for conducting the activities related to dry-sand prairie restoration in the Project Area. These activities would occur in areas consisting predominantly of Sparta soils. As these areas have proven susceptible to natural and induced erosion processes in the past, increased efforts would be made to protect these locations into the future. Access roads currently exist to service all of the areas proposed for these treatments. These roads would be utilized to administer the treatments, including the transport of heavy equipment, implements, non-retrievable inputs (i.e. seed, lime, etc.), and prescribed burning and timber harvesting equipment. The effects related to this use would be similar to that described under the vegetative treatments portion of this section. In addition, due to the combination of current public use (motorized recreation) in these areas, the fragility of the soils, and the level of inputs that would be necessary for successful restoration, the access roads leading to these areas would be closed to the public during and after the restoration efforts are completed. These closures would occur with gates to continue to allow access for management purposes. As a result, the transportation system and restoration areas would be protected, but the public that currently utilizes this area for motorized recreation would experience a level of displacement.

The management of the transportation system, under Alternative 2, would reduce motorized public access throughout the Project Area. This alternative would be pro-active in reducing the potential for further expansion of roads related to the anticipated increase in Forest use. By closing duplicate/dead-end classified roads and unclassified roads, the associated roadbeds would begin re-vegetating and induced erosion and forest fragmentation would be reduced. Though this alternative would promote a greater sense of displacement for Forest users in comparison to Alternatives 1 and 3, the designed loop systems would offer a transportation system that provides for motorized vehicle travel throughout the Project Area.

Motor vehicle travel throughout the Project Area would be limited to the roads identified to be managed as open. The maintenance and signing of the road system would improve because limited resources could be directed towards a distinct system of roads. This would aid in the use of the system for recreation patrols and law enforcement. The proposed road system would still allow adequate access for wildland fire suppression activities. The areas most prone to wildfires occur in the areas on contiguous pine plantations. For this project, these areas are also proposed for a combination of vegetative treatments (thinning, regeneration, or removal) or dry-sand prairie restoration. All of which would reduce the potential for wildfire occurrence. In addition, the closures in the area of most concern would occur through gating, which would allow access for the activities associated with wildfire suppression. However, the "natural" control lines that roads can serve as would gradually be lost as existing roadbeds become revegetated.

There are portions of roads that are identified to be closed that are experiencing resource damage related to motor vehicle traffic. These areas typically occur on slopes or contain erosive soils. Through the management of the roads under this alternative, the areas that would be closed would no longer be impacted by motor vehicles and natural or artificial reclamation would take place.

The proposed timber harvesting activities occurring under Alternative 2 would widen some roads to accommodate logging equipment. There would also be improvements made to existing road entrances and haul routes. Indirectly, this would result in an improved road system for low-clearance passenger vehicles. There would be no expected indirect effects related to vegetative management activities on roads in the Project Area that are not utilized for timber hauling. There would also be no indirect effects to the road system related to the wildlife habitat creation activities, and the non-native and/or invasive species treatments.

Rehabilitation would occur at two sites that have been damaged by ORV use. The roads leading into and out of these locations would be closed to allow for rehabilitation and to protect these areas once the work is completed. These roads would be obliterated to allow for natural and planted vegetation to become established. Over time, there would be no indication that these roads existed.

The resulting road network would continue to be utilized by those dumping trash, though the opportunistic areas would be reduced. The use of the Forest for this activity typically occurs on dead-end spurs located directly off of county roads in areas that are fragmented with private property. All of which exist in this Project Area. The management of the roads under this alternative would most limit the locations where this occurs, as compared with Alternatives 1 or 3.

(3.5.4b) Cumulative Effects

The effects of actions in the past and present would be similar to those of Alternative 1. The future effects of implementing Alternative 2 would be the continued public and administrative use of a more restrictive road system within the Project Area, as compared with Alternatives 1 and 3. With the likely increases in human population and recreational pressures on National Forest System lands and private lands in and around the Project Area, it is likely that the use of the road system would increase. The result of this

alternative would be a well-designed, higher-use road system that would minimize resource damage. By reducing the road densities within the Project Area, fewer opportunities would exist for the development and expansion of unauthorized user-developed roads. There would be an overall reduction in Forest fragmentation due to the reduced road density. The Project Area would move closer to the road density standards for Management Areas 4.2 and 4.4.

With the closing of classified and unclassified roads under this alternative, traffic would be channeled to the Forest roads that are left open and the roads maintained by Newaygo County. This channeling effect would carry into the future as those utilizing the road system become accustomed to the layout of the changed road system. Increased use of the county maintained roads to reach Forest destinations would be expected under this alternative, as some of the short-cut routes would be eliminated. County roads in and adjacent to the Project Area have been designed to handle this use and would not be negatively affected by the changes proposed to the Forest road network under this alternative.

(3.5.5) Alternative 3: The Effects of the Proposed Actions on Transportation

(3.5.5a) Direct and Indirect Effects

The management of the transportation system under this alternative would result in the following (mileages are approximate):

Table 3.20: Alternative 3: Effects to the Transportation System

All Roads Left Open in the Project Area (miles)	Classified Road Closures (miles)	Unclassified Road Closures (miles)	Resulting Road Density (miles/square mile)
25.4	5.3	7.5	4.1

The differences between the two action alternatives would be most apparent in two distinct areas:

Area 1: Described as the portion of National Forest System lands that is east of Hemlock Road, south of Two Mile Road, and west of Elm Road (Compartment 565). Under Alternative 2, the roads in this area would be closed, leaving parking space to accommodate those that use the area for recreation. Under Alternative 3, the entire network of roads in this area would be left open to motorized vehicle traffic.

Area 2: Described as the portion of National Forest System lands that is north of 36th Road, east of Locust Road, south of 28th Road, and west of Elm Road. Under Alternative 2, a portion of the road system would be left open to accommodate passage across National Forest System lands from 36th Road to 28th Road utilizing portions of Unclassified 1 and Unclassified 7, Under Alternative 3, the entire network of roads in this area would be left open to motorized vehicle traffic. The following table illustrates the differences between Alternatives 2 and 3.

Table 3.21: Road Action Variations between Alternatives 2 and 3

Road Identification	Alternative 2		Alternative 3		Compartment
	Action	Miles	Action	Miles	
Unclassified Road 19	Open	0.2	Open	0.5	565
	Closed	0.3			
Unclassified Road 23	Closed	0.1	Open	0.1	565
Forest Road 9610	Open	0.2	Open	0.6	565
	Closed	0.4			
Unclassified Road 1	Open	0.9	Open	1.2	572
	Closed	0.3			
Unclassified Road 2	Closed	0.1	Open	0.1	572
Unclassified Road 4	Closed	0.3	Open	0.3	572
Unclassified Road 5	Closed	0.3	Open	0.3	572
Unclassified Road 6	Closed	0.1	Open	0.1	572
Unclassified Road 7	Open	1.0	Open	1.0	572
Unclassified Road 8	Closed	0.1	Open	0.1	572
Unclassified Road 10	Closed	0.7	Open	0.7	572
Unclassified Road 11	Closed	0.4	Open	0.4	572
Unclassified Road 12	Closed	0.3	Open	0.3	572
Unclassified Road 13	Closed	0.9	Open	0.9	572
Total	**Open**	**2.3**	**Open**	**6.6**	
	Closed	**4.3**			

This system would provide an overall decrease in road density from what currently exists, but an increased road density compared to Alternative 2. The road management proposed under this alternative is a result of a combination of the findings of the Mast Lake Road Analysis (2008) and the public response to scoping. Individual roads were identified within the Project Area that were not components of the loop system identified in the Road Analysis, but received moderate traffic for recreational purposes. These roads would be left open under this alternative.

The direct and indirect effects related to the management of the transportation system under this alternative would be similar to the effects under Alternative 2. The anticipated amounts of traffic, the related road improvements, and temporary disturbances related to the vegetative treatments would occur in the same locations under both action alternatives. Under Alternative 3, there would be an increase in the number of acres proposed for red pine thinning treatments; however, this increase is related to a shift from areas proposed for prairie restoration under Alternative 2. So, while the actual treatment acres under the two alternatives would be similar, there would be a difference as to the type of treatment that would be occurring in specific locations. Based on these differences in treatments, the use of the transportation system would vary. On the roads utilized to facilitate the red pine thinning under Alternative 3 that would be utilized to facilitate the prairie restoration under Alternative 2, there would be fewer direct effects. This would be due to the higher number of passes with heavy equipment that would be necessary on these roads to conduct the prairie restoration activities. These activities would include a combination of timber harvesting, stumping, tilling, seeding, and maintenance.

The three roads that would be re-opened, improved, and closed post-sale (Unclassified Road 38, Unclassified Road 41, and Forest Road 5374) under Alternative 2, would receive the same treatment under this alternative. Likewise, the improvements that would be made on the three haul roads that would be left open under Alternative 2 (Forest Road 5900, Forest Road 9430, and Forest Road 9426) would be improved and left open under this alternative. The necessary spur roads (or short entrances)

that would need to be developed under Alternative 2 for access to timber landing sites would also occur under this alternative.

Indirectly, this alternative would result in an improved road system that promoted the passage of low-clearance passenger vehicles. There would be no expected indirect effects on the roads related to vegetative treatments on roads that are not part of the timber hauling system.

The management of the transportation system, under Alternative 3 would reduce motorized public access throughout the Project Area in comparison to Alternative 1, but would provide increased access and less displacement compared to Alternative 2. As Alternative 1 offers no active management of the transportation system, the effects from this alternative would be more similar to those of Alternative 2, though lesser in scale.

The effects related to the utilization of the roads for conducting wildlife habitat creation activities, NNIS treatments, and the restoration of the two sites damaged by ORVs, would be similar under both of the action alternatives. This alternative would offer decreased opportunities for trash dumping, compared to Alternative 1, and increased opportunities compared to Alternative 2. Portions of the existing road network would continue to be utilized by those dumping trash.

Forest fragmentation would be reduced compared to Alternative 1 and would be increased compared to Alternative 2. Gradually, roads that are closed would become naturally revegetated. Motor vehicle travel throughout the Project Area would be limited to the roads identified as open. This would aid in the use of the system for recreation patrols and law enforcement. While the management of the roads may affect wildland fire suppression tactics, it would not be to the extent of Alternative 2. This would be due to the increased number of interior roads that would be left open under this alternative. The use of roads proposed for closure as control lines would gradually be lost, as existing roadbeds become revegetated. Under this alternative, there are portions of roads that are identified to be closed that are currently experiencing, or are susceptible to, resource damage related to motor vehicle traffic. These areas typically occur on slopes, contain erosive soils, or are located in lowland areas. Through the management of the roads under this alternative, the areas that would be closed would no longer be impacted by motor vehicles and natural or artificial reclamation would take place.

(3.5.5b) Cumulative Effects

The effects of the actions in the past and present would be similar to those of Alternative 1. The future effects of implementing Alternative 3 would be the continued public and administrative use of a road system within the Project Area that is less restrictive than Alternative 2 and more restrictive than Alternative 1. With the likely increases in human population and recreational pressures on National Forest System lands and private lands in and around the Project Area, it is likely that the use of the road system would increase. The result of this alternative would be a well-designed, higher-use road system that would reduce resource damage and still allow public access onto selected interior roads. By reducing the road densities within the Project Area, fewer opportunities would exist for the development and expansion of unauthorized user-developed roads, though not to the extent of Alternative 2. The Project Area would move closer than Alternative 1 to the transportation standards for Management Areas 4.2 and 4.4, but not as close as Alternative 2.

Table 3.22: Road Summary of the Relevant Issues

Issue	Alternative 1	Alternative 2	Alternative 3
Would provide the most amount of motorized access.	Yes	No	No
Would provide the least amount of motorized access.	No	Yes	No
Would provide a designated "rustic" thru-route, consisting of existing open roads, previously closed roads, and new road construction.	No	No	No
Would reduce the potential for dumping trash in the Project Area	No	Yes	Yes

(3.6) Recreation/Visual Quality

(3.6.1) Area of Analysis

The analysis area used for the recreation direct and indirect effects discussion is the Project Area. The analysis area used for the cumulative effects discussion is Newaygo County.

(3.6.2) Related Information and Existing Condition

Recreation in the Huron-Manistee National Forests

The Huron-Manistee National Forests serve as the "backyard" playground for many Midwest residents. More than 60 million people are within a day's drive of enjoying recreation opportunities on the forests. Proximity to population centers and accessibility due to road densities makes the Forests popular for year-round outdoor recreational activities. Population growth for the Manistee National Forest impact area (a nine county area) was 15.4% during 1980-2000. Muskegon and Newaygo Counties had the largest absolute growth accounting for 54% of the impact area's growth (Social and Economic Assessment for the Michigan National Forests, 2003).

The Forests receive approximately 3 million visits annually (Recreation Demand and Capacity Trend Analysis, Huron-Manistee National Forests 2004). One million of these visits are distributed evenly between motorized and non-motorized trail use. Overall, the trend for outdoor recreation participation indicates the continued growth in the demand of outdoor recreation opportunities, facilities and services (Cordell 1999). According to the report by Cordell (1999), the five fastest growing outdoor recreation activities through the year 2050 (measured in activity days) are expected to be: visiting historic places, downhill skiing, snowmobiling, sightseeing, and non-consumptive wildlife activity. Recreational use in the Mast Lake Project Area is expected to increase as the population continues to increase. The Forests' niche emphasizes providing quality sustainable recreation opportunities and benefits with an emphasis on activities that are appropriate for the roaded natural or more remote natural settings. The Mast Lake

Project Area is located in the rural setting. The rural setting is classified by National Forest System lands which are less remote than roaded natural areas. These areas are often isolated and near larger population centers, such as Newaygo, Big Rapids, and White Cloud. The Mast Lake Project Area falls slightly outside of the Forests' niche.

Recreation in the Mast Lake Project Area

The Mast Lake Project Area is comprised of medium to small blocks of National Forest System lands. The National Forest lands are easily accessed by a network of county, Forest Service, and user-created roads. There are no designated trails or developed recreation sites in this project area. Private land uses include permanent and seasonal residences and forested lands used primarily for hunting. The hunting of wildlife is one of the top five primary recreational activities on the forests (Social and Economic Assessment for the Michigan National Forests, 2003). The harvesting of forest products on private lands has been increasing. This project area, in particular, is seeing a high amount of firewood cutting by private individuals. The hardwood stands located in the project area are ideal for woodcutters because of the proximity to their residential areas. Towns or villages within ten miles of the Project Area are White Cloud, Newaygo, Woodville, Croton, and Big Rapids.

The scenery of the National Forest System lands in the Project Area is characterized by level terrain with interspersed streams, rivers, lakes, wetlands, and forested stands. These stands include red pine, aspen, and hardwoods. The combination of topography, water resources, vegetation, and access provide a variety of recreational opportunities. Sightseeing and driving for pleasure are among the nation's leading recreational activities, and demand for them is expected to continue.

People recreate in the Mast Lake Project Area because of the variety of natural resources that are present. Recreational uses of National Forest System land within the Project Area are deer, bear, turkey, and grouse hunting, mushroom gathering, driving for pleasure, dispersed and developed camping, wildlife observation, hiking, ORV riding, horseback riding, and snowmobiling. There are no designated trails or developed recreation sites within the Project Area.

Undesirable uses in the Project Area include: trash dumping, construction of permanent hunting blinds, and illegal off-road vehicle use, both on National Forest and on private lands. Trash dumping occurs throughout the Project Area along many forest roads as well as user-created roads. Permanent deer blinds are found throughout the Project Area. The illegal off-road vehicle use that is occurring both on National Forest and private lands throughout the Project Area is causing erosion and sedimentation in certain locations, especially on steep hillsides and drainage crossings.

Recreational use in the Project Area is expected to increase as the population continues to increase. Population growth for the Manistee National Forest impact area (a nine county area) was 15.4% during 1990-2000. Muskegon and Newaygo Counties had the largest absolute growth accounting for 54% of the impact area's growth (Social and Economic Assessment for the Michigan National Forests, 2003).

(3.6.3) Alternative 1: The Effects of the Proposed Actions on Recreation/Visual Quality

(3.6.3a) Direct and Indirect Effects

Under Alternative 1 – No Action, none of the proposed vegetative, recreation, or road management activities would occur. Therefore, no direct impacts to recreationists and their use of National Forest System lands in the Project Area would be expected. Recreationists would not be displaced during times of management such as prescribed burning, timber harvesting, or herbicide application. Nor would they be displaced to other areas because they were seeking areas more accessible by roads. Current levels of

recreational use would continue with seasonal peaks during summer and the fall hunting months. Recreational use of this area is expected to increase over time as more people move to Newaygo County.

In the long term, indirect recreational impacts would occur due to a decrease in hunting opportunities for species favoring early successional forests. Areas of non-native invasive species would continue to expand, displacing native vegetation favored by wildlife. Expansion of the road system by area users would be expected to continue increasing the opportunities for the dumping of trash. Users wanting an area that provides opportunities for solitude would need to go to other areas of the National Forest.

Off-Road Vehicle damaged areas would not be rehabilitated and would continue to degrade through continued illegal use. New areas of off-road damaged areas would likely occur.

No human-caused changes to the scenery of the National Forest System lands would occur in this Alternative. Development of private lands is expected to continue with the result being a change in the character of the area from a natural appearing to a more rural setting. Human use and activity would continue to increase on private lands with a potential increase in the encroachment on public lands from private land activities.

(3.6.3b) Cumulative Effects

Private land within the Project Area is currently a mixture of permanent and seasonal homes along with undeveloped land. The conversion of seasonal to permanent homes has been occurring at an increasing rate as the population ages and people retire "Up North." This trend is expected to continue in Newaygo County with the development of private lands accelerating as people build new homes or convert cabins to year-round residences. Existing uses of the area would continue and it is likely that new uses would emerge in time. More recreationists would result in more impacts to public facilities and resources in the Project Area. More use would increase the potential for overlap of users that may be seeking different types of experiences increasing the potential for conflict.

(3.6.4) Alternative 2: The Effects of the Proposed Actions on Recreation/Visual Quality

(3.6.4a) Direct and Indirect Effects

Of the two action alternatives, Alternative 2 would have the most amount of acres of vegetative treatments. Under Alternative 2, the proposed activities would displace recreationists temporarily during harvesting and burning operations. Impacts from burning would be of short-duration and limited to 1-2 days in the early spring or fall. Vegetative changes in these treatment areas would have a short-term affect on the dispersed camping and hunting activities. Some dispersed campsites would be less shaded and the sights and sounds of logging operations would be observed by recreationists for short periods of time. Walking through the effected areas would be temporarily difficult due to the presence of slash and stumps. The long-term effects would be an increase in hunting and wildlife viewing opportunities, due to creation of a more diverse forest with openings and improved habitat for game and non-game species. Cutting would likely be completed in three to five years.

Under Alternative 2, there would also be approximately 177 acres that would be converted to dry-sand prairie. Prairie restoration treatments for Alternative 2 exceed Alternative 3 by 94 acres. Therefore, there would be greater and longer-lasting impacts with this alternative. Associated with this restoration would be the complete tree/stump removal, followed by burning, site preparation, and seeding. The area would be converted to native plant species that historically occupied these areas. There would be more acres burned with this alternative, however the effects would be of short duration and would not be highly visible after one growing season. The amount of prairie restoration in this alternative may lead to

increased damage from the illegal use of ORVs in these areas. It would also encourage more dispersed camping, especially hunting camps, in these openings. Mitigation techniques, such as piling brush around the perimeter of these areas would decrease the temptation for ORVs to ride illegally (Reference Mitigation section in Chapter 2). Vegetative treatments in the prairie restoration areas would present opportunities to educate the visiting public about restoring native plant communities.

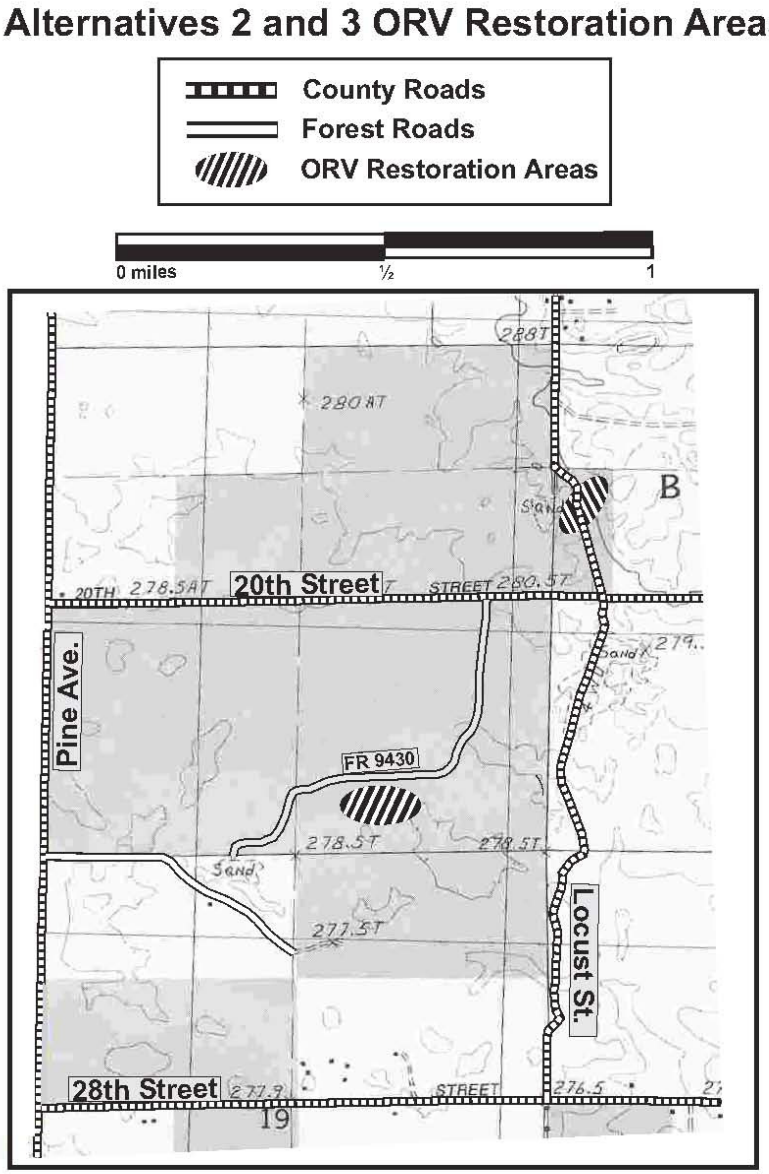
Under Alternatives 2 or 3, mechanical and/or herbicide treatment of non-native invasive species would occur on less than 10 acres scattered throughout the Project Area. The infested areas of non-native invasive species (NNIS) are small and generally remote. Regardless of the short-term effects, natural succession and the re-growth of plants would return the treated areas to a more original appearance during the next growing season. Temporary visual impacts (such as bare spots) would be expected to last no longer than a single growing season, after which they would be obscured by the native vegetation. Prior to treating with herbicides, the areas would be posted as closed. Users would be temporarily displaced for 1-2 days during treatment operations.

Alternative 2 proposes to close the most roads. Those who use the existing road system to recreate would be directly affected by the closing of roads within the Project Area. Access within the Project Area by vehicle would still be possible, but would not be as extensive. Parking and turn-around areas would be provided where roads are closed. The proposed road closures would reduce the amount of roads to access the Project Area for driving for pleasure; however, approximately 20.4 miles of classified Forest Roads and county roads would remain open to provide access for recreation activities within the Project Area. Opportunities for viewing wildlife may increase because of reduced disturbances to wildlife from motorized vehicles. However, fewer areas for the establishment of hunting camps would be available in this area. Some recreationists may move to other areas that provide more road access. Closed roads would provide opportunities for hiking, horseback riding, and walk-in hunting. Safety would increase in the entire area as roads not maintained and in an unsafe condition would no longer be open. Illegal off-road vehicle (ORV) use would be expected to lessen with the implementation of this alternative's transportation system, as riding temptations are reduced.

There would be greater visual impacts from the prairie restoration activities and road closures. The visual impacts from prescribed burning activity would be of short duration and would not be visible after the first growing season. Landings used for timber sales would be returned to a natural condition upon completion of the timber sale (especially along open roads) or maintained as wildlife openings. Those areas of prairie restoration would be visually changed as they would no longer be forested. When possible, road closures would blend into the landscape by using transplanted trees and native materials. Based on previous projects of this nature, visual impacts from harvesting would be greatly diminished 5-10 years after the logging operations have ceased. This would not be true of the prairie restoration sites.

Alternatives 2 and 3 both propose to rehabilitate two areas damaged by ORVs. These areas equate to approximately 2 acres of resource damage. The areas are all located in Management Area 4.4 Rural (Reference Map 3-1). There is substantial erosion and soil loss in these areas. Both of the action alternatives would stabilize the soil on the slopes, revegetate the exposed areas, and construct physical barriers to prevent the continued illegal use of ORVs. This would lead to a decrease in illegal off-road vehicle use in these areas and serve to discourage this type of activity, both within the Project Area and Forest-wide. Positive benefits to wildlife would occur, thereby improving hunting opportunities and the viewing of wildlife for area recreationists. Opportunities to acquire funding for these restoration projects would be sought through the Michigan Off-Road Vehicle Trail Improvement Grant Fund.

Map 3.1: Proposed ORV Damage Restoration Projects



Although there are no recreation sites or trails within the Project Area, there is obvious use of this area by recreationists. There has been illegal riding of ORVs and the illegal dumping of trash, which inadvertently affect the quality of a recreation experience. Alternatives 2 and 3 both propose the removal of trash from approximately 20 sites. The management of the transportation system under either alternative would prevent the future dumping of trash and illegally created ORV trails in the areas where road closures would occur.

The indirect effects related to this alternative would include an increase in hunting opportunities. Aspen management would improve grouse habitat which would create increased grouse hunting opportunities. The prairie restoration projects would likely result in a small overall increase in deer and turkey habitat in these prairie communities. The planting of trees and shrubs, seeding of native species, and opening maintenance would have positive benefits to recreationists, including hunters and those who enjoy viewing and photographing wildlife. Deer hunting opportunities would increase for a few years as the young aspen provides forage for deer. Implementing the road closures under Alternatives 2 and 3 would provide increased opportunities for hiking and solitary experiences. Illegal ORV use would be expected to decrease with the implementation of the proposed transportation system under these altenatives.

(3.6.4b) Cumulative Effects

The impacts from recreational use and the demand for additional facilities and amenities would be expected to increase as the population of Newaygo County increases. The existing uses of the area would continue and it is likely that new uses would emerge in time. Cordell's Assessment of Demand and Supply Trends also revealed that future capacity shortages are expected in the following categories: trailhead facilities for snowmobiling, Off-Highway Vehicle use and hiking; canoe landings and boat launches; day use areas associated with swimming opportunities; and Visitor Center capacity. Users could be affected by their feeling of overcrowding and an inability to find places to recreate. Development of private land within the Project Area is expected. Twenty percent of seasonal home owners were "likely" or "very likely" to convert their seasonal residences to a permanent home within the next 5 years and the number increased to almost 30% when the timeframe was extended (Leefers et al. 2003). This conversion from seasonal to permanent use would increase the number of recreationists in this area. More people would result in more pressures on the facilities and resources in the Project Area. More use would increase the potential for overlap of users that may be seeking different types of experiences increasing the potential for user-conflicts.

(3.6.5) Alternative 3: The Effects of the Proposed Actions on Recreation/Visual Quality

(3.6.5a) Direct and Indirect Effects

In comparison to Alternative 2, this alternative would offer ~94 acres of dry sand prairie restoration and only 12.8 miles of road would be closed. This would leave ~25.4 miles of road open. Because there are fewer management activities under this alternative, there would be less opportunity for the displacement of recreationists. Opportunities to view and hunt wildlife would be greater in Alternative 3 than Alternative 2.

Because there are less acres of prairie restoration activities proposed in this alternative, there would be fewer impacts in those areas while prairie restoration activities would take place. With this activity, the scenery of the restored areas would be changed, as forest vegetation would not grow back. Complete tree/stump removal would occur. This would be followed by prescribed burning, site preparation, and seeding. The area would be converted to the native plant species that historically occupied these areas. The visual effect related to the prescribed burning activities would be of short duration and would not be visible after the first growing season. In comparison to Alternative 2, the decreased amount of prairie

restoration under this alternative would lead to fewer opportunities for damage in these areas from the illegal use of ORVs. It may also lead to fewer opportunities for dispersed camping in the newly established open areas these. Mitigation methods (such as the piling of brush around the perimeter of these areas) would also serve as a deterrent to ORV use in these areas (Reference Mitigation section in Chapter 2). Vegetative treatments in the prairie restoration areas would still present opportunities to educate the visiting public about restoring native plant communities.

The visual impacts from the prescribed burning activities would still be of short duration and would no longer be visible after the first growing season. In addition, fewer acres would be burned. Landings used for timber sales would either be returned to a natural condition upon completion of the sale or maintained as wildlife openings. There would be fewer road closures to blend into the landscape by using transplanted trees and native materials. Based on previous projects of this nature, visual impacts from harvesting would be greatly diminished 5-10 years after logging is completed.

Those who use roads to recreate would be directly affected by the closing of the user-developed roads and the decommissioning of Forest Service System roads within the Project Area. The proposed road density, miles of open road/square mile, would be higher in this alternative than in Alternative 2. Alternative 3 would allow for more vehicle access to the Project Area for recreationists.

The remainder of the activities proposed for this project would have similar effects to recreation and visual quality under both Alternatives 2 and 3. Therefore, the discussion under Alternative 2 would apply to Alternative 3.

(3.6.5b) Cumulative Effects

The cumulative effects for Alternative 3 are similar to Alternative 2.

(3.7) Fisheries and Watershed

(3.7.1) Area of Analysis

Direct and Indirect Effects of the proposed alternatives will be analyzed within the Project Area (PA). Cumulative Effects for the streams in the Muskegon River Watershed will be analyzed until the streams reach the Muskegon River/Hardy Dam Pond backwaters because at this point the hydrology of the watershed is greatly affected by the impoundment. Cumulative Effects for the streams in the White River Watershed will be analyzed until the streams reach the South Branch of the White River because very soon after this the South Branch flows into the White Cloud Mill Pond impoundment. At this point, the hydrology of the watershed is greatly affected by the impoundment. Cumulative effects for lakes and wetlands will be analyzed within the PA because the effects will be localized within this area. Cumulative effects will be analyzed for the previous ten years and within the foreseeable future which is typically ten to fifteen years.

All effects will be analyzed based on the objectives and activities outlined in Table 2.4. Activities that are not expected to have any effect on fisheries and watershed are: 1) changing Land Suitability Class; 2) changing stand boundaries; 3) stand area adjustments; and 4) creating or combining stands and easements.

(3.7.2) Existing Condition

The Mast Lake Project Area occurs within the Muskegon River Watershed and the White River Watershed. The Muskegon River begins in the north-central Lower Peninsula of Michigan, flowing from Higgins and Houghton Lakes, southwesterly to the City of Muskegon and discharging into central Lake

Michigan. The river is 212 miles long and has approximately 94 tributaries flowing directly into the mainstem. The watershed encompasses over 2,350 square miles of land (O'Neal 1997).

Any current description of Michigan rivers should include a historical perspective, especially when discussing streambank stability and erosion. Much of the following historical information regarding streambank erosion and sediment delivery has been derived from Bassett's (1988) "Rivers of Sand." Unstable sand substrate, severe bank erosion, and a lack of large woody debris are typical of many streams in northern Michigan. Evidence based upon historical records and photographs suggests that streams had much less sand, more woody debris, and more stable streambanks prior to the advent of wholesale logging in the late 1800s and the construction of hydroelectric dams on the major river systems in the early to mid-1900s. Historic logging practices such as the cutting of riparian forests, running massive log drives, using high banks for log rollways, and creating splash dams for the transport of logs downriver had some very deleterious effects on the rivers, much of which is still evident today. The removal of woody debris to facilitate log drives created a great deal of channel instability. The log drives themselves exacerbated the problem with tremendous forces acting upon the sandy soils found in many riparian areas, resulting in a great deal of accelerated bank erosion.

Water quality in the Muskegon River Watershed is generally good. Forest and grasslands comprise approximately 66% of the watershed, farmland 17%, surface water 10%, and urban areas 7% (MWRP 2008). Four impoundments including three hydroelectric dams on the mainstem are located in the watershed (O'Neal 1997). Threats to the watershed include sedimentation and storm water and agricultural runoff. O'Neal (1997) states that in the Lower Michigan Drift Plain (of which the Muskegon River and White River watersheds are part of) cropland-pastureland has an estimated average annual sheet and rill erosion of 2.09 tons/acre whereas forest land has a rate of 0.15 tons/acre. Soil erosion rates from crop and pasture land are occurring at rates 14 to 21 times higher than erosion rates on forest land.

The portion of the PA that falls within the White River Watershed falls within the Upper South Branch Subwatershed (Rediske et al. 2003) of the White River Watershed. This subwatershed covers 60,473 acres and contains nearly 26% of all the wetlands found in the White River Watershed. Mature forests comprise approximately 68% of the subwatershed, cropland and open fields 25%, wetlands 5% and developed areas 2% (Rediske et al. 2003).

There are approximately 17,000 acres within the PA. Of these 17,000 acres approximately 4,000 (23%) are National Forest System lands. Eighty-eight percent of National Forest System lands in the PA are classified as being age class 20 or greater and a review of aerial photos indicates that at least 40% of the total PA is classified as being age class 20 or greater. Approximately 1,020 acres of the PA are swamps, marshes, and intermittent wetlands and another 52 acres are lakes and ponds.

The headwaters or portions of State of Michigan designated trout streams Bennett, Flinton, and Fivemile Creeks occur within the PA (Michigan Department of Natural Resources 2008). A portion of Thumser Creek also occurs within the PA area and the named lakes, ponds, and wetlands listed in Table 3.23 also occur within the PA. The headwaters of a few unnamed streams occur in sections 5, 8, 17, and 20 of Big Prairie Township and these streams flow into the Hardy Dam Pond. There are also a number of unnamed ponds and wetlands in the PA including one small, unnamed body of water on National Forest System land in the Harness Marsh of Big Prairie Township.

Table 3.23: Lakes, Ponds, and Wetlands within the Mast Lake Project Area

Name	Township	Section
Pearson Lake	Goodwell	15
Pickerel Lake	Goodwell	14 & 23
Beaver Pond	Goodwell	23
Mud Lake	Goodwell	22
Mast Lake	Goodwell	34
Carey Lake	Goodwell	26
Round Lake	Goodwell	26
Dudgean Swamp	Goodwell	24 & 30
Harness Marsh	Big Prairie	6

Bennett Creek, which is in the northern portion of the PA, flows easterly out of Pickerel Lake to the Beaver Pond and out of the Beaver Pond into the Muskegon River. It was last surveyed in 1980 outside the PA (T14N, R10W, sec 19) upstream of 8-mile Road. During the survey, 27 brook trout and 3 brown trout were captured along with blacknose dace, johnny darter, central mudminnow, brook stickleback, creek chub, common shiner, burbot, white sucker, and mottled sculpin (O'Neal, personal communication). Thumser Creek is also in the Muskegon River Watershed and it originates east of Mast Lake and flows south into the Hardy Dam Pond. No survey information was available for Thumser Creek.

Flinton Creek, flows out of the Dudgean Swamp and heads primarily southwest until it flows into the South Branch of the White River north of White Cloud. Flinton is a runoff-driven cool water stream with a fair base flow and an average gradient of 4–10 feet/mile (Rediske et al. 2003). It has been described as having good populations of brook, brown and rainbow trout (MDNR 1975).

Fivemile Creek, flows out of the northwest portion of the PA and heads primarily southwest until it flows into the South Branch of the White River north of White Cloud. Fivemile Creek (like Flinton Creek) is also a runoff-driven cool water stream with a fair base flow and an average gradient of 4–10 feet/mile (Rediske et al. 2003). It also has been described as having good populations of brook, brown, and rainbow trout (MDNR 1975).

The majority of the wetlands found throughout the Project Area are vegetated. The U.S. Fish and Wildlife Service classify these based on the type of System, the Class, and the Water Regime. Table 3.24 shows the types of wetlands on National Forest System lands within the PA.

Table 3.24: Types of wetlands found in Mast Lake PA.

Wetland Type	System	Class	Water Regime
PF01A	Palustrine	Forested, broad-leaved deciduous	Temporarily flooded
PF01C	Palustrine	Forested, broad-leaved deciduous	Seasonally flooded
PF04B	Palustrine	Forested, needle leaved evergreen	Saturated
PSS3B	Palustrine	Shrub/scrub, broad leaved evergreen	Saturated
PSS4B	Palustrine	Shrub/scrub, needle leaved evergreen	Saturated
PEMC	Palustrine	Emergent	Seasonally flooded
PUB/EMG	Palustrine	Unconsolidated bottom, emergent	Intermittently exposed

Road density in the PA is 6.1 miles of road per square mile of land and thirty-eight road stream crossing have been identified in the PA (Thompson 2004). Many of these are for intermittent streams and seasonal flows. Roads negatively impact streams and wetlands in a number of ways: 1) they increase, concentrate, and accelerate the amount of runoff which can lead to warmer water temperatures; 2) runoff causes flashy flows and in-stream erosion; and 3) roads intercept and divert subsurface flow, reduce groundwater recharge and can indirectly lead to the conversion of wetland vegetation types to upland types (Brooks et al. 1997). At road/ stream crossings, the movement of aquatic organism is often limited and pollution (including sediment) is often delivered to streams. Sediment fills in pools and covers spawning gravel, which leads to a more homogeneous habitat. It also causes the stream to get wider and shallower. This leads to warmer water temperatures and less desirable habitat. Roads also fragment the watershed, limiting animal movement and reducing the amount of usable terrestrial habitat. Within the Mast Lake Project Area, the road density is higher than prescribed in the Forest Plan and these roads are fragmenting wetlands, inputting sediment and other pollutants into streams and wetlands, and probably affecting subsurface flow.

There are no current Forest Service projects in the area; however, Big Prairie Township (in cooperation with The Nature Conservancy) is in the process of doing 40 acres of prairie restoration work within the PA. Consumer's Energy is also considering this activity, although scope and size has not been determined. The Forest Service is also in the process of developing a Motor Vehicle Use Map for the Manistee National Forest. Once this map is available, roads on National Forest System lands that are not identified on it could be closed.

(3.7.3) Alternative 1: The Effects of the Proposed Actions on Fisheries and Watershed

(3.7.3a) Direct, Indirect, and Cumulative Effects

Under this alternative, no activities would take place and there would be no direct, indirect, or cumulative effects to the watershed or fishery resource. High road densities would continue to fragment the watershed. Relative to the wetlands (swamps, marshes, and intermittent wetlands) this alternative would result in the continued natural succession of these areas.

(3.7.4) Alternative 2: The Effects of the Proposed Actions on Fisheries and Watershed

(3.7.4a) Direct and Indirect Effects

Under this alternative, there would be approximately 465 acres of vegetation treatments, of which 179 acres would be clearcuts. There would also be 204 acres of wildlife habitat creation. This would include opening maintenance/expansion and aspen management. In the areas proposed for clearcutting, there would be a loss in canopy cover. Forested canopies serve to intercept precipitation and reduce the amount of surface runoff. The canopy also serves to reduce the effects that direct rainfall can have on the understory soils. In the harvested areas for both vegetative treatments and wildlife habitat creation, reduced amounts of rainfall would be intercepted and the soils would be exposed to erosive effects for a limited duration, while the areas become re-vegetated (Pritchett and Fisher 1987). Soil loss through erosion would be expected during and after treatments, until the treated sites begin to revegetate. Sediment that reaches aquatic systems would negatively impact water quality and aquatic habitat (Waters 1995). Mitigation measures and Best Management Practices would be utilized to reduce erosion during and after treatments. Regeneration clearcuts would temporarily fragment the watershed, whereas, wildlife openings would more permanently fragment the watershed. The erosion rates for non-forested vegetated openings would be closer to those of forested lands than of crop and pasture land (see current conditions above). As a result, any negative impacts to water quality from the vegetation and

wildlife treatments would be minimal and only last as long as it takes a site to begin the process of revegetation.

Other harvesting activities would allow for a continued forest canopy that would promote an increase in understory vegetation. This would promote water retention within these stands, as compared with the stands proposed for regeneration. Evapotranspiration in these areas would tend to decrease with the removal of the large trees and the water table would rise. Over time, as the understory becomes established, the gains in the amount of water that is held within the system would become negligible (Pritchett and Fisher 1987). No lakes or rivers are present in any stand that would be prescribed for vegetative treatment.

Reducing the road density in the PA from 6.1 mi/mi^2 to 3.3 mi/mi^2 would reduce fragmentation in the watersheds, reduce sediment input from erosion into the watersheds, and improve the water quality by reducing surface runoff. Reducing the concentration and acceleration of runoff would aid in maintaining cool water temperatures and reducing runoff that causes erosion (Brooks et al. 1997). Restoring the two ORV sites would improve watershed conditions and reduce sediment input into aquatic systems. Directly related to the transportation system in this Project Area is the abundance of trash that has been illegally dumped on National Forest System lands. Under this alternative trash would be removed from 20 sites. This would eliminate possible point sources of groundwater contamination. Through the management of the transportation system, the locations available for dumping would be reduced. Opportunities for point-source contamination of the surface water would still exist at the locations within the Project Area where the water systems and wetlands come into contact with the county roads.

Under this alternative, approximately 9.4 acres of NNIS would be treated with herbicides. There would not be any direct or indirect effects expected to any of the aquatic systems from the herbicide treatments.

Under this alternative approximately 177 acres would be restored to dry sand prairie. Of this, approximately 145 acres would be converted from forested stands and 32 acres would be restored from existing openings. The conversion would require the harvesting and stumping of forested land, prescribed burning, site preparation, and the seeding of all sites. The effects of these treatments would be similar to those for the vegetation and wildlife habitat creation treatments discussed above; however, as these treatments would occur over a period of several years, there would be a greater potential for soil loss from erosion. If the eroded sediments reach the aquatic systems, water quality and habitat would be negatively affected. However, mitigation measures and BMPs would be utilized to reduce erosion during and after treatments. Prairie restoration would increase the fragmentation of the watershed. Erosion rates for non-forested vegetated openings should be closer to those of forested lands than crop and pasture land (see current conditions above). As a result, any negative impacts to the water quality from prairie restoration treatments would likely be minimal and last only as long as it takes a site to begin revegetating.

(3.7.5) Alternative 3: The Effects of the Proposed Actions on the Fisheries and Watershed

(3.7.5a) Direct and Indirect Effects

Under this alternative there would be an additional 86 acres of additional vegetation treatments in the form of red pine thinning and red pine regeneration. There would also be an additional 6 acres of wildlife habitat creation in the form of opening maintenance. These additional acres would contribute to slightly more watershed fragmentation, but are not likely to have a different effect to fisheries and watershed than described under Alternative 2.

Under this alternative, the road density in the PA would only be reduced from 6.1 mi/mi^2 to 4.1 mi/mi^2. This would have similar effects as those discussed in Alternative 2; however, because less roads would be closed under this alternative, it would not be as effective at reducing erosion and watershed fragmentation as Alternative 2. The effects of trash removal would be the same as discussed under Alternative 2.

This alternative would propose to treat 9.4 acres of NNIS with herbicides. Herbicides would be applied by hand sprayers directly onto the NNIS plants. There would no expected direct or indirect effects to aquatic system from the herbicide treatments.

Under this alternative, approximately 85 acres are proposed for prairie restoration. These activities would result in reduced fragmentation and potential for erosion, in comparison to Alternative 2.

(3.7.6) Alternatives 2 and 3: The Cumulative Effects of the Proposed Actions on the Fisheries and the Watershed

(3.7.6a) Cumulative Effects

Fisheries management in the Project Area would continue to concentrate on improving road stream crossings, erosion control and maintaining riparian buffer zones. As the forest continues to mature, more large woody debris (LWD) would be input into streams and wetlands. This would serve to protect the streambanks from erosion, provide habitat for aquatic insects, cover for fish, and provide habitat diversity (Gregory 2003).

Over time, the areas prescribed for regeneration timber harvests would become revegetated. This would reduce watershed fragmentation and surface runoff. The input of sediment into the streams would be expected to be minor. The sediment would work its way through the system until it reaches either the Hardy Dam Pond or the White Cloud Mill Pond. In wetlands and lakes, the input of sediment would slightly increase the rate at which these habitats are filling-in and succeeding.

While there would be no expected effects from the NNIS treatments from this project, aquatic NNIS are being treated in other areas. There would be the potential that these treatments could occur within the cumulative effects area. These treatments should not negatively affect watershed condition and aquatic habitats.

Roads that are closed during the project would begin to revegetate and surface runoff and pollution entering aquatic systems from the road system would be reduced. Other roads not identified in the Manistee National Forest MVUM map that will be put out in 2009 will be eligible for closure. This would further reduce the watershed fragmentation and the input of non-point source pollution into aquatic systems.

The cumulative effects from the dry sand prairie restoration would be similar to those discussed for regeneration harvesting activities, although prairie type grasses would take over the sites instead of woody vegetation. The major difference would be that these sites would continue to fragment the watershed.

The Forest Plan (II-33) provides a guideline that at least 34% of a sixth level watershed should be maintained in a forested state greater than an age-class of 15 years. Analysis of the PA indicates that none of the 6th level watersheds would approach having less than 34% of their area classified as age-class 15 or less.

Within the Cumulative Effects Area, public land (including land owned by Consumer's Energy) makes up a small percentage of the ownership. In the future, it would be likely that the private property ownership patterns within Big Prairie and Goodwell Townships would become more fragmented. This would likely be the most pronounced near the Hardy Dam Pond, where there is a larger demand for seasonal and recreational residences. Agriculture would also likely continue to be present and could expand with biofuel technologies in these Townships, as economics and soil productivity allow. Relative to the watershed, these trends and activities have their largest impact through the development of new roads for access (sedimentation), the filling in of existing wetlands for new construction (loss), and the potential for household and agricultural chemicals and nutrients to leach through the soil profile and into the ground water (contamination).

(3.7.7) Aquatic Management Indicator Species

A list of the fisheries Management Indicator Species (MIS) and minimum viable populations for the Forests are found in the Forest Plan (II-33 through 34) and Forest Environmental Impact Statement (FEIS). The rationale for the MIS selection and management strategies for these species was considered in the FEIS. These species were selected because they represent a particular environmental condition or habitat type for a variety of species needing similar habitat conditions. The effects of the activities on MIS are described for each alternative in Table 3.25.

Table 3.25: Aquatic Management Indicator Species

MIS Species	Habitat	Status	Alternative 1	Alternative 2	Alternative 3
Brook Trout (*Salvelinus fontinalis)*	Cold, spring fed streams	Brook Trout are found in the Project Area.	No change	No change	No change
Mottled Sculpin *(Cottus bairdii)*	Cold, spring fed streams	Mottled Sculpin are found in the Project Area.	No change	No change	No change

(3.8) Wildlife

(3.8.1) Area of Analysis

Under the National Environmental Policy Act, cumulative effects are defined as the impact on the environment that 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 other actions. Under Section 7 of the Endangered Species Act, cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the Action Area considered in this BA/BE. Future Federal actions that are unrelated to the proposed actions are not considered in this section because they require separate consultation pursuant to Section 7 of the Act. The area of analysis for the direct and indirect effects on wildlife resources is the National Forest System lands where treatments will occur, and adjacent private lands included within the Project Area boundary. The cumulative effects analysis area for wildlife resources encompasses the Manistee National Forest.

(3.8.2) Existing Condition and Resource-Specific Information

(3.8.2a) Wildlife Species Habitat Associations

Early Successional Vegetative Types

Openings, prairies, savannas, and barrens have declined within the Huron-Manistee National Forests over the past century due to extensive reforestation and fire control efforts, and the process of natural succession. As remnant openings, prairies, savannas, and barrens fill in with fire intolerant woody and shade tolerant herbaceous species, suitable habitat for the Karner blue butterfly, a federally endangered species and Terrestrial Management Indicator Species associated with oak/pine savanna and pine barren communities, is becoming scarcer. The decline in Karner blue butterfly habitat quality and quantity within the Forests' has led to a reduction in occupied subpopulations.

Early-successional aspen forest also is gradually being lost due to succession. Forest maturation of aspen forest communities may be reducing habitat quantity and quality for ruffed grouse, a Terrestrial Management Indicator Species associated with early successional forests dominated by aspens and poplars (*Populus* spp.). The Forests' monitoring information for grouse indicates that the population trend is probably cycling down after a high in 1999. However, population trends for the State of Michigan indicate that grouse populations may be slightly increasing or stabilizing.

Other game and non-game wildlife species that may be associated with early successional vegetative types within the Project Area include, but are not limited to: eastern box turtle, eastern massasauga rattlesnake, hill-prairie spittlebug, Sprague's pygarctia, dusted skipper, Ottoe skipper, red-headed woodpecker, whip-poor-will, ruffed grouse, American woodcock, cottontail rabbit, snowshoe hare, fox and gray squirrel, red and gray fox, coyote, wild turkey, and white-tailed deer. Early successional wildlife species are declining across their range in Michigan due to habitat loss and degradation and direct mortality resulting from fire suppression, vegetative succession, vegetative management, transportation management, water level manipulation, wildfires, human persecution and illegal collection, and vehicle collisions (USDA Forest Service 2005).

The Forest Plan emphasizes management for oak barrens/savanna ecosystems, particularly for Karner blue butterfly conservation. Currently, the Project Area includes 171 acres of upland openings. Over the next several decades, the Forest Plan calls for the restoration and maintenance of 30,000 acres of upland openings across all of the Huron-Manistee National Forests, and 10,000 acres of savannas, barrens, and prairies within old-growth areas (USDA Forest Service 2006b). The Forest Plan also recognizes the importance of early successional aspen communities, identifying a goal of approximately 2,400 acres of aspen regeneration harvests annually to create early successional habitat for a variety of species (Forest Plan 2006). Currently, none of the 815 acres of aspen stands within the Project Area are in an early-successional stage (<10 years of age). Over the next decade, the Forest Plan calls for 16% (24,100 out of 149,909 acres) of aspen stands within the Huron-Manistee National Forests to be in an early-successional stage (USDA Forest Service 2006b).

Mature Forest

Mature pine and oak stands in the Huron-Manistee National Forests provide habitat for a variety of wildlife species including, but not limited to: northern goshawk, red-shouldered hawk, bald eagle, American marten, eastern box turtle, pileated woodpecker, brilliant scarlet tanager, black bear, red and gray fox, coyote, black-throated green warbler, gray and fox squirrel, white-tailed deer, bobcat, and northern flying squirrel. Acreage of mid- to late-successional forest types has increased within the Huron-Manistee National Forests. However, forest fragmentation and disturbance/destruction of nesting, roosting, denning, and foraging sites resulting from timber harvest, road construction, and recreation threatens the viability of these species. Management for early successional vegetative types

under the Forest Plan would involve the conversion of mature red pine and white pine, and oak stands. Currently, mid- to late-successional forests within the Project Area include 1,090 acres of red/white pine, 144 acres of jack pine and jack-pine-oak, 1,647 acres of mixed oak, and 815 acres of quacking and big-toothed aspen.

Lakes and Creeks

Currently, the Project Area includes 161 acres of lowland openings. There also are a series of creeks that flow through the Project Area and serve as tributaries to either the White or the Muskegon River. Flinton and Fivemile Creeks serve as tributaries to the White River, while Bennett Creek serves as a tributary to the Muskegon River. In addition, Thumser Creek connects a series of wetland areas within the Project Area and eventually flows into the Hardy Dam Pond. Several small lakes (Pearson Lake, Mud Lake, Pickerel Lake, Carey Lake, Round Lake, Mast Lake, Beaver Pond) and wetlands also are scattered throughout the Project Area. These waters and their associated uplands may provide habitat for waterfowl and shorebirds, such as black-crowned night-heron, great blue heron, wood duck, Mallards, black duck, Canada goose, and other water-oriented species such as beavers, wood turtle, Blanding's turtle, eastern massasauga rattlesnake, and spotted turtle. Bald eagles may also forage for fish and waterfowl within these water bodies. In Michigan, the viability of these species is being threatened by habitat loss and degradation, disturbance of foraging and nesting animals, and increased mortality resulting from human activities such as draining wetlands for agriculture, development adjacent to water bodies and along shorelines, road construction, increases in recreational use and traffic, pollution, and illegal collection.

(3.8.2b) Occurrence of Sensitive Wildlife Species

The Huron-Manistee National Forests provide habitat for 382 species of breeding vertebrate animals. These include 168 species of birds, 54 species of mammals, 24 species of reptiles, 18 species of amphibians, and 118 species of fish. The Forests also provide habitat for 28 migratory species and a large number of invertebrates, primarily insects.

Federally-listed species, Terrestrial Management Indicator Species, and Regional Forester's Sensitive Species (RFSS) that may be present or have habitat within the Project Area include: Karner blue butterfly, dusted skipper, Ottoe skipper, hill-prairie spittlebug, Sprague's pygarctic, bald eagle, red-headed woodpecker, black-crowned night-heron, whip-poor will, northern goshawk, red-shouldered hawk, ruffed grouse, American marten, wood turtle, Blanding's turtle, eastern massasauga rattlesnake, spotted turtle, and eastern box turtle. The habitat ecology and distribution (within Michigan, and if available, within the Manistee National Forest) of these species are briefly summarized in Table 3.26. Citations are noted where more detailed information can be found concerning ecology, life history, and status. Trends for Terrestrial Management Indicator Species on the Huron-Manistee National Forests are discussed in the Monitoring and Evaluation Report for Fiscal Year 2001 (HMNF 2001).

A Biological Assessment and Biological Evaluation determined the potential effects of proposed actions on all of the wildlife species listed in Table 3.26, except for ruffed grouse, which was not included because it is only a Terrestrial Management Indicator Species, not a Threatened, Endangered, or Sensitive Species. All other RFSS were not included because: 1) they have not been documented to occur on the Manistee National Forest; 2) they are found in habitat(s) unlike those found in the proposed project; 3) they were not found during field surveys; and/or 4) habitat for the species exists within the proposed Project Area; however, the species would not be present within the Project Area during project implementation. RFSS not included in this evaluation will have no effect from the Proposed Action.

The Endangered Species Act of 1973 requires federal agencies to ensure that actions authorized, funded, or carried out by the agency are not likely to jeopardize the continued existence of listed or proposed endangered or threatened species or to adversely modify critical habitat. Four federally listed terrestrial

wildlife species were considered for the Project Area: Indiana bat (potential habitat), piping plover, Kirtland's warbler, and Karner blue butterfly. The Project Area is outside the potential range for Indiana bat and is not within the Tippy Management Zone and hence will not be analyzed further. This project is also outside the potential range for piping plover and Kirtland's warbler on the Huron Manistee National Forests. As such, these species also will not be analyzed further. The Karner blue butterfly was analyzed to determine potential effects from implementation of the project. There is *no designated critical habitat* for threatened or endangered species in any of the treatment areas.

Field surveys and queries of The Michigan Natural Features Inventory database and Endangered Threatened Sensitive database revealed that the Karner blue butterfly, northern goshawk, hill-prairie spittlebug, Sprague's pygarctia, Blanding's turtle, and spotted turtle have documented occurrences within the Project Area (Table 3.27). There is no documented occurrence of occupied Karner blue butterfly subpopulations within the stands proposed for treatment, and no occupied subpopulations were located during field surveys. In addition, there is no known suitable Karner blue butterfly habitat within the stands proposed for treatment. However, in 2003 and 2004, Karner blue butterflies were observed in 2 sites that are adjacent to and within dispersal distance of the following stands proposed for treatment: Compartment 572, Stands 4, 5, 6, 7, 10, and 13. Hill-prairie spittlebug is documented to occur within proposed treatment units located within Compartment 572, Stands 4, 7, 10, and 29. Hill-prairie spittlebug also is documented to occur adjacent to Compartment 572, Stands 5, 6, 13, 20, 21, and 22. Sprague's pygarctia is documented to occur adjacent to Compartment 572, Stands 4, 5, 6, 7, 10, and 13.

Active northern goshawk nests are documented to occur and/or were found during field surveys within Compartment 563, Stand 1, and Compartment 572, Stands 34 and 35. Primary and secondary buffers around these active nests, as directed by The Management Recommendations for the Northern Goshawk on the Huron-Manistee National Forests (USDA Forest Service 1993), incorporate the following stands proposed for treatment: Compartment 565, Stands 1, 7, 8, 9, 10, 11, and 12; Compartment 572, Stands 24, 34, 35, and 36; and Compartment 570, Stands 1, 2, 4, and 34. Blanding's turtle and spotted turtle were observed within Compartment 566, Stand 34 during field surveys. Other RFSS occurrences documented near the Project Area include: an active bald eagle nest site documented within 0.5 miles of the Project Area on Croton Dam Pond, and a black-crowned night-heron rookery documented within 1 mile of the Project Area south of 8th Street between Oak and Pine Avenues.

Table 3.26: Habitat Ecology and Distribution for Wildlife Species Included in this Evaluation.

Common Name	Habitat Ecology	Distribution
Karner Blue Butterfly	Heterogeneous oak/pine savanna/barrens habitats with variable light conditions, abundant wild lupine (the sole food source for the caterpillar), abundant adult nectar sources, warm season grasses for basking and roosting, and ants to protect larvae from parasites and predators. Dispersal between subpopulations needs to be maintained by connecting subpopulations with corridors and maintaining an average nearest neighbor distance of 1 km between subpopulations (Rabe 2001, USDI Fish and Wildlife Service 2003).	Found in 11 counties in Michigan. Small, isolated populations occur in Lake, Mason, Mecosta, Montcalm, Muskegon, Newaygo, and Oceana counties in the MNF (Rabe 2001, USDI Fish and Wildlife Service 2003).

Table 3.26 (continued)

Common Name	Habitat Ecology	Distribution
Dusted Skipper	Typically found in localized colonies in bluestem grassland, barrens, prairie, or other openland habitats where little bluestem - its larval food plant - occurs [larvae may also feed on big blue stem (*Andropogon gerardii*)]. Adults nectar on a variety of plant species, including blackberry, cinquefoil, lupine, puccoons, vetches and yarrow (USDA Forest Service 2005).	Found in localized, patchy colonies scattered across 15 counties of the Lower Peninsula, from Cheboygan to Monroe counties. Occurs in Oceana, Muskegon, Mecosta, Newaygo, and Lake counties in the MNF (USDA Forest Service 2005, NatureServe 2008).
Hill-Prairie Spittlebug	Prairie bowls in mesic dry sand prairie zones. Feeds on many families of forbs (NatureServe 2008).	Located typically in highly restricted disjunct populations (often in only a half-meter-wide mesic zone around prairie bowls) within 6 counties in southwest Michigan. Occurs in Oceana, Muskegon, Montcalm, Newaygo, and Lake counties in the MNF, disjunctly to south west Michigan (NatureServe 2008).
Ottoe Skipper	Dry sand fields and prairies with abundant nectar sources. Uses a variety of grasses and forbs as host plants (Cuthrell 2001, USDA Forest Service 2005, NatureServe 2008).	Populations are localized within 6 Michigan counties. Occurs in Montcalm, Newaygo, and Lake counties primarily in the southern portion of the MNF (Cuthrell 2001, USDA Forest Service 2005, NatureServe 2008).
Sprague's Pygarctia	Dry prairies, oak savannas, or openings with *Euphorbia corrallata,* or other acceptable spruges that can be used as its host plant (NatureServe 2008).	Located in 5 Michigan counties, including Muskegon and Newaygo in the MNF (NatureServe 2008).
Red-Headed Woodpecker	Open woodlands, especially with beech or oak, open situations with scattered trees, parks, cultivated areas, and gardens with mast crop abundance. Nests in excavated holes in live trees, dead stubs, snags, utility poles, or fence posts in open situations with scattered trees, parks, cultivates areas and gardens. Eats insects, invertebrates, berries and nuts, sap, and young and eggs of birds (USDA Forest Service 2005, NatureServe 2008).	Species is widespread across the HMNF, but is uncommon, and populations occur in smaller more isolated habitat patches (USDA Forest Service 2005, NatureServe 2008).

Table 3.26 (continued)

Common Name	Habitat Ecology	Distribution
Whip-Poor-Will	Insectivore that occurs in open coniferous, deciduous, and mixed woodlands with well spaced trees and a low canopy, abundant shade, nearby open areas, and sparse ground cover. Prefers stands of even-aged young to medium aged second-growth, including early successional aspen/birch (USDA Forest Service 2005, NatureServe 2008).	Broadly distributed throughout Michigan and the MNF, occurring in all the counties located in the Forest, and in all but 10 counties in the central, southern, and southeastern parts of Michigan (USDA Forest Service 2005, NatureServe 2008).
Ruffed Grouse	Aspen and aspen-alder mixes, 5-25 years old provide brood habitat and cover, with older age classes for nesting and winter food sources. Eats herbaceous plants, seeds, fruits, insects, and buds and leaves of trees/shrubs (NatureServe 2008).	Broadly distributed throughout Michigan and the MNF (NatureServe 2008).
Northern Goshawk	Nests in large tracts of mature pine, hardwood, or mixed forests with an intermediate amount of canopy closure, large deciduous trees for nesting, small forest openings for foraging, and an open understory. Preys on a wide variety of vertebrates and, occasionally, insects. (Cooper 1999a, USDA Forest Service 2005, NatureServe 2008).	Breeding records are documented within 24 counties in the Lower Peninsula. More than half of the total occurrences in Michigan are recorded from the HMNF. Generally widely distributed and abundant within the MNF, occurring within all counties within the Forest, except for Mecosta County (Cooper 1999a, USDA Forest Service 2005, NatureServe 2008).
Red-Shouldered Hawk	Nests in large tracts of mature deciduous or mixed forests with closed canopies, large deciduous trees for nesting, nearby wetland and upland habitats interspersed for foraging, and variable amounts of understory vegetation. Preys on a wide variety of vertebrates and, occasionally, insects (Cooper 1999b, USDA Forest Service 2005, NatureServe 2008).	Breeding records are documented within 36 counties in the Lower Peninsula. Except for Muskegon and Mecosta counties, occurs within all counties within the MNF. High concentrations of nesting red-shouldered hawks with good reproductive success have been documented in the Manistee County area of the Forest (Cooper 1999b, USDA Forest Service 2005, NatureServe 2008).

Table 3.26 (continued)

Common Name	Habitat Ecology	Distribution
Bald Eagle	Nests in tall, dominant deciduous or coniferous trees, and sometimes cliffs, along or close to (within 4 km) major rivers, large lakes, deep marshes, or clusters of small lakes and streams where adequate prey is available and human disturbance is minimal to none (USDA Forest Service 2006a, USDI Fish and Wildlife Service 2006, NatureServe 2008). Preys primarily on fish, but frequently feeds on carrion, waterfowl, and other birds and mammals (USDI Fish and Wildlife Service 1983, USDA Forest Service 2006a, NatureServe 2008).	Breeding records are documented within 46 counties in the Lower Peninsula. Occurs within all counties within the MNF. The number of active territories on or near the HMNF exceeds 45, producing more than 50 fledglings per year (USDA Forest Service 2006a, USDI Fish and Wildlife Service 2006, NatureServe 2008).
Black-crowned night-heron	Occupies wetlands, marshes, swamps, wooded streams, and the shores of ponds and lakes. Roosts in mangroves or swampy woodland. Nests in shrubs and small trees located on islands, in swamps, or over water to avoid predation. Feeds opportunistically usually on fish, amphibians, and invertebrates obtained in shallow water, but also on small mammals and young birds on land (Monfils 2004, NatureServe 2008).	Documented within 10 counties in lower Michigan's Lower Peninsula, including Newaygo County in the MNF. Most nesting in Michigan occurs along the shores of Lakes Huron and Erie (Monfils 2004, NatureServe 2008).
American Marten	Mature or diverse upland or lowland conifer or mixed forests with 40-60% canopy closure and good understory growth, with abundant slash, logs, stumps, hollow trees, other woody debris, and burrows during inactive periods. Uses openings if cover is available but avoid large (>90 m) openings. Feeds primarily on small mammals, birds, insects, and carrion, but berries and other vegetable matter eaten in season (HMNF 1996, USDA Forest Service 2005, NatureServe 2008).	Records are documented in Wexford, Lake, and Manistee Counties within the MNF (HMNF 1996, USDA Forest Service 2005, NatureServe 2008).

Table 3.26 (continued)

Common Name	Habitat Ecology	Distribution
Eastern Box Turtle	This terrestrial turtle typically occurs in forested habitats (coniferous, deciduous and mixed) with sandy soils near a source of water such as a stream, pond, lake, marsh or swamp. Also found in thickets, old fields, pastures, marshes, vegetated dunes, and at bog edges adjacent to water sources. Access to sandy, open areas for nesting sites is critical for successful reproduction. Eats plants, fruit, fungi, snails and other invertebrates, carrion, and rarely small vertebrates (Hyde 1999, USDA Forest Service 2005, NatureServe 2008).	Within the past 10 years, found in 20 counties in Michigan. Occurs in fragmentated populations in Mason, Manistee, Oceana, Muskegon, Newaygo, and Lake counties in the Manistee National Forest (Hyde 1999, USDA Forest Service 2005, NatureServe 2008).
Eastern Massasauga Rattlesnake	Requires adjoining lowlands/wetlands and uplands, with lowlands/wetlands that provide water near the surface for hibernation in the winter, and drier upland habitats (e.g., grasslands, fields, savannas, and prairies) that have open sunlight intermixed with shaded areas to allow for thermoregulation in the summer. Gives birth in mammal burrows or fallen logs in the uplands in the fall, and hibernates in crayfish or small mammal burrows in the wetlands in the winter (Lee and Legge 2000, USDA Forest Service 2002b, USDA Forest Service 2005).	Located within 50 counties in Michigan frequently in isolated patches. Occurs along the Little Manistee River and its tributaries on the MNF in Manistee, Newaygo, and Lake counties (Lee and Legge 2000, USDA Forest Service 2002b, USDA Forest Service 2005).
Blanding's turtle	Occupies productive, clean, shallow waters (lake shallows, ponds, marshes, creeks) with abundant aquatic vegetation and soft organic substrate. In spring and summer, during mating and nesting seasons, occupies terrestrial habitats, preferring to nest in adjacent open, sunny, upland areas with moist but well-drained sandy or loamy soils. Hibernates underwater within organic substrate of ponds and creeks. Omnivorous, feeding primarily underwater predominantly on crayfish and aquatic insects (Lee 1999b, USDA Forest Service 2002b, USDA Forest Service 2005, NatureServe 2008).	Documented within 36 counties in Michigan's Lower Peninsula and within all the counties in the MNF. Fairly common in parts of the Lower Peninsula (Lee 1999b, USDA Forest Service 2002b, USDA Forest Service 2005, NatureServe 2008).

Table 3.26 (continued)

Common Name	Habitat Ecology	Distribution
Wood Turtle	Occupies clear, medium-sized rivers with sand or sand-gravel substrates, and adjacent forested riparian and floodplain areas with numerous openings and a dense mixture of low herbs and shrubs, providing partially shaded, wet-mesic herbaceous vegetation for foraging. In summer, occupies nearby terrestrial habitats, preferring to nest on steep, eroding, sandy, or sandy-gravelly slopes near the river that have little or no ground vegetation, are sunlit most of the day, and receive little human disturbance. Hibernates underwater under overhanging roots or logs, in pools or along the stream bottom under the ice, or in beaver lodges or muskrat burrows (Lee 1999a, USDA Forest Service 2004, USDA Forest Service 2005, NatureServe 2008).	Documented within 45 Michigan counties and within all the counties in the MNF. Within the MNF, has been found on the Pine, Little Manistee, Big Sable, Pere Marquette, Baldwin, White, and Muskegon Rivers and their tributaries. Suitable habitat is widely distributed and of high abundance across the MNF (Lee 1999a, USDA Forest Service 2004, USDA Forest Service 2005, NatureServe 2008).
Spotted Turtle	Occurs in clean, shallow, slow-moving creeks and streams with muddy, soft bottoms and some aquatic and emergent vegetation. Also utilizes shallow ponds, wet meadows, marshes, and wetlands. In spring and summer, during mating and nesting, occupies nearby terrestrial habitats including open fields and woodlands. Nests on grassy, well-drained areas with sandy or loamy soils exposed to full sunlight. Hibernates in shallow water, in the mud, or in muskrat burrows or lodges. Omnivorous, feeding primarily underwater on invertebrates and aquatic vegetation (Lee 2000, NatureServe 2008).	Documented within 32 Michigan counties and within Mason, Oceana, Muskegon, and Newaygo counties in the MNF. Occurs in isolated populations primarily in the southern and western portions of Michigan's Lower Peninsula (Lee 2000, NatureServe 2008).

Table 3.27: Occurrence of Endangered, Threatened, and Sensitive Species adjacent to or within the Project Area.

ETS Wildlife Species	Compartment	Stand(s)
Karner blue butterfly (dispersal distance from occupied sites)	572	4, 5, 6, 7, 10, 13
Northern Goshawk (within primary and/or secondary buffer of active nests)	565	1, 7, 8, 9, 10, 11, 12
	570	1, 2, 4, 34
	572	24, 34, 35, 36
Hill-Prairie Spittlebug (within stands)	572	4, 7, 10, 29
Hill-Prairie Spittlebug (adjacent to stands)	572	5, 6, 13, 20, 21, 22
Sprague's pygarctia (adjacent to stands)	572	4, 5, 6, 7, 10, 13
Blanding's Turtle (within stand)	566	34
Spotted Turtle (within stand)	566	34

(3.8.3.) Direct and Indirect Effects

(3.8.3a) Early Successional Vegetative Types

Alternative 1 (Direct and Indirect)

Under Alternative 1, the quantity and quality of early successional vegetative types would continue to decline in the Mast Lake Project Area due to fire suppression and natural succession. As remnant openings, prairies, savannas, and barrens filled in with fire intolerant woody and shade tolerant herbaceous species, suitable habitat favored by the Karner blue butterfly, hill-prairie spittlebug, and Sprague's pygarctia would likely become scarcer as savanna plants are shaded-out or out-competed and sunlit areas disappear. In addition to the loss of openland habitats early successional aspen forest would continue to decline due to succession. As aspen forest communities matured and were replaced by white pine, red pine, and oak stands, acreage of suitable ruffed grouse habitat, and subsequently the number of ruffed grouse in the Project Area, would likely decline. Other RFSS preferring openland habitats or early succession aspen forest for parts of their life cycles that might experience a reduction in habitat quantity and quality under this alternative include: the eastern box turtle, eastern massasauga rattlesnake, dusted skipper, Ottoe skipper, red-headed woodpecker, and whip-poor-will. Other game and non-game wildlife populations that might also experience a reduction in habitat quantity and quality, and subsequently population numbers within the Project Area, include, but are not limited to: American woodcock, cottontail rabbit, snowshoe hare, fox and gray squirrel, red and gray fox, coyote, wild turkey, and white-tailed deer.

In addition, Alternative 1 would fail to control non-native invasive plant species within remnant openings, prairies, savannas, and barrens. Failure to control invasive plants would not directly result in adverse impacts to local populations of wildlife. However, failure to successfully control these invasive species would allow the continued infestation and degradation of more areas of wildlife habitat within these early successional vegetative types. Aggressive invasive plants species such as leafy spurge tend to replace native plants upon which wildlife generally depend for food and cover (Westbrooks 1998). In general, species having relatively specific habitat requirements are more susceptible to adverse effects from the continued spread of invasive plants than habitat generalists. For example, habitat quantity and quality for Karner blue butterfly, Sprague's pygarctia, and dusted skipper would likely decline if Japanese barberry, autumn olive, honeysuckle, and/or leafy spurge shaded-out or out-competed wild lupine, little bluestem, or *Euphorbia corrallata* (their host plants) and other important nectar sources.

Habitat quantity and quality for the Karner blue butterfly, hill-prairie spittlebug, Sprague's pygarctia, eastern box turtle, eastern massasauga rattlesnake, dusted skipper, Ottoe skipper, red-headed woodpecker, whip-poor-will, and ruffed grouse also might decline under Alternative 1 because it would maintain current road densities, and thus human access and use, within the Project Area. These densities are higher than the Forest Plan objective for the relevant Management Areas (USDA Forest Service 2006b). Vehicle and foot traffic along these roads might increase the level of disturbance (e.g., human activity, noise, and habitat degradation), damage host plants and other plant species used for food or cover, temporarily displace, alter the movement, or disrupt the normal behavior of wildlife, and increase the risk of vehicle collisions, visitors directly harming, harassing, or killing wildlife, illegal collection, wildfires, dispersed camping, and cross-country travel. Thus, maintaining current levels of access and use would likely increase the risk of mortality and reduce habitat quantity and quality for threatened, endangered, and sensitive species and management indicator species associated with early successional vegetative types.

As habitat quality and quantity declined for wildlife associated with early successional vegetative types under Alternative 1, occurrences of these species within the Project Area would likely decline. Surviving populations would become even more isolated and disconnected, and thus subject to a higher risk of

extirpation from catastrophic events. Overall, Alternative 1 is likely to have adverse direct and indirect effects on wildlife associated with early successional vegetative types.

Alternatives 2 and 3 (Direct and Indirect)

Under Alternatives 2, and 3, there would be no direct effects to the Karner blue butterfly. There is no documented occurrence of occupied Karner blue butterfly subpopulations within the stands proposed for treatment, and no occupied subpopulations were located during field surveys. In addition, there is no known suitable Karner blue butterfly habitat within the stands proposed for treatment. However, the following stands proposed for treatment are within dispersal distance of 2 sites historically occupied by the Karner blue butterfly: Compartment 572 Stands 4, 5, 6, 7, 10, and 13. One of the historically occupied sites occurs on private land while the other is on National Forest System lands. These 2 sites historically supported small Karner blue butterfly populations; 5 Karner blue butterflies were observed at the site located on private land in 2004 and 1 Karner blue butterfly was observed at the site located on Forest Service Land in 2003. Karner blue butterflies produce 2 broods each year, with first flight activity occurring between the 2nd week of May and the 2nd week of June, and second flight activity occurring between the 2nd week of July and the 2nd week of August (MNFI 2008). Because no treatments would occur between May 1 and August 31, Karner blue butterflies potentially dispersing through these stands would be protected.

Alternatives 2 and 3 might kill or temporarily displace small numbers of ruffed grouse, hill-prairie spittlebug, Sprague's pygarctia, and other wildlife associated with early successional vegetative types within the Project Area. For example, cutting, prescribed burning, seeding/planting, site preparation (particularly soil scarification), and road closures and rehabilitation activities could affect movement patterns of ruffed grouse, red-headed woodpecker, and whip-poor-will for short periods of time. Management activities also could destroy ruffed grouse, red-headed woodpecker, and whip-poor-will nests, and/or kill slow moving wildlife such as the hill-prairie spittlebug, Sprague's pygarctia, dusted skipper, Ottoe skipper, eastern massasauga rattlesnake, and eastern box turtle. These activities also might disrupt the normal behavior of wildlife, which could limit the use of foraging, nesting, roosting, or hibernation sites and potentially affect productivity. Vehicle use and foot traffic along roads and within openings during management activities might temporarily increase the level of disturbance (e.g., human activity, noise, and habitat degradation), damage plant species used for food or cover, temporarily displace, alter the movement, or disrupt the normal behavior of wildlife, and increase the risk of vehicle collisions, and visitors directly harming, harassing, or killing wildlife. In addition, amphibian populations would likely decrease within two years of regenerating a stand due to leaf and moisture loss, but would likely rebound to normal levels after 20 years (Ash 1997). Breeding birds, small mammals, and less mobile species, such as reptiles and invertebrates, are most likely to be directly affected in these operations due to heavy equipment use and prescribed burning. Operations during the breeding season have the potential to cause disturbance, destroy or damage nests and dens, or kill/injure small young and less mobile species. Management activities conducted between September and March could directly impact wildlife use in the fall and small numbers of wintering animals, but would largely protect nesting birds, bats, hibernating reptiles, and other breeding wildlife. For example, because the eastern massasauga rattlesnake occupies hibernation sites in wetlands during the winter and utilizes adjacent uplands during the summer (Lee and Legge 2000), the potential for direct effects would be greater during summer treatments. In addition, because the eastern box turtle occupies hibernacula underground during the winter, management activities are more likely to have a direct effect on the eastern box turtle between early spring and late fall when they are most active (Hyde 1999). The season, intensity, and frequency of management activities, particularly prescribed burns, also could have detrimental effects on Regional Forester's Sensitive Insect Species (e.g., hill-prairie spittlebug, Sprague's pygarctia, dusted skipped, Ottoe skipper) through the killing of eggs, larvae, or adults.

Spot or strip application of glyphosate would be used under Alternatives 2 and 3 to control non-native invasive plant species. The ecological risk assessment conducted for glyphosate suggests that use at rates commonly used by the Forest Service poses little or no risk to wildlife (USDA Forest Service 2003). Glyphosate is not highly toxic to avian receptors (e.g., red-headed woodpecker, whip-poor-will, ruffed grouse), to insect species (e.g., dusted skipper, hill-prairie spittlebug, Ottoe skipper, Sprague's pygarctia), to reptilian species (e.g., eastern massasauga rattlesnake, eastern box turtle), or to the small mammal, amphibian, and fish species that form the chief prey of carnivores such as red-shouldered hawks, northern goshawks, and bald eagles (USDA Forest Service 2003). In addition, glyphosate is not a cholinesterase inhibitor such as organophosphate or a carbamate insecticide (or chemically related to such insecticides) that are highly toxic to wildlife, especially insects and other invertebrates. Nor is glyphosate chemically related to the chlorinated hydrocarbon insecticides such as DDT that are highly persistent in the environment and known for causing eggshell thinning of raptors (birds of prey) such as bald eagles and ospreys.

Wildlife associated with early successional vegetative types could be dermally (absorbed through the skin) exposed to herbicides by direct contact with herbicide spray or with recently treated foliage. Oral exposure also could occur by ingesting treated foliage, contaminated nectar, or prey items that have consumed parts of treated plants, or by drinking from water sources that have received contaminated surface runoff. However, herbicide toxicity and risk data (Appendix D) for mammalian, aquatic, avian, and terrestrial wildlife species suggest glyphosate is generally safe to mammals, birds, and other wildlife if used in accordance with the manufacturer label. Because of the small area of treatment, wildlife associated with early successional vegetative types are not likely to come in direct contact with herbicide spray or recently treated foliage, and nectivores, insectivores, and fruitivores such as dusted skipper and eastern box turtle are not likely to feed solely on plant parts recently treated with herbicide sprays. Spot treatment would also reduce the likelihood that wildlife comes in direct contact with herbicide spray or recently treated foliage, and minimize exposure for nearby plant species, further reducing opportunities for wildlife to feed on treated foliage or contaminated nectar. The risk assessment for glyphosate concludes that small birds and animals that consume vegetation or insects from areas treated with the maximum application rate for an extended period of time could experience adverse effects. However, this type of treatment would not occur. In addition, glyphosate is not expected to bioaccumulate in the food chain (USDA Forest Service 2003). Only formulations labeled for use in aquatic areas would be used in wetlands or riparian areas.

Research to date suggests that glyphosate can be used with minimal direct impact on the Karner blue butterfly (USDI Fish and Wildlife Service 2003). To protect the two historically occupied Karner blue butterfly sites that occur adjacent to stands proposed for treatment and sites occupied by the hill-prairie spittlebug and Sprague's pygarctia, herbicide application would be prohibited in Compartment 572 Stands 4, 5, 6, 7, 10, 13, and 29 between April 1 and August 15, except when the wind is not blowing toward the occupied habitat and there is a minimum buffer of 100 feet (30 m) between the occupied habitat and the treatment area. Thus, herbicide treatments would have no direct impact to the Karner blue butterfly, hill-prairie spittlebug, or Sprague's pygarctia.

Adverse direct effects that Alternatives 2 and 3 might have on ruffed grouse, hill-prairie spittlebug, Sprague's pygarctia, and other wildlife associated with early successional vegetative types are expected to be minimal because management activities would potentially affect small acreages in localized areas within the Project Area in any given time period. Potential adverse effects would be reduced further with the implementation of the conservation measures outlined in: the Programmatic Biological Evaluation for the Huron-Manistee National Forests for the dusted skipper, Ottoe skipper, red-headed woodpecker, whip-poor-will, eastern massasauga rattlesnake, and the eastern box turtle (USDA Forest Service 2005), and the Conservation Approach for Eastern Massasauga (*Sistrurus C. Catenatus*) (USDA Forest Service 2002b). These conservation measures would be implemented in areas where these RFSS are documented

or found within the Project Area. The conservation measures outlined for the dusted skipper and Ottoe skipper also should be implemented where hill-prairie spittlebug and Sprague's pygarctia are documented or found. In addition, the locations of known nests, roosts, or burrows of RFSS would be flagged or marked, and management activities would be performed carefully to avoid physical injury to nests or burrows and less mobile RFSS. If other sensitive wildlife species are found during project activities, appropriate protection measures would be implemented to reduce potential adverse direct effects.

Management activities proposed under Alternatives 2 and 3 would likely have a greater effect on local populations of ruffed grouse, hill-prairie spittlebug, Sprague's pygarctia, and other wildlife associated with early successional vegetative types through habitat change. For example, prescribed burns might damage vegetation and increase the amount of bare ground within treated openings, temporarily decreasing cover and the abundance of native grasses, herbs, wildflowers, and fruit-bearing shrubs. In addition, red-headed woodpeckers and other wildlife species dependent on hard mast production (e.g., wild turkey, squirrels, and white-tailed deer) would likely experience a reduction in food resources as oaks are removed during aspen expansion, the expansion of openings and savannas, and other proposed wildlife habitat improvements. The effects of herbicides on the growth and flowering of lupine and other nectar plant species varies (USDI Fish and Wildlife Service 2003), and at times might result in a temporary reduction in habitat quantity and quality for Regional Forester Sensitive Insect Species (e.g., dusted skipper, hill-prairie spittlebug, Ottoe skipper, Sprague's pygarctia), and other nectivores and herbivores. Such reductions are expected to be minimal with the seeding/planting of native nectar plants. Restoration activities may also create conditions favorable to non-native invasive species that may out-compete or shade-out more desirable native savanna plant species; however, the proposed herbicide treatments under Alternatives 2 and 3 should minimize the occurrence of non-native invasive species. Controlling non-native invasive shrubs (e.g., autumn olive and honeysuckle) that bear fruit and serve as nectar sources for bees and other insects would likely reduce available habitat and food for wildlife associated with early successional vegetative types such as dusted skipper and eastern box turtle. However, adverse indirect effects from control efforts are expected to be minimal with the planting of alternative fruit-bearing shrubs that also serve as fruit and nectar sources (e.g., crabapple, Alleghany plum, hawthorn).

Disturbance from road closure and rehabilitation activities proposed under Alternatives 2 and 3 also might impact the habitat of wildlife associated with early successional vegetative types within the Project Area. For example, roads might serve as dispersal corridors or provide habitat for Regional Forester Sensitive Insect Species (e.g., dusted skipper, hill-prairie spittlebug, Ottoe skipper, Sprague's pygarctia) if host plants, nectar sources, and other required resources are present. As a consequence, road closures and rehabilitation might kill or temporarily displace and/or impact the habitat of sensitive insect species.

In addition, small numbers of wildlife associated with early successional vegetative types might be killed or temporarily displaced, or their movement patterns or behavior might be altered, by the creation of a more open landscape due to increased recreational use. An increase in openland habitats would likely increase access for activities such as riding off-road vehicles and horses, hunting, fishing, poaching, illegal collection, and dispersed camping. As a consequence, increased recreational use might increase the likelihood for direct mortality to wildlife associated with early successional vegetative types. Wildlife species that have limited mobility or are breeding are most likely to be directly affected. An increase in human use might also reduce the quantity and quality of early successional habitat by increasing fragmentation, the level of disturbance, the amount of bare ground, and soil erosion, and introducing non-native invasive plant species. The potential for adverse effects should be minimized with the installation of signs explaining the benefits of restoring native plant communities and requesting recreationists to stay on designated roads and trails, and by implementing mitigation techniques that

would limit access to managed dry sand prairies and openings such as piling brush around the perimeter of treatment areas.

Much of the habitat change expected under Alternatives 2 and 3 would likely have beneficial indirect effects to ruffed grouse, hill-prairie spittlebug, Sprague's pygarctia, and other wildlife associated with early successional vegetative types. Proposed vegetative management activities would increase the quantity and quality of early successional aspen forest and openland habitats (e.g., openings, prairies, and oak/pine savanna/barrens). Aspen regeneration and expansion cuts would provide the age-class diversity required for ruffed grouse, whip-poor-will, and American woodcock on approximately 178 acres under Alternatives 2 and 3. As a consequence, occurrences of these species would likely increase within the Project Area.

Openland habitats would be created and/or maintained on up to 214 acres under Alternative 2 and 128 acres under Alternative 3. This acreage would contribute to the Forest Plan's management goals for restoring dry sand prairies, oak/pine barrens/savannas, and upland openings (USDA Forest Service 2006b). Opening, savanna, and dry sand prairie restoration/maintenance activities would increase habitat quantity and quality for wildlife associated with openland habitats (e.g., dusted skipper, hill-prairie spittlebug, Ottoe skipper, Sprague's pygarctia, eastern massasauga rattlesnake, red-headed woodpecker, whip-poor-will, eastern box turtle) by: maintaining open areas; providing a diversity of foraging habitats; promoting nectaring sources from shrubs and wildflowers, larval host plants including bluestem and spruges, and savanna plant species such as warm season grasses; and providing other features important to wildlife, such as sunning areas, roosting sites, and nesting areas. Occurrences of dusted skipper, hill-prairie spittlebug, Ottoe skipper, and Sprague's pygarctia would likely increase as openland habitats within warm season grasses and nectar plants increase within the Project Area. The eastern massasauga rattlesnake, red-headed woodpecker, eastern box turtle, and whip-poor-will have diverse habitat requirements that include openland habitats, and consequently also would benefit from restoration activities. The eastern massasauga rattlesnake requires adjoining lowlands/wetlands and uplands, with lowland/wetlands that provide water near the surface for hibernation in the winter, and drier upland habitats (e.g., grasslands, fields, savannas, and prairies) that have open sunlight intermixed with shaded areas to allow for thermoregulation in the summer (Lee and Legge 2000, USDA Forest Service 2002b, USDA Forest Service 2005). Red-headed woodpeckers require open woodlands with mast crop abundance and nesting cavities in live trees, dead stubs, snags, utility poles, or fence posts (USDA Forest Service 2005, NatureServe 2008). Eastern box turtles occur in upland forested habitats with sandy soils, thickets, old fields, pastures, marshes, vegetated dunes, and bog edges near or adjacent to a source of water, and require access to nearby sandy, open areas for nesting (Hyde 1999, USDA Forest Service 2005, NatureServe 2008). Whip-poor-wills occur in open coniferous, deciduous, and mixed woodlands with well-spaced trees and a low canopy, abundant shade, nearby open areas, and sparse ground cover (USDA Forest Service 2005, NatureServe 2008). Other wildlife species that may experience an increase in habitat quantity and quality, and subsequently population numbers, following treatments to enhance early successional vegetative types within the Project Area include, but are not limited to: cottontail rabbit, snowshoe hare, fox and gray squirrel, red and gray fox, coyote, wild turkey, and white-tailed deer. Although Alternative 3 would create fewer acres of openland habitat than Alternative 2, dry sand prairie restoration sites that have degraded soils would be excluded from treatment and a more diverse habitat mosaic would be achieved under this Alternative. Disturbance from restoration treatments in such sites under Alternative 2 would likely increase the amount of bare ground and soil erosion, and introduce non-native invasive plant species.

Currently, there is no known suitable Karner blue butterfly habitat within the Project Area. Under Alternatives 2 and 3, dry sand prairie restoration and opening maintenance would potentially create up to 214 acres of suitable Karner blue butterfly habitat and promote dispersal between the two historically occupied sites located adjacent to stands proposed for treatment. It also would provide the potential for

Karner blue butterflies to establish subpopulations in the Project Area in the future. Thus, Alternatives 2 and 3 might have beneficial effects for future generations of Karner blue butterfly. To promote the creation of suitable Karner blue butterfly habitat, the conservation measures described for unoccupied Karner blue butterfly habitat in the Biological Opinion on the Programmatic Biological Assessment for the Huron-Manistee National Forests Land and Resource Management Plan (USDI Fish and Wildlife Service 2006), the Programmatic Biological Assessment for the Huron-Manistee National Forests (USDA Forest Service 2006a), the Final Recovery Plan for the Karner blue butterfly (*Lycaeides melissa samuelis*) (USDI Fish and Wildlife Service 2003), and the Forest Plan Standards and Guidelines (USDA Forest Service 2006b) would be implemented within the Project Area.

Road closures and rehabilitation activities are expected to primarily have beneficial effects to local populations of wildlife associated with early successional vegetative types within the Project Area. Road closures would reduce human access and use within the Project Area in the long term, which would likely decrease levels of disturbance (e.g., human activity, noise, and habitat degradation), reduce damage to important savanna plant species, and reduce the risk of vehicle collisions, visitors directly harming, harassing, or killing wildlife, illegal collection, dispersed camping, and cross-country travel. Rehabilitation of closed roads would likely provide food resources and improve dispersal corridors for wildlife associated with early successional vegetative types. Over time, the effects of fragmentation and erosion/sediment delivery would be reduced as native vegetation became re-established along closed roads. Thus, this management activity would likely decrease the risk of mortality and improve habitat quantity and quality for wildlife associated with early successional vegetative types. In addition, the road closures proposed under Alternatives 2 and 3 should reduce the potential for damage from ORV use and dispersed camping in managed openings and dry sand prairies. Alternative 2 would provide more protection from ORV use and dispersed camping than Alternative 3 given that it proposes an additional 5 miles of road closures. Overall, management activities proposed under Alternatives 2 and 3 would have primarily beneficial direct and indirect effects on wildlife associated with early successional vegetative types within the Project Area, and any adverse direct and indirect effects would be expected to be minimal.

All Alternatives (Cumulative)

Increases in human populations and the associated land development, road construction, and recreational uses are expected on private lands within the MNF. These activities would likely result in the degradation and permanent loss of habitat for the Karner blue butterfly, hill-prairie spittlebug, Sprague's pygarctia, ruffed grouse, and other wildlife associated with early successional habitats, and directly impact individuals of these species by:

- increasing habitat fragmentation, level of disturbance (e.g., human activity, noise, and habitat degradation), amount of bare ground, and soil erosion, and introducing non-native invasive plant species;
- increasing predation and/or competition by increasing wildlife populations associated with human residential areas such as raccoons, opossums, and skunks;
- damaging host plants (e.g., wild lupine, spruges, bluestem) and other important plant species that provide food (e.g., foliage, nectar, or fruit) and/or cover, as well as other required habitat elements such as nesting, roosting, and/or hibernation sites;
- temporarily displacing, altering the movement, or disrupting the normal behavior of wildlife associated with early successional habitats;
- and increasing the risk of vehicle collisions, wildfires, visitors directly harming, harassing, or killing individual wildlife, illegal collection, dispersed camping, and cross country travel.

Additional actions performed on private lands that may adversely affect wildlife associated with early successional habitats in the future within the MNF are fire suppression, mowing and grazing, off-road vehicle use, application of pesticides, and timber harvest. In addition, mineral developments are

reasonably certain to occur within the MNF and have the potential to cumulatively affect wildlife associated with openlands and early successional aspen forest. Although land development activities may increase non-forested areas on private lands within the MNF, the habitat conditions preferred by wildlife associated with early successional habitats that might occur within the Project Area are not likely to increase proportionately. For example, there is unlikely to be a proportionate increase in the host and nectar plants preferred by the Karner blue butterfly and Regional Forester Sensitive Insect Species (e.g., dusted skipper, hill-prairie spittlebug, Ottoe skipper, Sprague's pygarctia), or in habitat requirements such as nesting, roosting, and hibernation sites utilized by RFSS such as the red-headed woodpecker and the eastern box turtle. In addition, newly created non-forested areas on private lands within the MNF are unlikely to provide the diverse habitat mosaics preferred by RFSS such as the red-headed woodpecker, whip-poor-will, eastern massasauga rattlesnake, and eastern box turtle. Creation of non-forested areas on private lands within the MNF is also reducing the acreage of early successional aspen stands. In addition, private forested lands are expected to shift towards a mix of young and mature oak and lowland hardwoods, replacing other forested types including aspen. As a consequence, there will likely be a decline in suitable habitat for ruffed grouse and whip-poor-will. Overall, habitat quantity and quality for wildlife associated with early successional vegetative types, and subsequent occurrences of these species, would likely decline on private lands within the MNF. With the increasing development and fragmentation of private lands, suitable habitat for wildlife associated with openlands and early successional aspen forest on federal lands within the MNF is likely to become more important in the future.

To promote the recovery of Endangered, Threatened, and Sensitive species associated with early successional habitats, the Forest Plan directs the restoration and maintenance of 30,000 acres of upland openings across all of the Huron-Manistee National Forests, and 10,000 acres of savannas, barrens, and prairies within old-growth areas (USDA Forest Service 2006b). In addition, under the Forest Plan's new management direction, approximately 2,400 acres of aspen regeneration harvests are to be created annually to provide habitat for species associated with early successional aspen stands (USDA Forest Service 2006b). The dry sand prairie restoration, opening maintenance, and aspen regeneration/expansion treatments proposed under Alternatives 2 and 3 would help achieve Forest Plan goals. Implementation of the conservation measures should protect Threatened, Endangered, and Sensitive species associated with early successional vegetative types and their habitats on National Forest Lands within the Project Area from potential impacts. Although increases in human populations and associated land uses and developments are expected within the MNF in the future, the beneficial effects of Alternatives 2 and 3 should help to mitigate the potential negative effects of activities on private lands. The Nature Conservancy also is working with Big Prairie Township to restore dry sand prairie on 40 acres adjacent to the Mast Lake Project Area. In addition, 2 private land conservation groups own and manage for prairie and savanna habitats on about 510 acres in adjacent Brooks Township. The combined effect of these adjacent projects would result in a diverse mosaic of openings, dry sand prairie, and early successional forests on a landscape level within the MNF.

Over the next 50 years, the stands proposed for treatment under Alternatives 2 and 3 would regenerate and mature, again favoring wildlife species that prefer mature forest types. However, based upon the management direction in the Forest Plan, reversion to pre-treatment conditions would be prevented as vegetation management would continue to occur within the MNF in the future. Stands restored to savanna/barrens and openings would be re-treated before they converted to other forest types, thus continuing to provide suitable habitat for Karner blue butterfly, hill-prairie spittlebug, Sprague's pygarctia, and other wildlife associated with openland habitats. In addition, aspen stands would continue to be managed to provide the age-class diversity favored by ruffed grouse and whip-poor-will. Overall, the net long-term cumulative effect of the proposed opening maintenance, dry sand prairie restoration, and aspen regeneration/expansion treatments and other protective measures and planned

activities within the MNF would be beneficial to wildlife associated with early successional vegetative types.

(3.8.3b) Mature Forest

Alternative 1 (Direct and Indirect)

Under Alternative 1, the quantity and quality of mid- to late-successional forest habitats would continue to increase in the Project Area due to fire suppression and natural succession. Over time, Alternative 1 would create large blocks of maturing habitat spatially distributed across the Project Area. The quality of forested stands within such blocks would likely increase for the northern goshawk, red-shouldered hawk, bald eagle, American marten, black bear, eastern box turtle, and other wildlife species associated with mid- to late-successional forest habitats (e.g., pileated woodpecker, brilliant scarlet tanager, red and gray fox, coyote, black-throated green warbler, gray and fox squirrel, bobcat, and northern flying squirrel), as tree diameters, understory growth, large woody debris, and snags increased, and canopy gaps developed. As these mature forest characteristics developed, northern goshawks would likely experience an increase in suitable nesting and foraging habitat. Although no red-shouldered hawks or bald eagles have been observed nesting within the Project Area, an increase in mature forest near water or wetlands might increase the availability of potential nesting, roosting, and perching sites for these species. In addition, greater understory growth and woody debris might increase the abundance and availability of potential denning sites and prey species for the American marten and black bear. However, if succession leads to the loss of interspersed forest openings, uplands, and/or wetlands, the availability of suitable foraging habitat for the northern goshawk, red-shouldered hawk, bald eagle, American marten, black bear, and eastern box turtle might decline. The loss of intermittent openings also might reduce the availability of unshaded nesting sites adjacent to upland forests, which are critical for successful eastern box turtle reproduction (Hyde 1999).

Succession would also eventually lead to the loss of the jack pine forest within the Project Area under Alternative 1. Without fire or mechanical removal of woody vegetation to create sunlit areas, competing species such as oak or cherry would soon dominate the existing jack pine stands. Jack pine forests provide habitat for a diverse group of wildlife species including the American marten, black-backed woodpecker, spruce grouse, Kirtland's warbler, black bear, snowshoe hare, and white-tailed deer. As these forests mature, the dense understory growth and woody debris provide habitat for small mammals, insects, and birds, increasing prey abundance and availability for the American marten and black bear. In addition, such dense, multi-storied forests provide denning sites, overhead cover from predation, and help meet thermoregulatory needs during winter.

Under Alternative 1, there would be no Scotch pine removal. As a result, Scotch pine might replace native forest species reducing the quantity and quality of breeding and foraging habitat for northern goshawk, red-shouldered hawk, bald eagle, American marten, black bear, eastern box turtle, and other wildlife species associated with mid- to late-successional forest habitats. However, this potential adverse effect would likely be minimal due to the small acreages affected. Habitat quantity and quality for wildlife species associated with mid- to late-successional forest habitats also might decline under Alternative 1 because it would maintain current road and trail densities and, thus, human access and use within the Project Area. These densities are higher than the Forest Plan objective for the relevant Management Areas (USDA Forest Service 2006b). Traffic along these roads and trails might increase the level of disturbance (e.g., human activity, noise, and habitat degradation), and increase the risk of vehicle collisions, illegal collection and poaching, wildfires, dispersed camping, and cross-country travel. Such disturbance might cause northern goshawks to abandon their nest sites, and disrupt the normal nesting and foraging behavior of northern goshawks, red-shouldered hawks, bald eagles, American martens, black bears, and eastern box turtles, limiting use of nesting, foraging, and denning sites and potentially affecting productivity. These activities also might damage vegetation and increase the amount of bare

ground within forest openings and upland areas, and/or reduce water quality in wetlands and lakes via soil erosion or sediment delivery. Degradation of forest openings, upland areas, wetlands, and lakes might lead to a reduction in available foraging and nesting habitat for the northern goshawk, red-shouldered hawk, bald eagle, American marten, black bear, and eastern box turtle. However, human disturbances (and the associated reductions in nesting, foraging, and denning habitat) would potentially affect small acreages in localized areas within the Project Area in any given time period. Overall, Alternative 1 would be expected to have primarily beneficial direct and indirect effects on wildlife species associated with mid- to late-successional forest habitats, and any adverse direct and indirect effects are expected to be minimal.

Alternatives 2 and 3 (Direct and Indirect)

Management activities proposed under Alternatives 2 and 3 might temporarily displace and/or kill small numbers of northern goshawks, red-shouldered hawks, bald eagles, American martens, black bears, eastern box turtles, and other wildlife associated with mid- to late-successional forest types within the Project Area, as described above for management of early-successional habitats. Cutting, prescribed burning, seeding/planting, site preparation, road closures and rehabilitation, and vehicle and foot traffic associated with implementation might temporarily increase the level of disturbance (e.g., human activity, noise, and habitat degradation) near active northern goshawk, red-shouldered hawk, or bald eagle nests, potentially resulting in nest abandonment and/or the removal of nest sites. Implementation of treatments might also remove potential resting or denning sites for American martens or black bears, and/or temporary displace or disturb northern goshawks, red-shouldered hawks, bald eagles, American martens, black bears, and eastern box turtles searching for nesting, resting, denning, or foraging sites, limiting the use of potential habitat and potentially affecting productivity. In addition, implementation activities might temporarily increase the risk of mortality due to vehicle collision, and/or temporarily displace, alter the movement, or disrupt the normal behavior of foraging northern goshawks, red-shouldered hawks, bald eagles, American martens, black bears, and eastern box turtles, limiting the use of foraging areas and potentially affecting productivity. Management activities are more likely to have a direct effect on the eastern box turtle between early spring and late fall when they are most active (Hyde 1999).

Alternatives 2 and 3 also propose spot or strip application of glyphosate to control non-native invasive species. The ecological risk assessment conducted for glyphosate suggests that use at rates commonly used by the Forest Service poses little or no risk to wildlife (USDA Forest Service 2003a). Glyphosate is not highly toxic to avian receptors such as northern goshawks, red-shouldered hawks, and bald eagles, to insect species such as Karner blue butterflies, to reptilian species such as eastern box turtle and Blanding's turtle, or to the small mammal, amphibian, and fish species that form the chief prey of carnivores such as the American marten, red-shouldered hawk, northern goshawk, and bald eagle (USDA Forest Service 2003a). In addition, glyphosate is not a cholinesterase inhibitor such as organophosphate or a carbamate insecticide (or chemically related to such insecticides) that are highly toxic to wildlife, especially insects and other invertebrates. Nor is glyphosate chemically related to the chlorinated hydrocarbon insecticides such as DDT that are highly persistent in the environment and known for causing eggshell thinning of raptors (birds of prey) such as bald eagles and ospreys. Herbicide toxicity and risk data (Appendix D) for mammalian, aquatic, avian, and terrestrial wildlife species suggest glyphosate is generally safe to mammals, birds, and other wildlife if used in accordance with the manufacturer label. Northern goshawks, red-shouldered hawks, bald eagles, American martens, and black bears might consume prey items that are exposed to these herbicides. However, consumption of exposed prey would likely have a minimal effect on these species given that glyphosate is not expected to bioaccumulate in the food chain (USDA Forest Service 2003a). In addition, only formulations labeled for use in aquatic areas would be used in wetlands or riparian areas.

Adverse direct effects that Alternatives 2 and 3 might have on northern goshawks, red-shouldered hawks, bald eagles, American martens, eastern box turtles, and other wildlife associated with mid- to late-successional forest types are expected to be minimal because management activities would potentially affect small acreages in localized areas within the Project Area in any given time period. Potential adverse effects would be reduced further with the implementation of the conservation measures outlined in the:

- Marten Conservation Strategy (HMNF 1996);
- Management Recommendations for the Northern Goshawk on the Huron-Manistee National Forests (USDA Forest Service 1993);
- The Northern Goshawk (*Accipiter gentilis atricapillus*) in the Western Great Lakes Region: A Technical Conservation Assessment (Roberson et al. 2003);
- Conservation Assessment for Red-Shouldered Hawk (*Buteo lineatus*) (USDA Forest Service 2002a);
- Bald Eagle Management Plan for the Huron-Manistee National Forests (USDA Forest Service 2006c);
- Northern States Bald Eagle Recovery Plan (USDI Fish and Wildlife Service 1983);
- Programmatic Biological Evaluation for the Huron-Manistee National Forests (USDA Forest Service 2005); and
- Forest Plan Standards and Guidelines (USDA Forest Service 2006b).

These conservation measures would be implemented in areas where RFSS are documented or found within the Project Area. To further reduce the potential for direct effects, the locations of nests, roosts, or dens of rare or sensitive wildlife species, such as the northern goshawk, red-shouldered hawk, bald eagle, and American marten, would be flagged or marked, and management activities would be performed carefully to avoid physical injury to such structures and less mobile wildlife, such as the eastern box turtle. If other sensitive wildlife species associated with mid- to late-successional forest types are found during project activities, appropriate protection measures would be implemented to reduce potential adverse direct effects.

Management activities under Alternatives 2 and 3 would likely have a greater effect on local populations of northern goshawks, red-shouldered hawks, bald eagles, American martens, black bears, eastern box turtles, and other wildlife associated with mid- to late-successional forest types through habitat change. Aspen, red pine, oak, and jack pine harvests and the restoration of dry sand prairie would reduce the amount of foraging and breeding habitat within the Project Area. Species dependent on hard mast production (e.g., red-headed woodpecker, wild turkey, squirrels, and white-tailed deer) would likely experience a reduction in food resources, which might subsequently lead to a reduction in prey availability and abundance for foraging northern goshawks, red-shouldered hawks, bald eagles, American martens, and black bears. While dry sand prairie restoration would reduce hard mast production over the long term, aspen, red pine, oak, and jack pine harvests would reduce hard mast production over the short term. The proposed management activities also might damage vegetation and increase the amount of bare ground within forest openings and upland areas, and/or reduce water quality in lakes and wetlands via soil erosion or sediment delivery. Subsequent reductions in habitat quality and quantity for northern goshawk, red-shouldered hawk, bald eagle, American marten, and black bear forage species might lead to a short-term decline in prey abundance. Reductions in berry producing plants also might temporarily impact available forage for the American marten, black bear, and eastern box turtle. However, these potential short term effects are expected to be minimal given that human disturbance and associated reductions in foraging habitat would potentially affect small acreages in localized areas within the Project Area in any given time period, allowing foraging potential in those areas that are undisturbed.

In addition, management activities would increase forest fragmentation and the amount of edge, which might reduce the nesting success of forest-interior bird species, such as the northern goshawk and red-

shouldered hawk, due to the effects of forest fragmentation (e.g., higher rates of predation, higher rates of parasitism, and reductions in pairing success). Fragmentation of forest stands and the creation of larger openings favor the immigration of nest competitors and predators such as the red-tailed hawk and great-horned owl (Cooper 1999a). These species can either displace northern goshawk or red-shouldered hawk nesting pairs or directly depredate young and/or adults from a nest site (Cooper 1999a). Forest fragmentation also might restrict the movements of American marten through the Project Area as this species avoids large openings. Forestry practices such as clearcutting produce only temporary edges and fragmentation. For example, aspen regenerates quickly and within approximately 10 years, the stands would have closed canopies, and in about 20+ years, tree heights would approach the original stands. Thus, any adverse effects from aspen, red pine, oak, and jack pine harvests would likely be short term for species favoring forest interior conditions.

Dry sand prairie restoration and opening expansion would likely reduce habitat quantity and quality for northern goshawks, red-shouldered hawks, and American martens over the long term. Reduction of forest interior conditions would be greatest under Alternative 2. Because a relatively small percentage (5%) of the Project Area would be affected by dry sand prairie restoration and aspen, red pine, oak, and jack pine harvests, the reduction in foraging and breeding habitat would not likely decrease the overall numbers of northern goshawks, red-shouldered hawks, bald eagles, American martens, black bears, and eastern box turtles, and other wildlife associated with mid- to late-successional forest types within the Project Area.

Alternatively, management activities under Alternatives 2 and 3 would likely have beneficial indirect effects to the foraging and breeding habitat of northern goshawks, red-shouldered hawks, bald eagles, American martens, black bears, eastern box turtles, and other wildlife species associated with mid- to late-successional forest types. Wildlife habitat creation cuts would increase the availability of snags and dens, woody debris, and mast-producing, fruit-bearing, and/or thermal cover providing shrubs/trees within forested stands in the Project Area. Opening maintenance/expansion treatments would improve the quality of openings by increasing native grasses, forbs, and berry producing shrubs, subsequently increasing the abundance and diversity of forage and prey species. Jack pine regeneration cuts would help maintain jack pine forests within the Project Area. Mature dense, multi-storied jack pine forests with dense understory growth and woody debris provide abundant prey, denning sites, overhead cover from predation, and cover for thermoregulation. Scotch pine removal would control a non-native invasive species and replace it with native vegetation (i.e., aspen and oak). The newly established native species (i.e., aspen and oak) would provide food and habitat sources for wildlife associated with mature forest habitats, and might result in an increase in species richness and diversity. Prescribed burning also might indirectly benefit wildlife associated with mature forest habitats by reducing the potential for wildfire and damaging or killing trees, contributing to the production of snags, down wood, and potential perch trees.

In addition, the road closures and rehabilitation activities proposed under Alternatives 2 and 3 also are expected to primarily have beneficial effects to local populations of wildlife associated with mid- to late-successional forest types. Road closures would reduce human access and use within the Project Area in the long term, which would likely decrease levels of disturbance (e.g., human activity, noise, and habitat degradation), and reduce the risk of vehicle collisions, illegal collection and poaching, wildfires, dispersed camping, and cross-country travel. Alternative 2 would provide more protection from human access and use than Alternative 3 given that it proposes an additional 5 miles of road closures. Rehabilitation of closed roads also would likely provide food resources and improve dispersal corridors for northern goshawk, red-shouldered hawk, bald eagle, American marten, and black bear forage species, such as squirrels, hares, and birds. Over time, the effects of fragmentation and erosion/sediment delivery would be reduced as native vegetation became re-established along closed roads. Overall, management activities proposed under Alternatives 2 and 3 are expected to have both beneficial and negative direct

and indirect effects to wildlife associated with mid- to late-successional forest types within the Project Area, and any adverse effects are expected to be minimal.

All Alternatives (Cumulative)

Increases in human populations and associated land development, road construction, and recreational uses are expected on private lands within the MNF. In addition, a change in land use from larger forested parcels to smaller parcels with more development is occurring on private ownerships and is expected to continue into the foreseeable future. These activities would likely increase the potential for human access and use near northern goshawk, red-shouldered hawk, bald eagle, American marten, eastern box turtle, and black bear nesting, roosting, resting, denning, and foraging sites, subsequently increasing the level of disturbance (e.g., human activity, noise, and habitat degradation), the effects of habitat fragmentation (e.g., higher rates of predation, higher rates of parasitism, and reductions in pairing success), and the risk of vehicle collisions, illegal poaching and collection, wildfires, dispersed camping, and cross country travel. Such disturbance might damage nesting, roosting, perching, resting, or denning sites and/or cause such sites to be abandoned. In addition, the increase in the number of residences and associated developments within the MNF has likely increased wildlife populations associated with human residential areas such as raccoons, opossums, and skunks, which may predate active nest sites.

Increases in human development, access, and use also might remove potential nesting, roosting, perching, resting, or denning sites and/or temporarily disturb northern goshawks, red-shouldered hawks, bald eagles, American martens, black bears, and eastern box turtles searching for new nest, roost, perch, rest, or den sites, limiting the use of potential habitat. Human disturbance also might disrupt the normal foraging behavior of wildlife associated with mid- to late-successional forest types, limiting use of foraging areas and potentially affecting productivity. In addition, increases in human development, access, and use might decrease the quantity and quality of forest openings, upland areas, and wetland habitats, as well as water quality in lakes, potentially decreasing the abundance of forage and prey species, and subsequently reducing foraging habitat for wildlife associated with mature forest habitats.

Thus, increases in human populations and associated developments and uses could result in the permanent loss and degradation of northern goshawk, red-shouldered hawk, bald eagle, American marten, black bear, and eastern box turtle nesting, roosting, perching, resting, denning, and foraging habitats on private lands within the MNF. This magnifies the importance of National Forest lands to these species. Timber harvest, fire suppression, and application of pesticides also are activities that might adversely affect wildlife associated with mid- to late-successional forest types on private lands within the MNF in the future. In addition, mineral developments are reasonably certain to occur in the foreseeable future within the MNF and have the potential to cumulatively affect wildlife associated with mature forest habitats.

The amount of mid- to late-successional forest habitat is expected to be reduced under the Forest Plan's new management direction in localized areas (USDA Forest Service 2006b). Management for early successional vegetative types would decrease the amount of mature forest available for the northern goshawk, red-shouldered hawk, bald eagle, American marten, and eastern box turtle, and increase the effects of fragmentation (such as increased competition from red-tailed hawks or predation from raccoons). However, other management directives delineated in the Forest Plan protect mid- to late-seral stages of forest vegetation. Semiprimitive, wild and scenic river designations, rare plant areas, and candidate RNA's would protect hardwood forests, reducing habitat fragmentation, as there would be fewer roads and less vegetation manipulation in these areas, and reducing disturbance from recreational activities.

The old growth designation would provide planned old growth in the northern hardwood and long rotation oak type. In addition, management of the hardwood forest types would continue to provide a

stable to increasing amount of mature habitat for wildlife associated with mid- to late-successional forest types, and would provide adequate amounts of regenerating hardwood types for prey habitat. The amount of pine thinnings, mature oak and aspen forest regeneration, and dead tree salvage treatments is projected to remain at 1979 – 2005 levels. Thus, overall, the Forest Plan's management directives would provide large blocks of maturing habitat spatially interspersed with early successional vegetative types across the MNF (providing habitat for early- and late-successional wildlife species). As a result, the amount of mid- to late-successional forest habitat is expected to remain stable at a broad scale across the MNF. In addition, in the long term, the overall quality of mid- to late-successional forest habitat would increase as stands matured and tree diameters increased, large woody debris and snags increased, and canopy gaps developed.

Implementation of the mitigation measures should protect RFSS species associated with mid- to late-successional forest types and their habitats on Forest Service lands within the MNF from potential impacts. Therefore, the effects of the Mast Lake Project are expected to be local, and would not be expected to affect the viability of the northern goshawk, red-shouldered hawk, bald eagle, American marten, or eastern box turtle within the MNF. Overall, populations of these RFSS are expected to remain stable or increase within the MNF.

(3.8.3c) Lakes and Creeks

Alternative 1 (Direct and Indirect)

Under Alternative 1, habitat improvement projects around existing ponds and wetlands in the Project Area would not occur at this time. Currently, surrounding edge habitat is poor or lacking around lowland openings within the Project Area. Snags, cavity/den trees, and mast-producing and fruit-bearing shrubs/trees also are deficient in these areas. Alternative 1 also would fail to control non-native invasive plant species within lowland openings. Canada thistle, common burdock, St. Johnswort, and spotted knapweed have documented occurrences within lowland openings proposed for treatment. Without control efforts, these non-native invasive species would replace native plants upon which wildlife generally depend for food and cover.

In addition, Alternative 1 would maintain current road densities, and thus human access and use, within the Project Area. These densities are higher than the Forest Plan objective for the relevant Management Areas (USDA Forest Service 2006b). Traffic along these roads might increase the level of disturbance (e.g., human activity, noise, and habitat degradation), and increase the risk of vehicle collisions, illegal collection and poaching, wildfires, dispersed camping, and cross-country travel. Road traffic also might temporarily displace or alter the movement of wildlife, temporarily disrupt the normal behavior of wildlife, lead to an increase in mammalian predators associated with human activities, damage nest sites, hibernacula, and forage plants, and reduce water quality in streams and lakes via increased erosion or sediment delivery. Wildlife species that might experience a decline in habitat quality and quantity due to changes in water quality include waterfowl and shorebirds, such as black-crowned nigh-heron, great blue heron, wood duck, mallards, black duck, and Canada geese, and other water-oriented species including beavers, wood turtle, Blanding's turtle, eastern massasauga rattlesnake, and spotted turtle, as well as fish species. Reductions in water quality and fish and/or waterfowl abundance also might lead to a decline in the quantity and quality of foraging habitat for bald eagles within the Project Area. Overall, Alternative 1 is likely to have adverse effects on RFSS associated with aquatic habitats.

Alternatives 2 and 3 (Direct and Indirect)

Alternatives 2 and 3 might temporarily displace or kill small numbers of Blanding's turtles, wood turtles, spotted turtles, eastern massasauga rattlesnakes, black-crowned night-herons, and other wildlife associated with aquatic habitats if management is implemented near wetlands, ponds, lakes, or streams. Cutting, prescribed burning, seeding/planting, site preparation, road closures and rehabilitation, and

vehicle and foot traffic associated with implementation might temporarily increase the level of disturbance (e.g., human activity, noise, and habitat degradation) near nest, roost, or hibernation sites, potentially resulting in the abandonment and/or removal of such sites. Management activities proposed under Alternatives 2 and 3 also might temporarily disturb Blanding's turtles, wood turtles, spotted turtles, eastern massasauga rattlesnakes, black-crowned night-herons, and other wildlife associated with aquatic habitats searching for sunning, foraging, roosting, nesting, or hibernation sites, limiting the use of potential habitat and potentially affecting productivity. Water-orientated wildlife species that have limited mobility or are breeding would be most likely to be directly affected in these operations due to heavy equipment use and prescribed burning, as described above for management of early successional habitats. Management activities are more likely to have an adverse direct effect on the wood turtle, spotted turtle, Blanding's turtle, eastern massasauga rattlesnake, and black-crowned night-heron if implemented near aquatic habitats between late spring to early fall when these species increase their use of adjacent uplands and forests for foraging, mating, and/or nesting (Lee 1999a, Lee 1999b, Lee 2000, Lee and Legge 2000, Monfils 2004). Between late fall and early spring, direct effects on Blanding's turtle, wood turtle, spotted turtle, and eastern massasauga rattlesnake would be expected to be insignificant as these species spend the majority of their time in aquatic habitats (Lee 1999a, Lee 1999b, Lee 2000, Lee and Legge 2000), which would largely protect them from any direct impacts. Direct effects on black-crowned night-heron also are expected to be minimal during this time period as wintering birds can readily move among roost sites.

Alternatives 2 and 3 propose spot or strip application of glyphosate to control non-native invasive species. Wildlife associated with aquatic habitats might be exposed to these herbicides by direct contact with herbicide spray or with recently treated foliage, by ingesting treated foliage or prey items that have consumed parts of treated plants, or by drinking from (or swimming in) water sources that have received contaminated surface runoff. However, the ecological risk assessment conducted for glyphosate suggests that use at rates commonly used by the Forest Service poses little or no risk to wildlife (USDA Forest Service 2003). In addition, consumption of exposed prey would likely have a minimal effect on these species given that glyphosate is not expected to bioaccumulate in the food chain (USDA Forest Service 2003). Glyphosate is not highly toxic to avian receptors such as black-crowned night-heron and bald eagle, to insect species such as Karner blue butterflies, to reptilian species such as Blanding's turtle or spotted turtle, or to small mammal, amphibian, and fish species (USDA Forest Service 2004). In addition, glyphosate is not a cholinesterase inhibitor (such as organophosphate) or a carbamate insecticide (or chemically related to such insecticides) that are highly toxic to wildlife, especially insects and other invertebrates. Nor is glyphosate chemically related to the chlorinated hydrocarbon insecticides such as DDT that are highly persistent in the environment and known for causing eggshell thinning of raptors (birds of prey) such as bald eagles and ospreys. Herbicide toxicity and risk data (Appendix D) for mammalian, aquatic, avian, and terrestrial wildlife species suggest glyphosate is generally safe to mammals, birds, and other wildlife if used in accordance with the manufacturer label. The Roundup formulation of glyphosate is an exception to this generalization due to the extremely low LC_{50} values for aquatic species (Appendix D). Only formulations labeled for use in aquatic areas would be used within 100 feet of wetlands or riparian areas.

Adverse direct effects on wildlife associated with aquatic habitats are expected to be minimal given that management activities would potentially affect small acreages in localized areas within the Project Area in any given time period. Potential adverse effects would be reduced further with the implementation of the conservation measures outlined in: the Programmatic Biological Evaluation for the Huron-Manistee National Forests for the eastern massasauga rattlesnake, wood turtle, and Blanding's turtle (USDA Forest Service 2005); the Conservation Approach for Eastern Massasauga (*Sistrurus C. Catenatus*) (USDA Forest Service 2002b); the R9 Species Conservation Assessment for Wood Turtle – *Glyptemys insculpta* (USDA Forest Service 2004), and the Conservation Assessment for Blanding's Turtle (*Emydoidea blandingii*) (USDA Forest Service 2002c). These conservation measures would be implemented in areas

where these RFSS are documented or found during project activities. Implementation of the Standards and Guidelines for Watershed Management described in the Forest Plan (USDA Forest Service 2006b: pages II-17 – II-22) also would reduce the potential for adverse direct effects.

For example, the potential for direct effects would be reduced somewhat by the Guideline stating that equipment should not be operated within the Streamside Management Zone when soils are saturated or when rutting is likely to occur (USDA Forest Service 2006b). This would limit activities to periods when the soils in the riparian corridor were frozen, such as winter, which would correspond to the inactive period of reptilian species. In addition, the locations of nests or burrows of rare or sensitive wildlife species, such as the spotted turtle, Blanding's turtle, and black-crowned night-heron, would be flagged or marked, and management activities would be performed carefully to avoid physical injury to nests or burrows and to less mobile wildlife, such as the wood turtle and eastern massasauga rattlesnake. If other sensitive wildlife species associated with aquatic habitats are found during project activities, appropriate protection measures would be implemented to reduce potential adverse direct effects.

Management activities under Alternatives 2 and 3 would likely have a greater effect on local populations of aquatic wildlife species through habitat change. The proposed management activities might damage vegetation and increase the amount of bare ground within treated lowland openings and nearby upland openings, temporarily decreasing cover and the abundance of important forage and prey species, such as herbs, wildflowers, berry producing shrubs, small mammals, and birds. Implementation of Alternatives 2 and 3 also might temporarily reduce water quality via increased erosion or sediment delivery, resulting in a short-term decrease in habitat quality and quantity for water-oriented wildlife species. However, these potential adverse effects are expected to be minimal given that human disturbance and associated reductions in habitat would potentially affect small acreages in localized areas within the Project Area in any given time period, allowing foraging, hibernating, mating, roosting, and nesting potential in those areas that are undisturbed. In addition, effects on water quality are expected to be minimal with the implementation of the Forest Plan Standards and Guidelines for Watershed Management (USDA Forest Service 2006b: II-17-II-22).

Alternatively, the habitat improvements proposed under Alternatives 2 and 3 for lowland openings would enhance edge habitat, add large woody debris to ponds, and increase the abundance and availability of snags, down woody debris, cavity/den trees, mast-producing, fruit-bearing, and/or thermal cover providing shrubs/trees, and duck boxes. Maintenance/expansion of lowland habitats would occur on up to 70 acres under Alternatives 2 and 3. Over time, these activities would increase habitat quality and quantity for Blanding's turtle, wood turtle, spotted turtle, eastern massasauga, black-crowned night-heron, and other wildlife associated with aquatic habitats within the Project Area. For example, placing wood in ponds would increase habitat diversity and cover for fish, invertebrates, reptiles and other components of the aquatic food chain, add nutrients to the aquatic system, and increase resting and basking opportunities for reptiles. Improvements in habitat quality and quantity subsequently might lead to an increase in local populations of waterfowl and shorebirds, such as black-crowned night-heron, great blue heron, wood duck, mallards, black duck, and Canada geese, and other water-oriented species including beavers, wood turtle, Blanding's turtle, eastern massasauga rattlesnake, and spotted turtle, as well as fish species. Improvements in water quality and increases in fish and/or waterfowl abundance also might lead to an increase in the quantity and quality of foraging habitat for bald eagles within the Project Area. In addition, upland opening maintenance/expansion and dry sand prairie restoration would likely have beneficial indirect effects to the foraging, mating, and nesting habitat of Blanding's turtle, wood turtle, spotted turtle, and eastern massasauga rattlesnake in the long-term, as they would increase the quantity and quality of adjacent openlands.

Road closures and rehabilitation activities proposed under Alternatives 2 and 3 would be expected to have beneficial effects to local populations of wildlife associated with aquatic habitats. Road closures

would reduce human access and use within the Project Area in the long term, which would likely decrease the levels of disturbance (e.g., human activity, noise, and habitat degradation), and reduce the effects of fragmentation and erosion/sediment delivery, and the risk of vehicle collisions, visitors directly harming, harassing, or killing wildlife, illegal collection, wildfires, dispersed camping, and cross-country travel. Alternative 2 would provide more protection from human access and use than Alternative 3 given that it proposes an additional 5 miles of road closures. Overall, Alternatives 2 and 3 are expected to have primarily beneficial direct and indirect effects on wildlife associated with aquatic habitats, and any adverse direct and indirect effects are expected to be minimal.

All Alternatives (Cumulative)

Increases in human populations and associated land development, road construction, and recreational uses are expected on private lands within the MNF. These activities would likely increase the potential for human access and use within or adjacent to aquatic habitats used by Blanding's turtles, wood turtles, spotted turtles, eastern massasauga rattlesnakes, black-crowned night-herons, and other wildlife associated with aquatic habitats. Increased human access and use could increase the level of disturbance (e.g., human activity, noise, and habitat degradation), increase the risk of vehicle collisions, illegal collection and poaching, wildfires, dispersed camping, and cross-country-travel, disrupt the movements and normal behavior of individual animals, and/or increase predation by increasing mammalian predator populations that are associated with human activities (e.g., raccoon, opossum, skunks). Development of residences near lakeshores and stream sides could also reduce habitat quantity and quality through actual destruction of nesting sites, roosting sites, hibernacula, cover, and/or important plant species that provide food (e.g., foliage, fruit). Such developments could also increase habitat fragmentation and reduce water quality in streams and lakes via increased soil erosion or sediment delivery. Timber harvest, fire suppression, mowing, off-road vehicle and motorboat use, and application of pesticides are also activities that might adversely affect wildlife associated with aquatic habitats on private lands. In addition, mineral developments are reasonably certain to occur in the foreseeable future within the MNF and have the potential to cumulatively affect wildlife associated with aquatic habitats. Overall, habitat quantity and quality for wildlife associated with aquatic habitats, and subsequent occurrences of these species, would likely decline on private lands within the MNF. With the increasing development and fragmentation of private lands, suitable habitat for wildlife associated with aquatic habitats on federal lands within the MNF is likely to become more important in the future.

Under the direction of the Forest Plan (USDA Forest Service 2006b), management actions to improve watershed condition would continue elsewhere within the MNF, focusing on erosion control, upgrading road stream crossings, lowering road densities, improving in-stream and lake habitat, and maintaining riparian buffer zones. As the forest continues to mature, more large woody debris (LWD) would be input into streams and lakes. LWD can protect stream banks from erosion, provide habitat for aquatic insects, provide cover for fish, and provide habitat diversity. Although management for early successional vegetative types, as directed by the Forest Plan (USDA Forest Service 2006b), would decrease the amount of mature forest and lead to more open space within the watersheds located within the MNF, there should be a minimal effect on runoff and flow regimes because all of the sixth level watersheds will still have more than 33% of their area in a mature forest (>20 year age class) condition. While increases in human populations and associated land uses and development are expected within the MNF in the future, the positive effects of planned watershed management activities on the Forest should mitigate the negative effects of activities on private lands. Overall, there should be an improvement in water quality, aquatic habitat, and watershed health within the watersheds located within the MNF.

(3.3.8d) Determination of Effects for Endangered, Threatened, and Sensitive Species

A Biological Assessment and Biological Evaluation was prepared for the Mast Lake Project (see Project Record) that documented the determinations of effects of Mast Lake Project activities on proposed, endangered, and threatened species and critical habitat, and on Regional Forester Sensitive Species by each alternative. Eighteen wildlife species that may be present or have habitat within the Project Area were analyzed in these documents including: Karner blue butterfly, dusted skipper, Ottoe skipper, hill-prairie spittlebug, Sprague's pygarctic, bald eagle, red-headed woodpecker, black-crowned night-heron, whip-poor-will, northern goshawk, red-shouldered hawk, ruffed grouse, American marten, wood turtle, Blanding's turtle, eastern massasauga rattlesnake, spotted turtle, and eastern box turtle. The determinations are listed below in Table 3-28. The determinations were made contingent on implementation of the conservation measures listed in Section 2.4 in the Biological Assessment and Biological Evaluation. The conservation measures would be implemented with the action alternatives.

Table 3-28: Determination of Effects for Endangered, Threatened, and Sensitive Species that might occur within the Mast Lake Project Area.

Species	Principal Habitat Characteristics	Status	Alternative 1	Alternative 2	Alternative 3
Karner Blue Butterfly (*Lycaeides melissa samuelis*)	Savanna/barrens habitat with heterogeneous light conditions and an abundance of wild lupine and other nectar sources.	E+MIS	No Effect	No Effect	No Effect
Northern Goshawk (*Accipiter gentiles*)	Nest in large tracts of mature pine, hardwood, or mixed forests with an intermediate amount of canopy closure, small forest openings for foraging, and an open understory.	RFSS	MINT	MINT	MINT
Red-shouldered Hawk (*Buteo lineatus*)	Nest in large tracts of mature deciduous or mixed forests with wetland and upland habitats interspersed for foraging, and variable amounts of understory vegetation.	RFSS	MINT	MINT	MINT

Table 3.28 (continued)

Species	Principal Habitat Characteristics	Status	Alternative 1	Alternative 2	Alternative 3
Whip-poor-will (*Caprimulgus vociferous*)	Early to mid successional forests with nearby openings/open woodlands. Breeds in deciduous or mixed woods.	RFSS	MINT	MINT	MINT
Ruffed Grouse (*Bonasa umbellus*)	Aspen and aspen-alder mixes, 5-25 years old provide brood habitat and cover, with older age classes for nesting and winter food sources.	MIS	MINT	MINT	MINT
Black-crowned night-heron (*Gavia immer*)	Nests in shrubs and small trees located on islands, in swamps and wetlands, or on the shores of ponds and lakes.	RFSS	MINT	MINT	MINT
Red-headed Woodpecker (*Melanerpes erythrocephalus*)	Mature open woodlands, open deciduous or mixed forest habitats, or savanna-like forest habitat with nearby openings, snags and mast crop abundance.	RFSS	MINT	MINT	MINT
Bald Eagle (*Haliaeetus leucocephalus)*	Nests in deciduous or coniferous trees, and sometimes cliffs, near rivers, lakes, or marshes where adequate prey is available.	RFSS	MINT	MINT	MINT

Table 3.28 (continued)

Species	Principal Habitat Characteristics	Status	Alternative 1	Alternative 2	Alternative 3
American Marten (*Martes Americana*)	Mature or diverse upland or lowland conifer or mixed forests with 40-60% canopy closure, good understory growth, abundant woody debris, burrows during inactive periods, and openings with cover.	RFSS	MINT	MINT	MINT
Dusted Skipper (*Atrytonopsis hianna*)	Bluestem grasslands or openings, pine or pine-oak barrens, oak savannas, and on rock outcrops.	RFSS	MINT	MINT	MINT
Ottoe Skipper (*Hesperia ottoe*)	Dry sand fields and prairies with abundant nectar sources.	RFSS	MINT	MINT	MINT
Hill-prairie Spittlebug (*Lepyronia gibbosa*)	Openings, oak barrens, prairies, frost pockets.	RFSS	MINT	MINT	MINT
Sprague's Pygarctic (*Pygarctia spraguei*)	Dry prairies, oak savannas, or openings with Euphorbia species (spurge).	RFSS	MINT	MINT	MINT
Spotted Turtle (*Clemmys gutatta*)	Clean, shallow streams, ponds, marshes, and wetlands with soft bottoms and abundant aquatic vegetation. In spring and summer, occupy nearby terrestrial habitats including open fields and woodlands.	RFSS	MINT	MINT	MINT

Table 3.28 (continued)

Species	Principal Habitat Characteristics	Status	Alternative 1	Alternative 2	Alternative 3
Wood Turtle (*Clemmys insculpta (Glyptemys)*)	Streams and adjacent forested riparian and upland floodplain areas with numerous openings and a dense mixture of low herbs and shrubs. In summer may roam widely overland occupying nearby terrestrial habitats including fields, woodlands, and marshes.	RFSS	MINT	MINT	MINT
Blanding's Turtle (*Emydoidea blandingii*)	Lakes, ponds, marshes, and creeks with abundant aquatic vegetation and soft bottoms. In spring and summer, occupies adjacent open, sunny, upland areas with sandy soils.	RFSS	MINT	MINT	MINT
Eastern Massasauga (*Sistrurus catenatus catenatus*)	Winters in a variety of open wetland habitats. Summers in nearby drier upland sites, usually open grass-sedge areas with shrubs.	RFSS	MINT	MINT	MINT
Eastern Box Turtle (*Terrapene carolina carolina*)	Upland forests with sandy soils and openings near a water source, and in adjacent fields, woodlands, and marshes.	RFSS	MINT	MINT	MINT

Table 3.28 (continued)

Status	Determinations
E = federally endangered T = federally threatened MIS = Terrestrial Management Indicator Species RFSS = Regional Forester Sensitive Species	MINT = May impact individuals or sub-populations, but not likely to cause a trend towards federal listing or loss of viability.

(3.9) Soils

(3.9.1) Area of Analysis

Direct and Indirect Effects: Site Specific Areas of Activity
Cumulative Effects: Mast Lake Project Area

(3.9.2) Resource Information and the Existing Condition

Soils within the Project Area can be grouped together through associations. For the areas being proposed for treatment in the Mast Lake Project Area, approximately 86% of the area is in the Plainfield-Grattan-Brems Association. Of these, approximately 41% are in the Sparta Series, 23% are in the Grattan Series, and 18% are in the Plainfield Series. Following is a description of this association, as described by the Newaygo County Soil Survey.

Plainfield-Grattan-Brems Association – *Nearly level to steep, excessively drained and moderately well-drained, sandy soils on outwash plains and moraines.*

This association consists mainly of Plainfield soils on outwash plains and Grattan and Brems soils on outwash plains and moraines. Slope ranges from 0-30 percent. Plainfield soils are nearly level to rolling and are excessively drained. Typically the surface layer is black and about two inches thick. The subsoil is dark brown and strong brown, loose sand about 25 inches thick. The underlying material to a depth of 60 inches is very brown sand. Grattan soils are nearly level to steep and are excessively drained. Typically, the surface layer is black sand about 4 inches thick. The subsurface layer is brown sand about 2 inches thick. The subsoil is about 14 inches of dark brown, loose sand that has a few chunks of brittle material. The underlying material to a depth of 60 inches is strong brown sand. Brems are nearly level and very gently sloping and are moderately well-drained. Typically the surface layer is dark brown sand about 8 inches thick. The subsurface layer is mottled sand about 38 inches thick. The upper part is strong brown and very friable, and the lower part is brownish yellow and loose. The underlying material to a depth of 60 inches is light yellowish brown, mottled, loose sand. Sparta and Coloma are minor soil series in this association. Most areas of this association are used as woodland and wildlife habitat. Because of soil blowing and droughtiness, the major soils are generally unsuited to cropland and poorly suited to pasture. They are fairly well-suited to woodland. Equipment limitations, erosion hazards, and seedling mortality are the major concerns in managing woodland.

Due to the important relationship that is associated with the Sparta Series to the Prairie Restoration activities, the following Series description is included from the Newaygo County Soil Survey:
Sparta Series – The Sparta Series consists of excessively drained, rapidly permeable soils on outwash plains. These soils formed in sandy deposits. Slope ranges from 0-12 percent. The Sparta soils in this county are more acid and have lower base saturation in the A horizon that is definitive for the series. These differences, however, do not affect the use and management of the soils. Typical samples of this Series may be described as such:
A horizon: 0-12 inches; black sand, dark grayish brown dry; moderate fine granular structure; very friable; many fine roots; extremely acid; clear smooth boundary.

Bw1 horizon: 12-20 inches; dark yellowish brown sand; weak fine subangular blocky structure; loose; common fine roots; about 1 percent gravel; very strongly acid; diffuse smooth boundary.
Bw2 horizon: 20-32 inches; yellowish brown sand; single grain; loose; few fine roots; about 1 percent gravel; very strongly acid; clear smooth boundary.
C horizon: 32-60 inches; very pale brown sand; single grain; loose; very strongly acid.

Sparta Series, severely eroded – This Sparta Series consists of excessively drained, rapidly permeable soils on outwash plains. These soils formed in sandy deposits. Slope ranges from 0-12 percent. The Sparta soils in this county are more acid and have lower base saturation in the A horizon that is definitive for the series. These differences, however, do not affect the use and management of the soils. Typical samples of this Series may be described as such:
A horizon: 0-2 inches; very dark brown sand; in many areas it has been completely removed by soil blowing.
Bw1 horizon: 2 -10 inches; yellowish brown loose sand.
C horizon: 10-60 inches; very pale brown fine sand and sand single grain.

(3.9.3) Ecological Landtype Phases (ELTPs)

The Forest Service utilizes Ecological Landtype Phases to describe the basic units of potential natural vegetation. These descriptions summarize landforms, soils, ground flora, and overstory, based on field sampling or observation. The following ELTPs have been identified in stands proposed for treatment in this project (Cleland et al. 1993).

ELTP 10 - Outwash plains with deep, excessively drained sand soils, very little soil horizon development; reference sites support northern pin oak/white oak. Soils have no textural banding and the vegetation is xeric and has low productivity.
Example Soil Name: Plainfield

ELTP 11 – Excessively well-drained sands with thin coarse loamy bands of outwash plains. Reference sites support black, white, and northern pin oaks. Soil development is minimal.
Example Soil Name: Sparta

ELTP 20 – Ice-contact hills and overwashed moraines with sandy soils, some spodic horizon development, possible textural bands or a water table in the substratum; reference sites support mixed oak/red maple. Soils have no textural banding and the vegetation is xeric and has low productivity.
Example Soil Name: Grattan

ELTP 21 - Ice-contact hills and overwashed moraines with sandy soils, some spodic horizon development, possible textural bands or a water table in the substratum; reference sites support mixed oak/red maple. Soils have thin textural banding in the substratum. Bands are usually 1/16 to 3 inches thick, or have a cumulative thickness of 1 to 3 inches, of loamy sand and sandy loam texture.
Example Soil Name: Coloma

ELTP 22 - Ice-contact hills and overwashed moraines with sandy soils, some spodic horizon development, possible textural bands or a water table in the substratum; reference sites support mixed oak/red maple. These are sub-irrigated sites having a water table at depths of 6-15 feet.
Example Soil Name: Grattan

ELTP 24 - Ice-contact hills and overwashed moraines with sandy soils, some spodic horizon development, possible textural bands or a water table in the substratum; reference sites support mixed oak/red maple. These are sub-irrigated sites, having a water table at depths of 3 ½ feet to 6 feet.
Example Soil Name: Covert

ELTP 25 – Well to excessively well-drained sands on outwash moraines, kame terraces, and glacial spillways. Reference sites composed of red, white, and black oaks and red maple. Soil development is medial.
Example Soil Name: Grattan

ELTP 31 - Ice-contact hills and overwashed moraines with sandy surface soils, moderate spodic horizon development, possible thin to thick textural bands or a water table in the substratum; reference sites support red oak/red maple. These soils have thin textural banding in the substratum. Bands are usually 1/16 to 3 inches thick, or have a cumulative thickness of 1 to 3 inches, of loamy sand and sandy loam texture.
Example Soil Name: Grattan

ELTP 35 - Ice-contact hills and overwashed moraines with sandy surface soils, moderate spodic horizon development, possible thin to thick textural bands or a water table in the substratum; reference sites support redoak/red maple. These soils have thick textural bands in the lower part of the solum or upper substratum. Bands are typically at least 6 inches thick, of sandy clay loam or finer texture. Indicator species groups are present.
Example Soil Name: Grattan

ELTP 37 - Ice-contact hills and overwashed moraines with sandy surface soils, moderate spodic horizon development, possible thin to thick textural bands or a water table in the substratum; reference sites support red oak/red maple. Loamy textures throughout the soil profile, or thick textural bands in the upper part of the solum. Bands are usually 6 inches or thicker, of sandy clay loam or finer texture. Indictor species groups are present. Vegetation is the most mesic and of high productivity.
Example Soil Name: Metea

ELTP 62-64 - Somewhat poorly drained area. These are sub-irrigated sites, with a water table at depths of 6-15 feet.
Example Soil Name: Thetford

ELTP 72 - Poorly drained areas. These are sub-irrigated sites, with a water table at depths of 6-15 feet.
Example Soil Name: Kingsville

ELTP 73 - Poorly drained areas. These are soils with medium to thick textural bands deep in the substratum. Bands are usually 3 to 6 inches thick, of sandy loam or sandy clay loam texture. Ground flora is often of sparse coverage.
Example Soil Name: Kingsville

ELTP 74 – Poorly drained areas. These are sub-irrigated sites, with a water table at depths of 3 ½ feet to 6 feet.
Example Soil Name: Glendora

ELTP 82 – Very poorly drained areas. These are sub-irrigated sites having a water table at depths of 6-15 feet.
Example Soil Name: Adrian

The effects on the soils from past management activities are present throughout the Project Area, and vary by location and activity. Generally, the level topography, few riparian areas, and the effects of historic management have dictated where recent management has occurred. In this area, soils that are located on operable sites for timber management have been impacted by clearcutting, fire, plantation establishment, and thinning. Soils in the lowland areas or adjacent to riparian areas have not been actively managed in the recent past and were passively managed, e.g., grazed after clearcut, prior to Forest proclamation. The Project Area has areas currently receiving moderate to heavy impacts on the soil, and others receiving little to no impacts. The past activities that have occurred, in conjunction with the site-specific soil characteristics, have resulted in a diverse cross-section of soil conditions with varying levels of productivity.

For this project, the characteristics of the soils and their capacity to withstand the various proposed activities were evaluated. Consideration was given to several factors: harvest and restoration areas; skid trails, landing locations, and logging roads; equipment limitations; biological considerations; potentials for wildlife habitat and plant habitats; erosion hazards and stabilization considerations; and effects of prescribed fire (Mast Lake Project Record). Soil typing and characteristics were first identified through published maps and then verified on the ground. Known sensitive areas (rating of serious or moderate concern) were dropped from treatment considerations or mitigation measures were established for protection, respectively.

(3.9.4) Alternative 1: The Effects of No Action on the Soil Resources

(3.7.4a) Direct and Indirect Effects

There would be no new management activities occurring under this alternative. Therefore, no management-related changes in the productivity of the land would occur. Natural processes and functions would continue to occur as organic matter accumulates within the upper soil profile and dead materials undergo decomposition. Soil organic matter would increase with accompanying changes in microorganisms and fungi population and activity. This would occur as the forested stands mature, and no events occur that export or reduce litter and biomass. This alternative would result in the highest above and below ground biomass levels (Pritchett and Fisher, 1987). With no vegetative management treatments, no carbon would be removed from the forest. Dead and dying trees would decay with carbon released to the atmosphere or accumulate in the soil profile. Soil compaction would continue to recover from past management activities that have occurred in this area as biomass accumulates and the soil microorganisms reduce the bulk density of affected areas. Locations identified as ELTP's 20 – 37 and 63 - 82 were moderately impacted by past management practices, accompanied by a loss of soil productivity due to diminished water-holding capacities and reductions in organic matter. Eventually, these locations would attain pre-management soil densities, except in locally severely eroded spots. Locations identified as ELTP 10 had greater reductions in soil productivity, principally caused by reductions in organic matter; these areas would take longer periods of time to attain pre-disturbance soil productivity levels. The Sparta loamy sand (eroded phase) was heavily impacted by wind erosion in the past, and would not recover its original productivity potential. Elsewhere, the effects of compaction and erosion, especially from road construction and ORV use, would be present for longer periods of time. Soil erosion would continue at locations where slopes exceed 2% and the ground vegetation is sparse to non-existent. There would be no prescribed burning or treatment of NNIS under this alternative.

Under this alternative, the soil resources in this area would be affected by vehicle-related compaction, erosion, and soil displacement. Once started, natural processes (precipitation and wind) would

exacerbate these effects. The current transportation system would be affected by the Forests' Motor Use Vehicle Rule (USDA Forest Service, 2005), and decrease use and negative impacts within the Project Area on National Forest System land; however, the number of roads and use would likely continue to expand on private lands. Existing classified Forest Service roads would remain open for public motor-vehicle use, and unclassified Forest roads would be closed to vehicle use when the Forest's Motor Vehicle Use Map is published in 2009. Effects of this road network would vary by location, site-specific soil characteristics, and local topography. Along open roads, the bulk density of the soils would increase due to increased compaction. The compaction would expand in some areas due to the development of by-pass roads to avoid wet pockets in the roadbed and the expansion of unclassified roads off of the existing road system. Isolated areas would be susceptible to increased erosion caused by vegetation removal, slope and textural factors, and the transporting effects of tire tread on the upper layers of the soil profiles. The productivity of the established roadbeds would continue to decline, as these areas are typically void of vegetation and kept clear of decaying organic matter.

Sand and gravel pits, of various sizes, have been developed in the Project Area, and commercial extraction occurs on private lands. Except for the direct impacts to the area of extraction, these uses do not appreciably diminish the soil productivity of adjacent lands. Sand and gravel extraction, including rehabilitation of the site, are regulated by the State of Michigan (Michigan Public Act 451 1994) and local ordinances.

Under Alternative 1, it would be likely that the dumping of trash within the Project Area would continue, especially at existing locations that serve as indicators to the public that this behavior would be unlikely to be detected in a given geographical area. These dumps serve as point-sources of pollution which often contain liquid and solid waste forms in various levels of decomposition. Depending on the contents, the continued presence and possible expansion of these sites would negatively affect site-specific soil fauna.

Under this alternative, erosion would continue to increase in some areas, and decrease in others as use patterns shift, accompanied by the impacts caused by vegetation removal and soil displacement. These same erosive effects would continue to occur at the ORV "scramble" areas under this alternative. Without barrier construction and rehabilitation, these areas typically expand as one area after another becomes more attractive to illegal off-road use.

(3.9.4b) Cumulative Effects

The soil resources in the Project Area were impacted in the late 1800s and early 1900s through logging practices, the conversion of portions of this area to agriculture and rangelands, periodic fire events, and moderate to severe wind erosion. Reforestation efforts, including tree planting furrows and mechanical harvesting operations, also impacted the soils in the Project Area from 1935 to 1990. Since the early 1930s, soil productivity has generally been stabilized or improved. In general, soil organic matter has been increasing within the Project Area since the permanent vegetative cover was established. Based on the site-specific soil characteristics, the nutrients supplied by decaying organic matter is either available to the vegetation or are leached to deeper soil layers. The overall effects of the activities that have occurred throughout the Project Area have generally increased the levels of nutrients available for plant use and storage as compared to the 1930s, but reduced levels occur on intensively managed areas, compared to native soil. ELTP 10 (especially the areas of eroded Sparta sand) has the greatest amount of impaired soil productivity.

Sparta sand soils are frequently encountered in Big Prairie Township, and have a unique history which has decreased their productivity. Easily converted to agriculture, these areas were quickly depleted of natural productivity, soil structure, and native vegetation, and became severely wind eroded; in some locations, 1-5 feet of soil has been removed. Conifer plantations were established in many locations, and the remaining prairies were converted to native forests or pasture land.

Under this alternative, live vegetation on National Forest System lands within the Project Area would be retained; however, dead and down timber could be removed for use as firewood. As individual groups of trees, shrubs, and herbaceous species complete their life cycles, general levels of biomass and soil organic matter accumulation would exceed removals. This would result in an increase in soil productivity. Timber harvesting activities would likely occur on private property within or adjacent to the Project Area into the future. This activity would have minimal impacts to the productivity of National Forest System lands. The short-term loss of litter fall from forested areas onto adjacent land would have minor effects to sustaining site-productivity if these private lands remained in a forested, or partially forested, condition.

Currently, eroding and compacted soils are coincident with public and private roads and areas where intensive vegetation activities occurred in the recent past. The effects related to these activities are most severe on the soils receiving concentrated equipment use, such as skid trails and landing sites, and non-vegetated lands. Soil compaction, rutting, puddling, and erosion would continue to occur on areas within the Project Area that would be left open to motor vehicle use. The soils that are impacted by non-developmental uses, including timber harvesting, agricultural uses, mechanical tree planting, fire, log landings, and skid trails would slowly recover through natural processes as long as there is vegetation cover, and organic matter removal does not exceed its accumulation. This natural rehabilitation assumes that soil damage resulting from past management activities has not surpassed the physical thresholds of the soil systems and that partial or complete vegetative cover was maintained. The most severely affected locations, eroded Sparta sand areas, permanent roads, and ORV use areas, would continue to be adversely effected into the future unless maintained within designed standards, relocated or eliminated. Soils impacted by commercial sand and gravel mining are eventually stabilized and converted to other land uses.

Conclusion: The duration and magnitude of Alternative 1 would not incrementally add to past, present, and reasonably foreseeable changes to soil productivity within the Mast Lake Project area.

(3.9.5) Alternative 2: The Effects of the Proposed Actions on the Soil Resources

(3.9.5a) Direct and Indirect Effects

Stone (1999, 2000) has documented soil compaction and loss of site productivity effects for similar harvest sites on the Huron National Forest. Fleming et al. (2006) found that soil organic matter removal or relocation decreased the volume of aspen regeneration. Contrarily, increased compaction levels increased this volume. Given these findings, under Alternative 2, the effects on the Project Area's soil resources would be local in scale and minor in severity. Skid trails and low standard roads occupy less than 2% of the National Forest System lands in the Project Area. The sandy soils and relatively flat terrain where thinning, shelterwood, and clearcut harvests are proposed would minimize the potential for erosion caused by equipment use. Soil compaction and organic matter removal would occur on collector skid trails (more passes than are typically associated with only tree felling and loading) and landing sites, but would not be detrimental to soil productivity if a small percentage of the area (i.e. <5%) received these impacts. By retaining the majority of woody material <4" in diameter from harvested trees within clearcutting units (and a lesser amount of this material in shelterwood units, thinning units, and sites with ELTPs 10, 20, and 21), short-term adverse effects on soil productivity could occur. Retaining woody material would reduce the negative effects of soil compaction, replenish the above and below-ground organic matter, and provide a substrate for fungi, bacteria, and other micro-organisms in the soil. Harvesting during periods of frozen soil, non-saturated soil conditions, and plant dormancy would sustain site productivity (Hallett and Hornbeck 2000). Nutrient cycling processes and organic matter decomposers would mitigate the presence of these small diameter woody debris as a hazardous fuel within 5 years of the harvest.

Individual timbered stands would experience an immediate export of site nutrients through the removal of trees. This would vary in intensity based on the type of harvest (clearcutting vs thinning). This loss of nutrients is a function of the source/sink relationship between soil nutrients and vegetation growth. Nutrients being stored and utilized by the trees at the time of harvest would be lost from the system. In clearcut and overstory removal harvests, this loss would be greater than in the proposed thinnings; however, vegetation re-growth at clearcut sites would occur more rapidly, protecting the ability of the soil to cycle nutrients available via leaf litter. Regeneration would be expected to occur the first year after harvest. This, coupled with the extensive root systems left from the previous stand, would reduce the susceptibility of a site to lose nutrients due to leaching and the erosive properties of wind and water (Lederle and Mroz 1991). As the tree root systems decay, water infiltration would increase due to channeling. This would provide increased nutrient and microorganism mobility. The effects related to this would work to reverse the effects of compaction present as a result of the harvesting activities. In thinning harvests, fewer nutrients would be exported from the system and replacement would occur more slowly through the additive processes of understory vegetation and residual tree canopy expansion. In addition, areas thinned would have a smaller area affected by the compaction and ground disturbance because of the type of harvesting equipment (Gingras 1994) (Lanford and Stokes 1995). The natural rehabilitative processes that would be present in clearcut stands related to compaction and the infiltration of water would also occur in the stands proposed for thinning, though to a lesser degree.

Commercial treatments would comply with the State of Michigan Best Management Practices (BMP's) for harvesting (Michigan Department of Natural Resources 1994), and (USDA-Forest Service Eastern Region Handbook 2509.18, Chapter 2). Specific parts of this FSH would be used to monitor the effects of soil compaction and organic removal in the Project Area.

Dry sand prairie restoration treatments would severely displace and reduce the organic matter levels by removing all trees, uprooting considerable numbers of stumps, and using prescribed fire to reduce the existing conifer litter. Low to moderately severe prescribed fires would reduce the organic matter and increase, for a short while, the nutrient availability. This is especially important for nitrogen, some of which volatilizes, and like other nutrients, is converted to chemical forms readily available for plant use. Prescribed fire would also increase soil pH for a short time as alkaline cations are released from burned organic matter, further stimulating plant growth (Certini 2005). The microbial community biomass would be decreased by prescribed fire, especially that of fungi and soil dwelling invertebrates. These effects would be of a short duration if plants quickly are re-established and if prescribed burns occur when moisture levels simultaneously prevent total consumption of organic matter and limit the transmission of extreme temperature into the soil profile. Soil fertility for herbaceous species would be amended by lime application if the pH is less than 5.5 after the initial prescribed fire. Mechanical equipment would be used to seed and prepare the seedbed for grasses and forbs where stumps are removed, which would reduce soil bulk density over approximately 10% of each restoration unit. Soil bulk density where stumps are removed would be partially restored by the weight of mechanical equipment and by using compacting equipment to increase seed contact with the soil. A short-term net loss of soil productivity would accompany these treatments, primarily through leaching, until the root mass of the grassland species fully occupies the upper soil profile (Miller and Donahue 1990). Byre and Kucharik (2003) found that the carbon to nitrogen ratio in the top 25 cm was not significantly related to ecosystem age. This was found in the restored prairies in Wisconsin after 24 years in coarse textured soils, and suggested that the rate of carbon accumulation over this period of time reaches an equilibrium following restoration from agricultural use. As the mollic soil horizon becomes renewed, soil productivity would begin to be restored, but approximating natural soil organic carbon levels in disturbed soils may take a century (Potter et al. 1999).

Due to the chemical binding properties of non-persistent herbicides to the soil and the small area to be treated within the Project Area, the mobility of any herbicide would vary with soil texture and organic matter content. Application of non-persistent herbicides would be performed by a State of Michigan licensed herbicide applicator, with adherence to all label restrictions and procedures. Glyphosate is the herbicide proposed for use under this alternative. The following tables display the use of this herbicide, relative to the soil resources.

Table 3.29: Characteristics of Glyphosate

Mobility and Persistence of Glyphosate in the Soil	Mechanisms of Degradation	Half-life in the Soil	Mobility
	Degradation is primarily due to soil microbes (1).	Average of 47 days (1).	Glyphosate has an extremely high ability to bind to soil particles, preventing it from being mobile in the environment (1).

(1)Tu et al., 2001b

Mechanical treatment (i.e. removal by hand) of invasive plant species would also occur under this alternative. This method of control would cause site-specific soil displacement. Due to the size of the plants being treated, this would cause minimal disturbance related to soil bound to the roots of these plants. Displaced soils would be returned to disturbed areas so as to approximate the native soil profile arrangement.

Alternative 2 would contain the maximum amount of road closures and the lowest overall road density among the three alternatives. These road closures would gradually allow for an increase of soil productivity in areas having slight to moderate compaction effects by facilitating re-vegetation of the roadbed. Soil bulk density on closed transportation system segments would slowly recover, though perhaps taking decades. The time to restore the soils within the normal range would depend on the existing compaction levels, soil physical properties (including the organic matter content), and the type of vegetation re-occupying the site (Greacen and Sands 1980). Effective motor vehicle closures on segments with minor erosion sites, gullies, and puddling would not be expanded from the current level of damage, and not significantly affect soil productivity. Severely damaged areas would not recover within the range of normal soil parameters unless activities to correct site-specific problems (e.g. topsoil replacement) were undertaken.

Road construction and reconstruction activities would include shaping, filling, or realigning road entrances to improve access to the treatment units. Temporary road construction and road reconstruction activities would disturb the soil because vegetation would be cleared from the surface and the soil would be shaped to reduce soil movement and erosion, and to support heavy equipment. Use of previously closed roads and landing construction activities would also disturb, move, and compact soil. Temporary road construction sites, skid trails, and landings would be located to minimize adverse soil and water impacts.

Under this alternative, the ORV areas would be rehabilitated. The soil currently affected by this would be stabilized, erosion in these areas would decrease, and productivity would slowly improve.

Trash within the Project Area would be cleaned up, and reduce dump sites as point sources of soil pollution; the reduced number of roads on National Forest System lands would also reduce the

opportunity to dispose of wastes. This would also have beneficial effects on site-specific populations of soil fauna.

(3.9.5b) Cumulative Effects

Under Alternative 2, the effects of past actions are identical to the No Action Alternative.

Live vegetation on National Forest System lands within the Project Area would be treated with a variety of management activities; dead and down timber could also be removed for use as firewood. As individual groups of trees, shrubs, and herbaceous species are felled or otherwise complete their life cycles, general levels of biomass and soil organic matter accumulation would exceed removals. Soil productivity would increase in areas not harvested, and would not be impaired where stem wood and a portion of branch wood and leafy materials are retained on site in commercially clearcut units, unless future rotation ages are shortened. Soils growing longer rotation cover types would not suffer impaired productivity through periodic thinnings.

The existing vegetation has greatly reduced soil erosion on Sparta sand soils in the past 70 years, primarily because of the wind protection afforded by litter and fine tree roots that protect the topsoil layer. However, conifer management on these soils is limited because of low tree productivity, organic matter removal from thinning and regeneration treatment, and the potential for soil displacement by mechanical equipment. Restoring native prairie vegetation (and the associated mycorrhizae) would potentially sequester greater amounts of nitrogen and atmospheric carbon in these soils. This would have the potential to restore and sustain the soil structure more rapidly (e.g., mollic horizon and crumbly structure) than if conifers were to remain as the dominant species (Brady and Weil 2002). A chance for wind erosion to further reduce soil productivity would occur as larger areas are treated, and as longer periods are required to fully stabilize the exposed soil surface. This would be most pronounced on the eroded Sparta sand soils. Thinning and regenerating forested stands on Sparta soils do not pose the same level of wind erosion risk. Where mature forest cover remains, and where young forest cover is quickly reestablished, blowing soils are not a threat to further reduce soil productivity. Periodic prescribed fires would favor herbaceous vegetation once it becomes established in restored prairies and greatly reduce the impacts of soil disturbance and organic matter removal associated with periodic plantation management.

Harvesting on private land within the Project Area would potentially have very small impacts to the productivity of National Forest System lands. The short-term loss of litter fall from forested areas onto adjacent lands would be insignificant to sustaining site productivity if these private lands remained in a forested, or partially forested condition

Currently, areas of eroding and compacted soils in the Project Area occur on public and private road locations and timber harvest areas (especially skid trails and landings that have received concentrated equipment use). Soil compaction, rutting, puddling, and erosion would continue to occur on those areas throughout the Project Area subject to vehicle uses. The affected soils resulting from harvesting, mechanical planting, fire, landings and skid trails would slowly recover through natural processes if critical physical thresholds were not exceeded in the past or potential harvests, and vegetation cover maintained. The most severely affected locations (permanent roads and legal and illegal motorized vehicle use areas) would continue to be adversely effected unless maintained within design standards, relocated, or eliminated.

It is likely that other private and public activities would occur in the future that could affect soil resources. The Project Area has a mixed ownership of National Forest and private lands, resulting in a semi-permanent combination of residential, agricultural, recreational, and woodland uses over the past 60 years (Rhemtulla et al. 2007). Current activities have detrimental effects that are local in scale and

minor in extent on the soil resources. Management activities on National Forest System land would likely have minor effects on the soil resources on private land, but would be beneficial where vehicle traffic is reduced from trespassing onto private from public lands. With the anticipated private land fragmentation and increase in public use, it is likely that the use of the Forest by the public for recreation and commodity production would increase. Through the management of the transportation system under this alternative, traffic related to this use would be channeled to the portion of this system that is left open to motor vehicles. This reduction in road densities would cause an overall decrease in area affected by soil compaction. This would result in increased water infiltration, nutrient cycling, and site productivity in the areas that have limited or restricted motor vehicle access.

Some of the private landowners within the Project Area currently manage their property for timber resources. Depending on the amount of acreage being managed and the management objectives, soils in these areas would be impacted to a greater degree than on other private parcels not being managed for timber. These effects would depend on the method of harvests, the site-specific soil characteristics, and the owner's objectives. This use is likely to stay the same or decrease over time due to the anticipated increase in private land fragmentation. In addition, some private land within the Project Area is being utilized for agriculture, including pasture, row cropping, and Christmas trees. The impacts to soils as a result of this use would depend on the cultural practices of the producer (tillage, crop rotations, etc.) and the soil characteristics. With mechanized equipment use, agricultural lands may experience reduced soil productivity, increased compaction, and decreased water infiltration compared to idle lands. This use is likely to stay the same or decrease over time due to the anticipated increase in fragmentation of private land. It is also evident that some of the private property within the Project Area contains intricate road networks; these roads vary in length, use, and type. Regardless, these corridors generally contain more compacted, less productive soils, than lesser developed areas. The presence of these roads is likely to remain the same or increase over time due to the anticipated increased use of ORVs for recreation.

Conclusion: The duration and magnitude of Alternative 2 would incrementally add to past, present, and reasonably foreseeable changes to soil productivity within the Mast Lake Project Area.

(3.9.6) Alternative 3: The Effects of the Proposed Actions on the Soil Resources

(3.9.6a) Direct and Indirect Effects

Under Alternative 3, the direct and indirect effects on the soil resources would be similar to that of Alternative 2 for the portions of the Project Area proposed for vegetative treatments, except that the scale of soil disturbance and compaction associated with red pine thinning and regeneration are about 30% more. However, the intensity of disturbance would be considerably less, as two of the existing plantations would not be restored to dry grassland habitat. As discussed in this section for Alternative 2, soil productivity will be maintained or enhanced in the short term by maintaining mature, or quickly obtaining young forest cover. The decline in short term soil productivity associated with plantation removal and the suite of treatments to establish grass and forb cover is greatly reduced, and the potential for success is enhanced, by restoring a total of approximately 50% fewer acres under Alternative 3. This value includes both the restoration of dry sand prairie on both forested and non-forested stands. In addition, the proposed locations for the restoration are on non-eroded Sparta sand soils. This further reduces the risk of wind erosion degrading soil productivity.

Under this alternative, there would be a final road density of 4.1 miles of road/square mile on National Forest System lands. This compares with 3.3 miles in Alternative 2 and 6.1 miles in Alternative 1. There are currently approximately 38.2 miles of road throughout the Project Area. Alternative 2 would leave approximately 20.4 miles left open, while this alternative would leave 25.4 miles open for motor vehicle use. The effects on the soil resources related to road closures would be similar to that described in Alternative 2, though less area is affected by these closures. Using an average of 10' for the width of roads,

these effects would occur on approximately 6.0 more acres in Alternative 3 than in Alternative 2. On the approximately 5.0 more miles of road left open under this alternative, there would be increased opportunities for motor vehicles to create additional unauthorized roads. The creation of which, serve to expand the areas affected by compaction, rutting, and erosion. The extent of these effects varies with the site-specific soil characteristics. Under this alternative there would be similar effects to Alternative 2 relating to road construction and reconstruction activities, including shaping, filling, or realigning road entrances to improve access to the treatment units.

Under this alternative, the areas damaged by ORVs would be rehabilitated. The soil currently affected by this would be stabilized and seeded, and soil productivity would slowly improve.

The effects relating to the trash dumps would be similar to those of Alternative 2.

(3.9.6b) Cumulative Effects

Under this alternative, the cumulative effects to the Project Area are similar to those of Alternative 2, with the following exceptions:
1) The rate of organic matter accumulation in the soils of the thinned plantations, and the stands remaining in red pine, would be affected into the future by periodic stem wood removals; and
2) For the stands that are dropped from consideration for restoration, conifer litter fall would continue to be added to the topsoil and the root systems of the remaining trees would continue to serve in holding the soil in place. As a result, the risk of additional soil loss in these plantations due to wind erosion would not occur. These differences would combine to build a spodic, rather than a mollic, horizon in these Sparta sand soils.

Conclusion: The duration and magnitude of Alternative 3 would incrementally add to past, present, and reasonably foreseeable changes to soil productivity within the Mast Lake Project Area.

(3.8) Air

(3.8.1) Area of Analysis

The analysis area for the direct and indirect effects of the treatments on air quality includes Big Prairie and Goodwell Townships, Newaygo County; Aetna and Mecosta Townships, Mecosta County; and Reynolds Township, Montcalm County. Prescribed burn treatments would likely occur when surface and transport winds have a westerly component and would therefore impact those areas northeast, east, and southeast of the prescribed burn locations in Big Prairie Township. The smoke generated by prescribed burns would directly impact areas immediately adjacent to treatment locations; those townships that are downwind of the transport wind direction would be indirectly affected (dispersal zones) by particulates and gases that drift away from the treatment locations.

The analysis area for cumulative effects is the northern lower peninsula of Michigan; this large area is appropriate because air quality is affected by long range atmospheric transport and other factors beyond the control of the Forest Service.

(3.8.2) Existing Condition and Resource-Specific Information

The entire State of Michigan is currently in attainment for emissions of carbon monoxide, nitrogen dioxide, sulfur dioxide, ozone, lead, and particulate matter into the airshed (Michigan Department of Environmental Quality (MDEQ) 2008). The primary source of these air pollutants are manufacturing, coal combustion, waste incineration, dust, and vehicle emissions, the majority of which are transported from distant point and non-point sources to the Project Area (MDEQ 2008). Mercury deposition remains a problem in the Project Area, but is not a result of Forest Service activities. Particulate matter less than

10 microns (PM_{10}) and less than 2.5 microns ($PM_{2.5}$) is generated by open combustion of forest vegetation, i.e., wildfires and prescribed fires.

(3.8.3) Alternative 1: The Effects of No Action on Air Quality

(3.8.3a) Direct, Indirect, and Cumulative Effects

There would be no new management activities occurring under this alternative, therefore, there would be no direct or indirect effects to the project area or local airshed.

If a high-intensity wildfire were to occur in the Project Area, the effects on the airshed would be extensive, but of relatively short duration. There would likely be a large input of smoke to the airshed resulting in an extensive increase in the negative impacts from large amounts of smoke that contain PM_{10} and $PM_{2.5.}$ These particulates cause and/or exacerbate negative health effects for those people located downwind from the fire, cause smoke on roadways, and trigger odors throughout the downwind area. While these impacts have the potential to affect areas many times larger than the area treated with prescribed fire, the longevity of the impacts would be of fairly short duration, and can be mitigated by reducing or eliminating exposure to the smoke.

Conclusion: The duration and magnitude of Alternative 1 would not incrementally add to past, present, and reasonably foreseeable smoke and particulates generated within the Project Area and northern lower Michigan.

(3.8.4) Alternative 2 and 3: The Effects of the Proposed Actions on Air Quality

(3.8.4a) Direct, Indirect, and Cumulative Effects

Air quality within the Project Area would be affected by vehicle emissions and dust generated by timber harvesting equipment and heavy trucks, and by particulate matter generated by prescribed fires. Carbon monoxide, nitrogen dioxide, sulfur dioxide, ozone, lead, and additional particulate matter would continue to be generated within, or transported into, the immediate environment. The sources are mainly fossil fuel power plants and vehicles from metropolitan areas upwind of the Project Area.

The prescribed burning activities would cause localized impacts to air quality for short time periods. The greatest amount of smoke generated typically would occur for 1 – 2 hours at each location burned. Prescribed burns of this nature are typically carried out in the spring and fall seasons, and are less than 12 hours from time of ignition to time of extinguishment, or when combustion ceases. For the prescribed burns relating to the conversion of existing pine plantations to dry sand prairies, the initial burns would be of light to medium intensity (e.g. 90 – 415 Btu/ft^2) and would consume the 1 and 10 hour time lag fuels (less than 1" in diameter). The subsequent burns would consume 1 hour time lag fuels (less than 0.25" diameter and live fuels), the grasses, forbs and small woody stems which become established after the first burn. The timing of prescribed burning activities in the selected areas would be based on local climate and fuel moisture levels. During the time of the burning activities, smoke and particulate matter would be introduced into the local airshed. The amount and duration would be dependent on the scale and intensity of the prescribed burning activities; however, tests indicate that, on average, 90% of smoke particulates generated by wildfires and prescribed fires are PM_{10} and 70% are $PM_{2.5.}$ (EPA 1998). Persons located downwind from these activities, and personnel conducting and controlling the prescribed fire, would be affected by these particulates. The activities proposed would likely occur through a series of independent prescribed burns occurring over a period of several years.

Conclusion: The duration and magnitude of Alternatives 2 and 3 would incrementally add to past, present, and reasonably foreseeable smoke and particulates generated within the Project Area and northern Lower Michigan.

(3.9) Heritage Resources

(3.9.1) Area of Analysis

Direct and Indirect Effects: Project Area
Cumulative Effects: Management Areas 4.2 and 4.4

(3.9.2) Existing Condition and Resource-Specific Information

There are 7 historic sites located within the Area of Potential Effect. The historic sites include one lumber camp, 3 homesteads, 1 farmstead, 1 historic depression, and 1 dump. No sites are listed on the National Register of Historic Places. National Register of Historic Properties eligibility determination for six of the existing sites remains unevaluated, while the dump site is Unknown (probably Not Eligible). Shovel testing is required in 1 location within the Project Area. These locations will be administered as Cultural Resource Reserve Areas until shovel- testing is authorized and funded.

In addition, there are eighteen historic cultural resource sites located within one mile of the Area of Undertaking. Of these sites, there are seven schools, three homesteads, two farmsteads, three town sites (probable same site), one cemetery, one ranger station, and one dump. Seventeen of the sites are listed as unevaluated for the National Register of Historic Places, while CRI#09040400316 is listed as not eligible to the National Register of Historic Places.

Heritage resource personnel surveyed the project area for heritage resources. The project design avoids all heritage resources, and provisions have been made for monitoring and for discovery of unanticipated resources. Based on avoidance and monitoring, the State Historic Preservation Officer has concurred with a determination of *No Effect* (36 CFR Part 800.16) for this project.

(3.9.3) Alternatives 1, 2, and 3: The Effects of the Proposed Actions on the Heritage Resources

(3.9.3a) Direct and Indirect Effects

Proposed vegetative management activities (timber cutting, prairie restoration, NNIS, and wildlife habitat improvement activities): Direct effects to known cultural resources include increased visibility and access to these sites, accidental damage and soil erosion. Indirect effects to known cultural resources consist of greater exposure to both intentional and unintentional vandalism. Indirect effects to unknown cultural resources could include increased site visibility or increased soil erosion which could cause permanent loss of archaeological information and could affect eligibility determinations for the National Register of Historic Places.

Proposed management of the transportation system: Direct effects to known cultural resources include increased visibility and access to these sites, accidental damage and soil erosion. Indirect effects to known cultural resources consist of greater exposure to both intentional and unintentional vandalism. Indirect effects to unknown cultural resources could include increased site visibility or increased soil erosion which could cause permanent loss of archaeological information and could affect eligibility determinations for the National Register of Historic Places.

Proposed management of the recreation sites (trash removal, ORV rehab): No negative effects from the management of recreation sites.

(3.9.3b) Cumulative Effects

There will be no cumulative effects on heritage resources as a result of any analyzed alternative. Alternative 1 consists of the No Action alternative, which maintains the current state of the archeological sites and will not alter the information potential of the sites. While other activities may impact archeological sites, these are not cumulative impacts (40 CFR 1508.7).

(3.10) Environmental Justice

(3.10.1) Area of Analysis

Direct and Indirect Effects: County
Cumulative Effects: State

(3.10.2) Existing Condition and Resource-Specific Information

Forest Service activities must be conducted in a discrimination-free atmosphere. Contract work that may be generated from this project would include specific clauses offering civil rights protection. The Forest Service would make a concerted effort to enforce these policies. Environmental justice is 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. 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. Environmental justice is also the identification of projects that are located near minority and low-income communities that have an adverse environmental impact. The purpose of the evaluation is to determine if a disproportional number of projects that have adverse environmental effects are located near minority and low-income communities.

According to the U. S. Census Bureau, approximately 13.1% of individuals in Newaygo County are below the poverty levels. The estimate for individuals in State of Michigan living below the poverty levels is 12.5%. Approximately 3.5% of Newaygo County's population is non-Caucasian. The estimate for the State of Michigan's population is 18.8%. This information indicates that Newaygo County does not qualify as an environmental justice community. None of the alternatives are expected to disproportionately impact human populations. There are no human health or safety factors associated with the alternatives that would affect low-income or minority populations in or around the Project Area.

(3.10.3) Effects Common to All Alternatives

No alternatives are expected to affect the civil rights of any landowners, or other individuals, near the Project Area. Any contracts would be issued in accordance with USDA regulations. There would be no discrimination based on race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, and marital or family status. The laws, rules, and regulations governing nondiscrimination conduct in government employment would be adhered to.

The demographic information indicates none of the alternatives would affect environmental justice within Newaygo County.

(3.11) Economics

(3.11.1) Area of Analysis

The area of analysis for the direct and indirect effects on the economy is the National Forest System lands where treatments would occur, and the adjacent National Forest and private lands within 50 miles of treatment sites. This represents a typical commuting distance for employees and a reasonable customer-base radius for business owners located within the Project Area. The area of analysis for the cumulative effects on the economy is northern Lower Michigan. This large area represents the distribution area for the processing of forest products and also corresponds to the range of those utilizing the Forest for recreational opportunities.

(3.12.1) Existing Condition and Resource-Specific Information

Traditionally, the timber and recreation resources on the Manistee National Forest contribute to the economic well-being of the communities in northwest Michigan. For example, timber harvesting and other associated projects on the National Forest affect the local economy by supplying timber to local mills, providing employment to local contractors to harvest the timber, and employing other contractors to complete reforestation, road work, and wildlife related work. Counties within the National Forests are eligible for revenue sharing from gross National Forest receipts (25% Fund or Secure Rural Schools and Community Self-Determination Act of 2000) and Payment in Lieu of Taxes (PILT); Newaygo County shares National Forest receipts under the 25% Fund and PILT methods. In addition, the public land base in these counties also generates numerous service-related employment and income opportunities associated with seasonal resident and tourism spending.

(3.12.2) Alternative 1: The Effects on the Economy

(3.12.2a) Direct and Indirect Effects

Taking no action would not generate revenues for the U.S. Treasury from the sale of timber; therefore, incremental revenue sharing associated with this Project would not occur. Employment opportunities arising from vegetation treatments and restorative habitat improvement projects would not occur within the Project Area. There would be no National Forest project costs under this alternative, other than administrative costs associated with preparation of the environmental analysis for this proposed project. Short-term recreation opportunities in the Project Area would not change and would remain focused on those activities occurring in undeveloped Recreation Opportunity Spectrum classes. In the long-term, recreation use by hunters could decline as the acres of early successional habitat declines.

(3.12.2a) Cumulative Effects

Taking no action within the Project Area would generate no incremental employment or income beyond that associated with the general economic conditions within the analysis area. If no vegetation treatments occurred in the Project Area, the income and employment effects of these actions would be shifted to other portions of the analysis area. Incremental payments from the 25% Fund/PILT could shift to other eligible counties. The maturing aspen forests and encroaching of trees in upland openings would result in decreased numbers of game animals via the loss of early successional habitats, resulting in a decline of revenues from sport hunters in the Project Area in the long-term. However, the public land base and private lands would supply a continuous opportunity to harvest wood products elsewhere in the analysis area. The demand for public recreation and the needs of the increasing local population for goods and services, in the context of general economic conditions, would continue to be the driving force behind employment and income within the Project Area.

Conclusion: The duration and magnitude of taking no action would not incrementally add to past, present and reasonably foreseeable economic forces and events within the Manistee National Forest, primarily because the Forest contributes less than 2% of the employment and income effect to the local economy. The general economic climate in the next decade would be expected to dominate the effects of timber harvesting-induced employment and income.

(3.12.3) Alternatives 2 and 3: The Effects of the Proposed Actions on Economics

(3.12.3a) Direct and Indirect Effects

Table 3.30 displays costs and revenues for Alternatives 2 and 3 for the primary activities and required payments of the Project.

Table 3.30: Estimated Revenues and Costs for Harvest Activities

Activity	Alternative 2	Alternative 3
Acres Harvested		
Red Pine	289	375
Aspen	116	116
Jack Pine	40	40
Prairie Restoration	177	85
Wildlife Habitat Improvements	159	165
Sale of Stumpage Revenue	**$450,250**	**$343,750**
Timber Sale Preparation Costs	61,750	67,750
Estimated Forest Road Construction Costs	10,000	10,000
KV Collections		
Required Reforestation	14,500	14,500
Prairie Restoration	183,250	88,000
NNIS Treatments	14,100	14,100
Wildlife Habitat Improvements	20,000	20,750
Close Unclassified Roads & ORV Rehabilitation	10,000	10,000
Total Costs	**313,600**	**225,100**
Est. Revenue Share	**110,000**	**83,500**
Net Revenue, U.S.	***26,650***	***35,150***

Commercial harvesting activities would contribute to revenue sharing from the U.S. Treasury to Newaygo County for use in education and road maintenance. Eligible sale area improvement costs would be funded by Knutson-Vandenberg Act (KV) appropriations. Private sector employees and local service providers would be engaged for commercial timber harvesting, road construction, and to perform services funded by KV appropriations. Commercial timber sale activities, such as preparation and administration costs, would be performed by Forest Service employees, and would be funded by appropriations to the Forest Service from the U.S. Treasury.

Short-term recreation use on Forest and lake locations may be displaced while harvest and restoration operations occur. The range of activities pursued would be those typically available in undeveloped Recreation Opportunity Spectrum classes. The long-term recreation use by hunters could increase as the number of early successional habitat acres changes.

Table 3.30 displays estimates of timber sale revenues, federal Treasury revenues and cost sharing amounts, and the cost to complete specific treatments within the Project Area. These estimates use average FY 2008 Forest and District program-level costs and market-based values (revenues received directly) for Alternatives 2 and 3.

The Forests' Plan and FEIS measure economic efficiency using present net value, which compares discounted benefits and costs of market and non-market resources. Non-market resource values predominant in the Project Area include hunting, fishing, horseback riding, camping, picnicking, and viewing wildlife. A present net value is not calculated at the Project level because these resources have values assigned at scales larger than the Project Area. In general, non-market values would be greater in Alternative 2 than in Alternative 3, where a change in scenic attractiveness is offset by larger prairie restoration costs. The creation of early successional habitat, which particularly increases wildlife viewing opportunities, would be equivalent between the Alternatives 2 and 3. Alternative 2 would contribute approximately 9,025 hundred cubic feet (Ccf) and Alternative 3 would contribute approximately 7,500 Ccf of harvested timber.

(3.12.3b) Cumulative Effects

Under Alternatives 2 and 3, the acres receiving prairie restoration treatment would be removed from the Forest's land base suitable for timber production. The Forest Plan currently has 401,121 acres of land available for timber management. There is 910 MMbf available to the meet the first decade ASQ, with an annual maximum allowable yield capacity of 1,225 MMbf. The remaining lands (465,597 acres) are not appropriate for timber production, but are anticipated to contribute some timber volume that does not contribute to the allowable sale quantity in the next 20 years. In conjunction with Project Area non-timber resources, Alternatives 2 and 3 contribute to the positive increase of Non-market present net values shown in Table III-54 of the DEIS.

Timber harvesting in northern lower Michigan accounted for 40% of the State's industrial roundwood, and 52% of its saw log production in 1998 (USDA-Forest Service 2003). Currently, northern Lower Michigan has about 544 businesses that employ personnel connected to the procurement, processing, and manufacture of wood products (MDNR 2008). Total employment and wage rates fluctuate with the general and forest product business cycles, and within the past two years, two large pulp mills have closed or reduced production, largely for competitive business reasons (Traverse City Record Eagle 2006, SAPPI Inc. 2005).

These events have reduced the total employment in the timber harvesting and manufacturing sectors by a significant factor in northern Lower Michigan. The competitive, global nature of the paper industry would likely reduce employment in pulp mills in the future. However, employment in the saw mills would decline at a smaller rate, due to steady saw log production levels and fewer capital investments (Leefers 2006).

Conclusion: The duration and magnitude of Alternatives 2 or 3 would not incrementally add to past, present and reasonably foreseeable economic forces and events within the Manistee National Forest, primarily because the Forest contributes less than 2% of the employment and income effect to the local economy. The general economic climate in the next decade is expected to dominate the effects of forest harvest induced employment and income.

(3.13) Irreversible and Irretrievable Commitment of Resources

(3.13.1) Area of Analysis

Direct and Indirect Effects: Specific Treatment Areas
Cumulative Effects: Project Area

(3.13.2) Existing Condition and Resource Specific Information

Irreversible commitments are decisions affecting non-renewable resources. Such commitments are considered irreversible, because the commitment would deteriorate the resource to the point that renewal could occur only over a long period of time or at great expense. Commitments are also irreversible if the resource has been destroyed or removed.

Loss of soil due to erosion would also be an irreversible commitment of resources. Due to the incorporation of the State of Michigan's Best Management Practices, Forest Plan standards and guidelines, and the site-specific mitigation measures in this document, it is not anticipated that there would be any significant soil loss under any alternative from soil erosion.

Loss of heritage resource sites resulting from accidental damage or vandalism would be an irreversible commitment of resources. The mitigation measures specified in this document provide reasonable assurances there would be no irreversible loss of heritage resources.

Irretrievable commitments of natural resources are commitments that result in the loss of productivity or use of resources due to management decisions made in the alternatives. These are opportunities foregone for the period of time that the resource is unavailable.

Foregoing timber harvest opportunities at this time in certain areas due to resource concerns or economics may represent an irretrievable commitment of resources because that volume would not be harvested. The commitment is irretrievable rather than irreversible, because future entries and harvesting of those areas may occur if they are still classified as part of the Forests' suitable timber base.

(3.13.3) The Effects of the Proposed Actions on the Commitment of Resources

There would be no irreversible commitment of resources under either Alternative 2 or Alternative 3.

Under Alternative 2, there would be approximately 177 acres that would be eligible for prairie restoration treatments. Of this, 145 acres are currently classified as Land Suitability Class (LSC) 500 within the commercial timber base. This classification allows these areas to be open for commercial timber harvesting into the future. The remaining 32 acres are currently classified as openings and are not considered to be viable for commercial timber harvesting operations. As a result of restoring these areas to dry-sand prairie, the 145 acres that are currently forested would no longer be classified as LSC 500 and the designation would change to LSC 200. While this designation could be changed in the future, it would exclude these areas from timber harvesting during the time that they remain with the LSC 200 classification.

Under Alternative 3, there would be approximately 83 acres that would be eligible for prairie restoration treatments. Of this, 57 acres are currently classified as Land Suitability Class (LSC) 500 within the commercial timber base. The remaining 26 acres are currently classified as openings and are not considered to be viable for commercial timber harvesting operations. As a result of restoring these areas to dry-sand prairie, the 59 acres that are currently forested would no longer be classified as LSC 500 and

the designation would change to LSC 200. While this designation could be changed in the future, it would exclude these areas from timber harvesting during the time that they remain with the LSC 200 classification.

Under both action alternatives, the extraction of timber would occur in other proposed areas throughout the Project Area. These areas would be considered forested and classified as LSC 500. This alternative would offer reasonable assurances of reforestation and provide for long-term sustained yield. As a result, these activities would not promote the irretrievable commitments of natural resources.

Chapter 4: Lists

(4.1) Preparers

Christopher Frederick
Baldwin-White Cloud District Interdisciplinary Planner (IDT Leader)

Heather Keough
Baldwin-White Cloud District Wildlife Biologist

Matt Sands
Manistee National Forest Shared-Services Silviculturist

Pat McGhan
Manistee National Forest Shared-Services Botanist

Michael Joyce
Manistee National Forest Shared-Services Fisheries Biologist

Russell Snyder
Manistee National Forest Shared-Services Archaeologist

Kathy Bietau
Baldwin-White Cloud District Recreation Planner

Mara Jones-Branch
Baldwin-White Cloud District Forester Trainee

Mark Shermak
Baldwin-White Cloud District Forester

(4.3) Agencies, Organizations, and Persons to Whom Scoping Letters Were Sent

(4.3.1) Private Landowners

Allan Adams
Larry Adams
Charles Aishe
Marvin Akerson
William Altman
John Anderson
Lawrence Archey
David Armstrong
Robin Arnold
Richard and Rose Arrigo
Scott and Patricia Atwell
Sue Ann Aurich
Leslie and Betty Baird
Lee and Arla Barnhill
Richard Barrett
Vernon Barrett
Terrance Baumgartner
Harold Beaubien Trust
Rodney and Diane Beaver
Allen Belka
Ruth Bentley
Boar Nest, LLC
Sherry Bohland
Patricia Brejcha
Wendell Briggs
Jerroll Brown
Henry Brown
Irwin F. Bryan III
Jerold Bryant Trust
Robert Buist Trust
James Bursma
Rickey Buttleman
Peter Byl
James Caliendo
John Carpenter
Dolores Cetrone
David Chidester
Stephanie Christy
Marilyn Cole
Brenda Colegrove
George Coram
Bobby Creekmore
Kevin Crissey
Joshua Davenport

George Davis
Michael Deater
Ray Deblock
Charles DeGraaf
Robert Deuchler
Darl DeVisser
Timothy DeVowe
David DeWeese
Raymond Dewey
Gordon DeYoung
John Dobozy
Carl and Valerie Dosch
Walter and Janet Dosch
Margaret Dreyer
Laurien and Amy Drouin
Daniel Dudley
Cornelius Dutmer
Thomas Eagan
Robert Edgar
Kenneth Eerdmans
Gerald Eisemann
Federal Home Loan Corp.
Mark Fellows
Kenton Fensch
Scott and Shayne Fifer
Alfred Fischl
Greg and Debra Fisher
Karen Flinton
Robert Folkema
Donald Follett
Bernie Geister
Ellen Golec
Denise Gordy
Jon Graham
Robert and Ann Graves
Alonzo Green
June Grypma
Terry Gulliford
H E Tope, Inc.
Linn Hackers
Robert Hall
Steven Hall
Whetsel Harrington
Helen M. Hartley Trust

Peter Haverkamp
Gerald Hein
Kenneth Hemmeke
Frank Hiestand
Angela Hitts
Jack Hoover
Thomas Horton
Burt Jackson
Robert Janssen
Ronald Jelsema
Steven Jelsema
Sandra Kanters-Miles
David Kelch
Daniel Kenel
Brandon Kent
David Kibbey
Damon and Robin Kincer
Rick Wright
Thomas Koopman
Mark and Dawn Kopek
Neil Koths Trust
Karen Kuhns
Lenus Kuhns Trust
Eugene Kuhns
Karl Kusmierski Trust
Thomas Landells
Ausma Lanka
Lawrence Lappin
Mary Lee-Pokryfki
Bob LeMarbe
Leonard Farms, LLC
Edward Lewis
Anthony Linderleaf
Lyle and Lillian Link
Barbara Lofquist
Mark and Debra Loper
Ronald Lord
Daniel Lucas
James Machiela
Terry Mast
Olindo Mattei
Joaquin Mayoral
Dennis McBride

Private Landowners (continued)

Francis McGuckin
Scott McKellar
John McMenamy
Mary McMenamy
Lauren McNees Trust
John Medeiros
Jeffrey Mellema
John Milam
Ettna Miller Trust
Theodore Miller
John Miller III
Gerald Moomey
Geraldine Moore
Brenda Moyer
Gordon Mundy Trust
Lynda Nelson
Dennis Nemecek
Timothy Okke
Ricky Olendkamp
Richard Olt
Timothy Olt
James Orszula
Larry Parke
Leo Parkhurst
Horace Parsons
Vickie Patmos Trust
Donna Mae Paulsen Trust
Gregg Paulsen
Mark Paulsen
Michael Paxson
Michael Perrin
Douglas Perrin
Donald Peterman
Denise Peters
Dennis Petzel
Josh Piper
Dennis Postma
Jacob Potter
Darnell Pringnitz
Shawn Rabidoux
Lawrence Rathgeb
Richard Rinzler

David Roberts
David Robinson
Karl and Laura Rock
Kerry and Sherri Rogers
Carl Romano
Nelson Root
Gary and Keri Ross
Abel and Maria Rubio
Nicholas Ruehmeier
Jim Rummelt
Duane and Patricia Rusco
Robert and Betty Russ
David and Colleen Ryman
Leslie Salacina
Russell Sall Trust
Robert Scheneman
David Schroeder
Ronald Schuelke, Jr.
Harlan Schumaker
William Schumaker
Tony Scott
Sedlecky Family Trust
Donald Shepard
Clifford Sheteron
Randy Sheteron
Robert Shreck
Ken and Joy Shula
Frank Shulskie
Larry and Mary Sieler
John Simonson
David Sizemore
Kent and Delores Slater
Alan Slowinski
Edwin Slusarczyk
Ann Smith Trust
Darrel Smith
Earl Smith
Jeffrey Smith
Michael Smith
Scott Smith
Roy Snell
Kenneth Snyder
Angela Splitstone
Lois Staples

Eric Stevenson
Kenneth Swart
Frank Taibi
James Taylor
Ronald Terbeek
Lalonda Terpening
Timmus, LLC
Ralph and Jill Tisron
Joseph Topolski
Fred Toxopeus
Raymond Umlor
Jeff Vandenboss
Jay VanDuinen
Richard VanDyke
Bruce VanDyke
Marilyn VanMeter
Jon VanSchoick
Victor VonSolkema
Raymond Venema
Albert Ventimiglio
Theodore Vereecken
Jeremy Walls
Weaver's Inc.
Joan Webster Trust
Wells Fargo Bank
Valentin Wendl
Charlene Wier
Paul Williams
Richard Williams
Joel Wilson
Harry Wiseman
Paul Wiseman
Joyce Wolfe
Daniel Woods
Douglas Woods
Gerald Wright, Sr.
Robert Wright
David Yonker
Kenneth Young
Clifford Zeien

(4.3.2) Huron-Manistee National Forest ALL Mailing List

(At the time of scoping)

David Anthony
Trina Ball
Tom Barnes – MI Association of Timberman
Andrew Boynton
Pat Brower – Great Lakes 4-Wheel Drive Assoc
Patrick Brown – MI Natural Features Inv
Thomas Buchele – University of Pittsburg School of Law
Tom Callison – Grand Traverse Band of Ottawa and Chippewa Indians
Curtis Chambers – Burt Lake Band of Ottawa and Chippewa Indians
Bill Chapin – Cycle Conservation Club of Michigan
Gary Cole
Doug Cornett – NW Wilderness Recovery
Karen Dannielsen – Great Lakes Indian Fish and Wildlife Commission
Dan Dessecker – Ruffed Grouse Society
Sharon Detz – Grand River Band of Ottawa Indians
Jason Dinsmore – Michigan United Conservation Clubs
Mark Donham – Heartwood
Frank Ettawageshik – Little Traverse Bay Band of Odawa Indians
Miles Falck – Great Lakes Indian Fish and Wildlife Commission
Audrey Falcon – Saginaw Chippewa Tribe
Ric Foster – Blue Ribbon Coalition
Tony Furlich – Hydrolake Leasing & Service
Charles Geerlings
Randy Gerke – Mid-Union Sled Haulers
Robert Heyboer
Jessica Hogrefe – U.S. Fish & Wildlife Service
Nottawaseppi Huron Band of Potawatomi Indians
Mark Kane – Sylvan Acres Association
Mary and Terry Klein
Mark Knee – Little River Band of Ottawa Indians
Bob Kowaygoskum – Grand Traverse Band of Ottawa and Chippewa Indians
Linda Lang
John Legge – The Nature Conservancy
Shuler Lewis – Cycle Conservation Club of MI
John Martinez
Matt Mauer
Lianna May
David Miehlke – Cycle Conservation Club of Michigan
Scott Miller – Two-Trackers 4-Wheel Drive Club
Dave Neu – National Wild Turkey Fed
Nottawaseppi Huron Band of Potawatomi Indians
Ogema – Little River Band of Ottawa Indians
Richard Pfaff Jr. – SE Michigan Council of Government
Glenn and Diane Postema
Marvin Roberson – The Sierra Club
Larry Robinson
Pat Rowell – USDA Forest Service
Wayne Rynbrand – Great Lakes 4-Wheel Drive Assoc.
Dwight Sargent – Inter-Tribal Council of Michigan
Louis Sarog – We Love Smokey Society
Gary Shawa – Burt Lake Band of Ottawa and Chippewa Indians
Dan Shepard - Little River Band of Ottawa Planning
Randy Showalter – National Wild Turkey Federation
Michael Slaughter
Dave Smith – Two-Trackers 4-Wheel Drive Club
Dale Stein
Heath Stein
Emma T. Suarez – Pacific Legal Foundation
Jeff Traynor – Great Lake 4-Wheel Drive Club
Winnay Wemigwase – Little Traverse Bay Band of Odawa Indians
Ann Woiwode – Sierra Club

(4.3.3) Baldwin-White Cloud District Mailing List

(At the time of scoping)

Dick Shotwell
Donald Rienders – Pine Medical Group
Fred Eyer – Pine River Association
Bill Dingman – Trail Riders Snowmobile Club
Irons Area Tourist Association
Mark Glover
Jim Maturen
Denny Douglas
Duane Quigg
North Country Trail Association
Rich Krieger
Robert Allen – Newaygo County Planning Board
Rosswell Fulton, Jr – Newaygo County Planning Board
Ronald Sanders – Newaygo County Commissioner
Kelly Smith – Newaygo County Road Commission

(4.3.4) Scoping Letter Respondents

Randy Showalter
Denise (Curt) Gordy
John Maderus
Tony Furlich
Kenton Sench
Cliff Shetron
David Kibbey
Mary Lee Pokryfki
Ron Jelsema
Mary Bursma
Sandra Coram
Terry Gulliford
Mike Smith
Steve Jelsema
Jeff Vandenboss
Gordon Mundy
Dennis and Edith McBride
Karl Stressman
Russ and Bev Sall
Robert Russ
Jerroll Brown
Robert Wright
Patrick Brower
Kenton Fensch
Randy Sheteron
John Miller
Laureen Deater
Allen Belka
Ausma Lanka
Shawn Rabidoux
Burt and Peg Jackson

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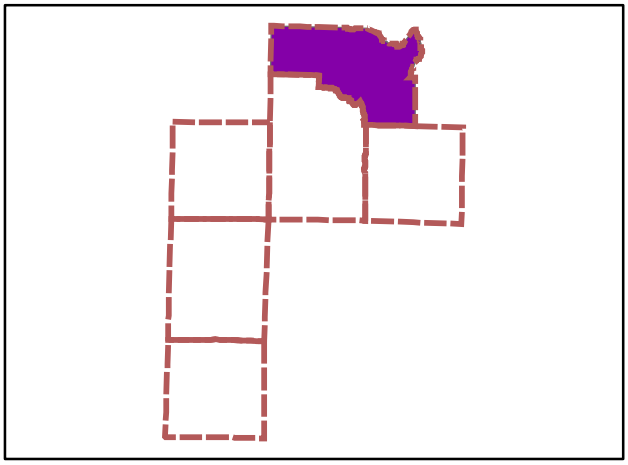
APPENDIX A
ROAD CARDS

Mast Lake Project
Roads Treatment
Compartment 564
Alternatives 2 & 3



Roads

ACTION

- CLOSE
- COUNTY
- OPEN
- PRIVATE
- NF Land
- Compartments

Miles
0 0.15 0.3 0.6 0.9 1.2

4 MILE
4 MILE
JACKSON
CYPRESS
COTTONWOOD
ELM
3 MILE
THRUSH DRIVE
UCD
UC25
FR9026Q
UC24
UC26
UC40
FR9026-T
FR5900
UC33
UC32
UC37
FR9618
UC38
FR9617
TWO MILE
FR9614
UC41
5874

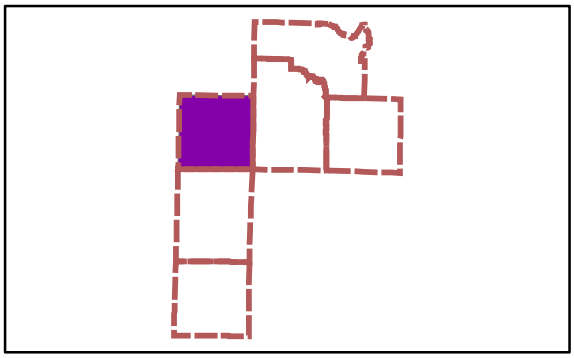
"The Forest Service uses the most current and complete data available. They may be: developed from sources of differing accuracy, accurate only at certain scales, based on modeling or interpretation, incomplete while being created or revised, etc. Using GIS products for purposes other than those for which they were created may yield inaccurate or misleading results. The Forest Service reserves the right to correct, update, modify, or replace GIS products without notification. The Forest Service will not be liable for any activity involving this information. Providers of other data should be consulted regarding the accuracy and scale of their data." For more information contact:
GIS Coordinator; Huron-Manistee NFs: 1755 S. Mitchell Street; Cadillac, MI 49601. (231)775-2421

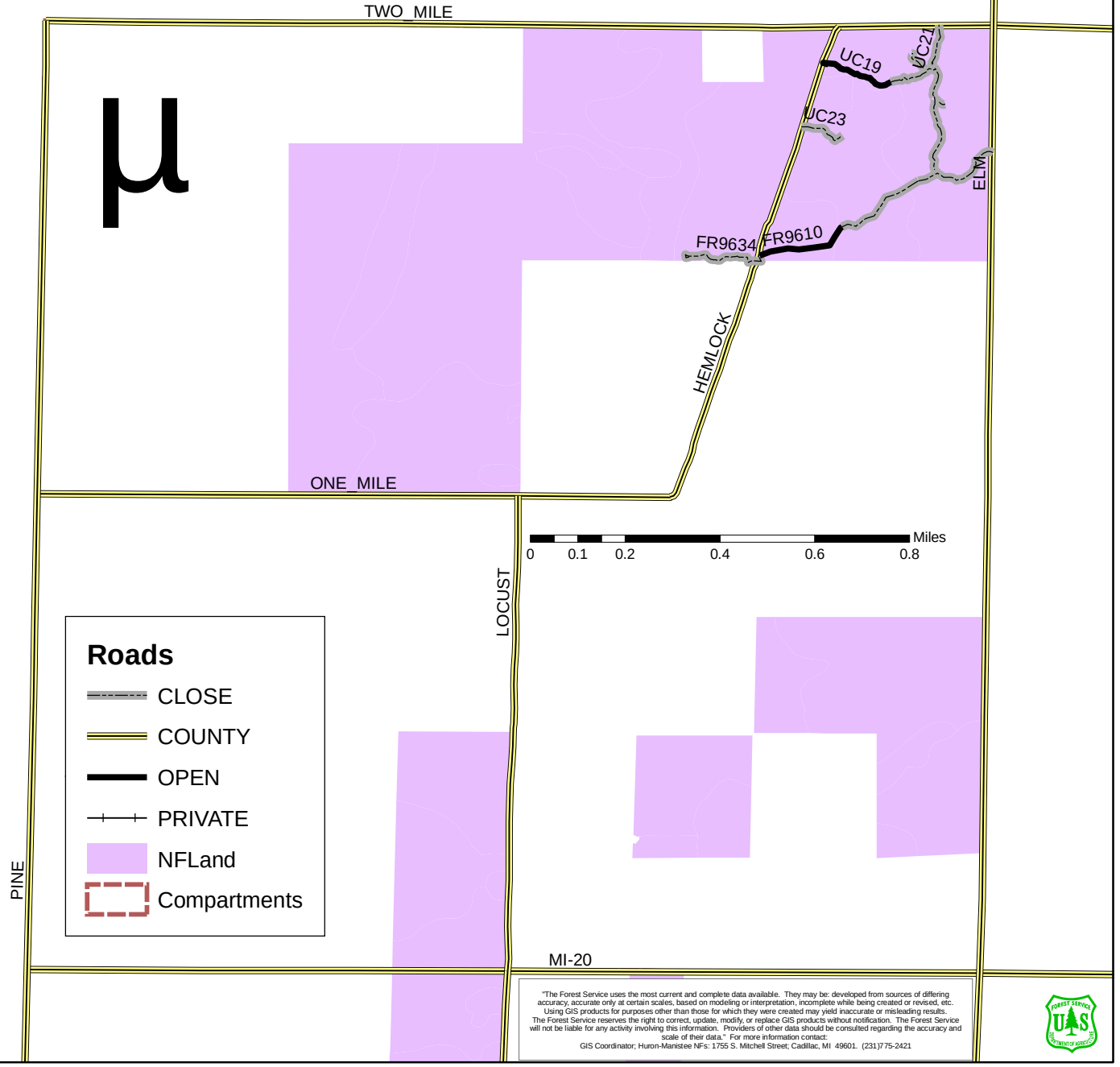
Mast Lake Project

RoadsTreatment

Compartment 565

Alternative 2



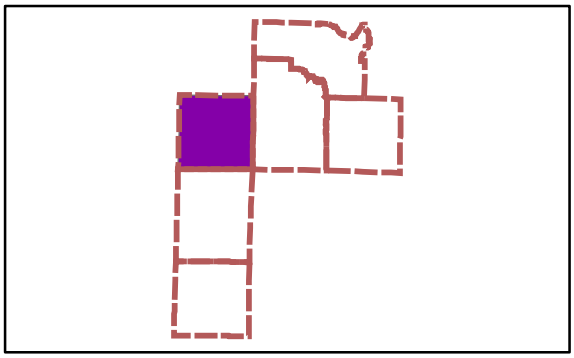


Mast Lake Project

RoadsTreatment

Compartment 565

Alternative 3



TWO_MILE

3_MILE

UC19

UC21

UC23

ELM

FR9634

FR9610

HEMLOCK

ONE_MILE

LOCUST

PINE

MI-20

Miles

0 0.1 0.2 0.4 0.6 0.8

Roads

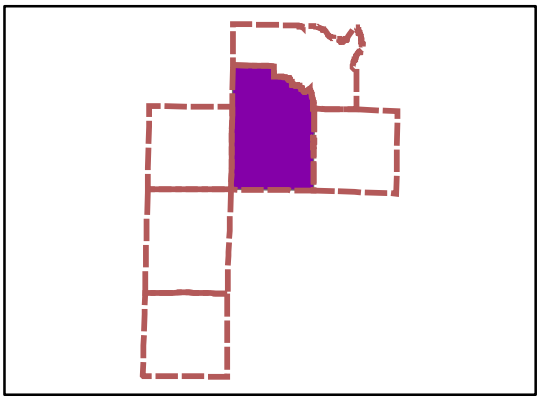
- CLOSE
- COUNTY
- OPEN
- PRIVATE
- NF Land
- Compartments

Mast Lake Project

Roads Treatment

Compartment 566

Alternatives 2 & 3

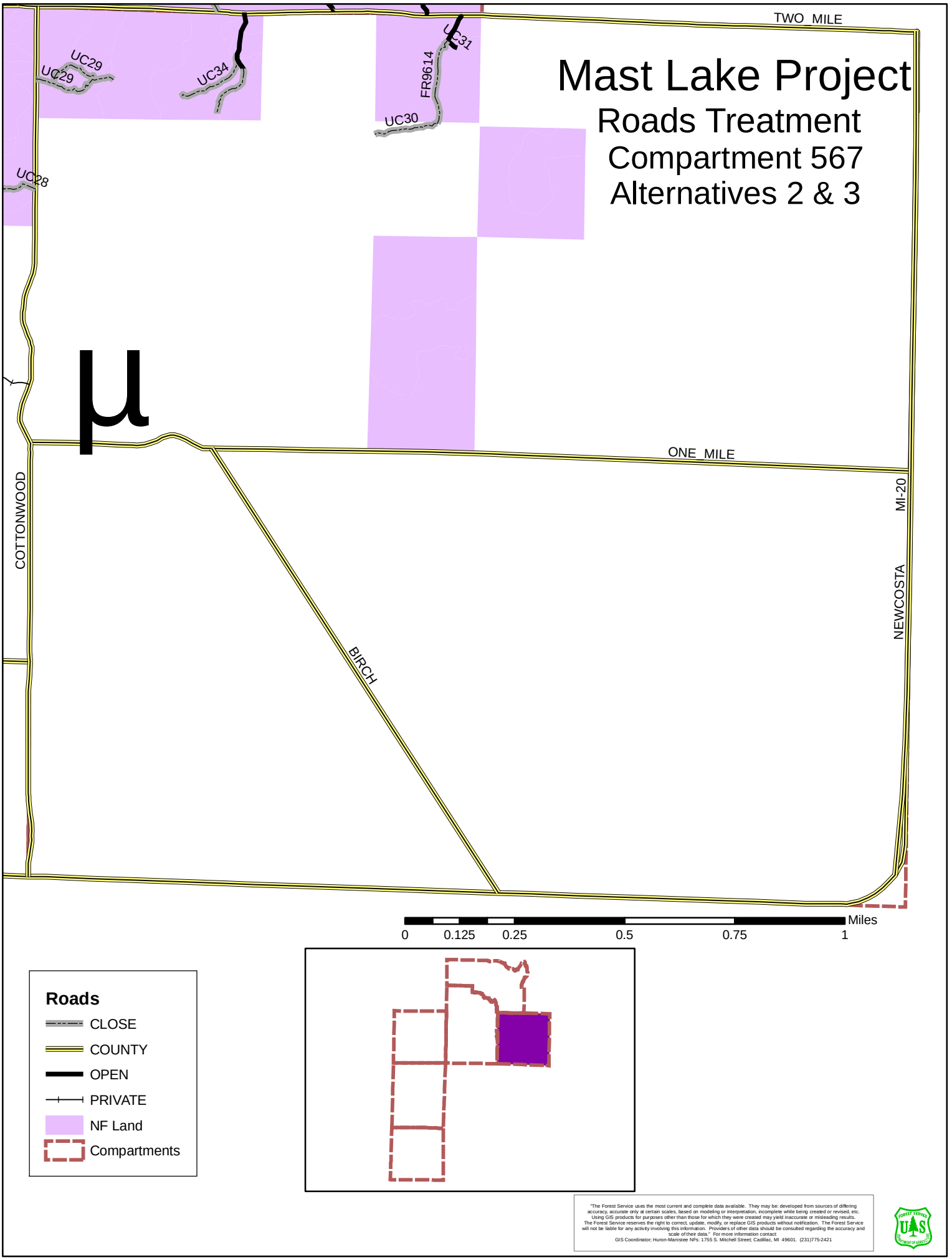


Roads

- CLOSE
- COUNTY
- OPEN
- PRIVATE
- NF Land
- Compartments

0 0.125 0.25 0.5 0.75 1 Miles

3 MILE
TWO MILE
ONE MILE
WASHINGTON
MI-20
ELM
CHER
CYPRESS
COTTONWOOD
THRUSH DRIVE
UC19
UC24
UC25
UC26
UC27
UC29
UC41
UCD
FR9026O
FR9026T
FR5374
FR9612
FR9613
FR610



Mast Lake Project

Roads Treatment

Compartment 567

Alternatives 2 & 3

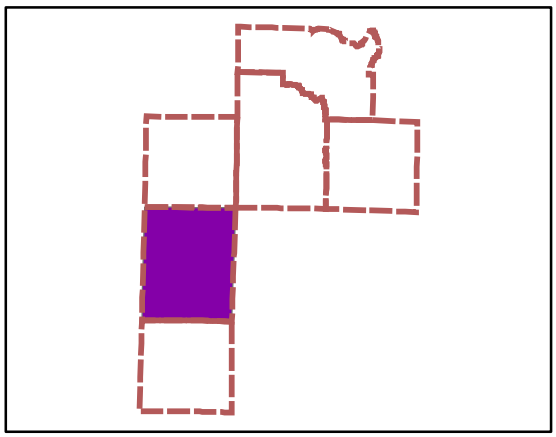
Mast Lake Project
RoadsTreatment
Compartment 570
Alternatives 2 & 3

μ

M-20
4TH
UCE
8TH
PINE
LOCUST
LOCUST
12TH
ELM
UC17
UC18
20TH

0 0.1 0.2 0.4 0.6 0.8 Miles

Roads
- CLOSE
- COUNTY
- OPEN
- PRIVATE
- NF Land
- Compartments

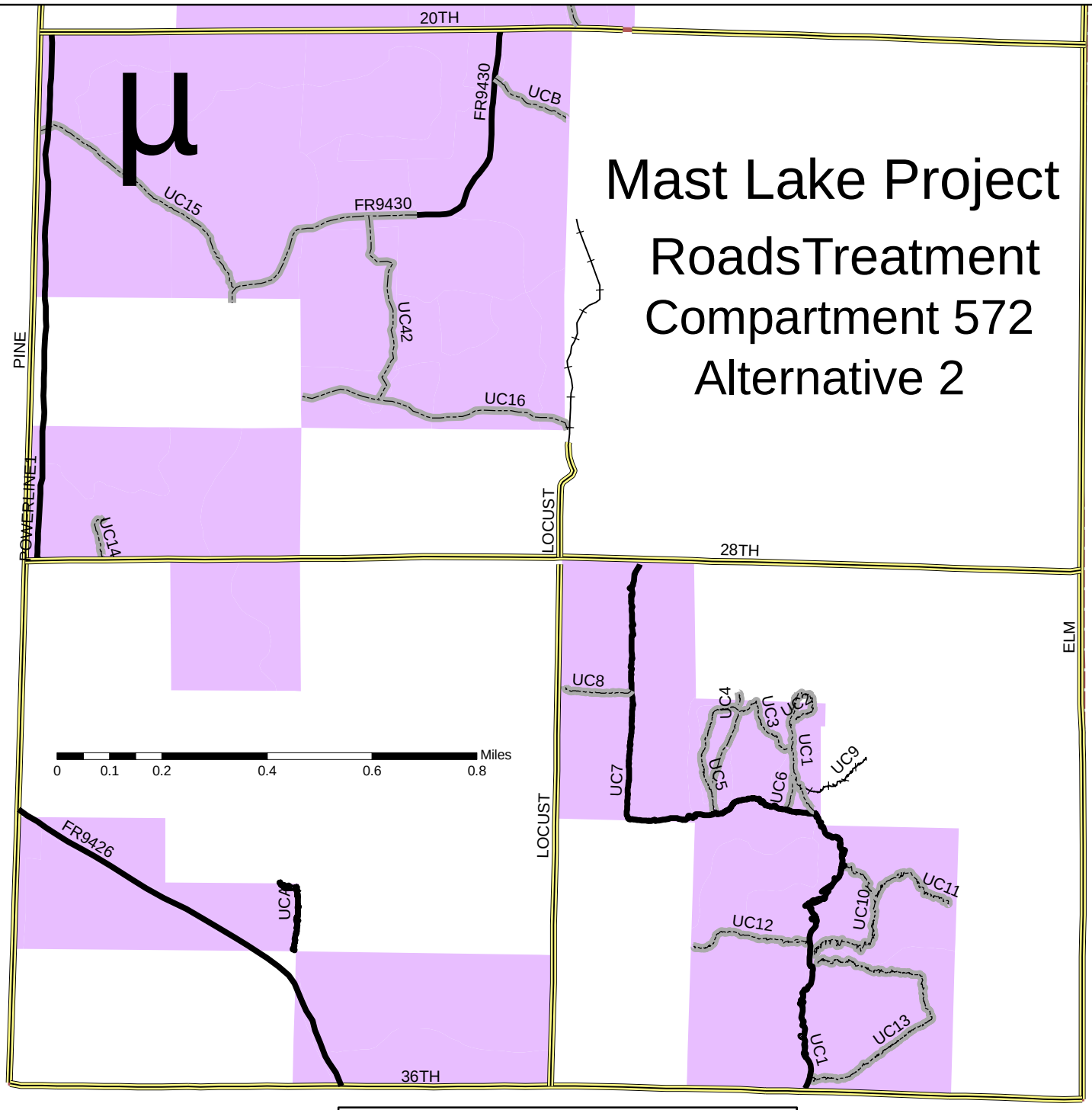


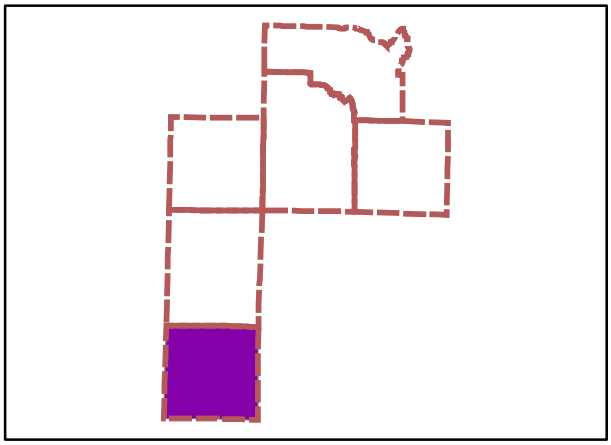
Mast Lake Project

RoadsTreatment

Compartment 572

Alternative 2

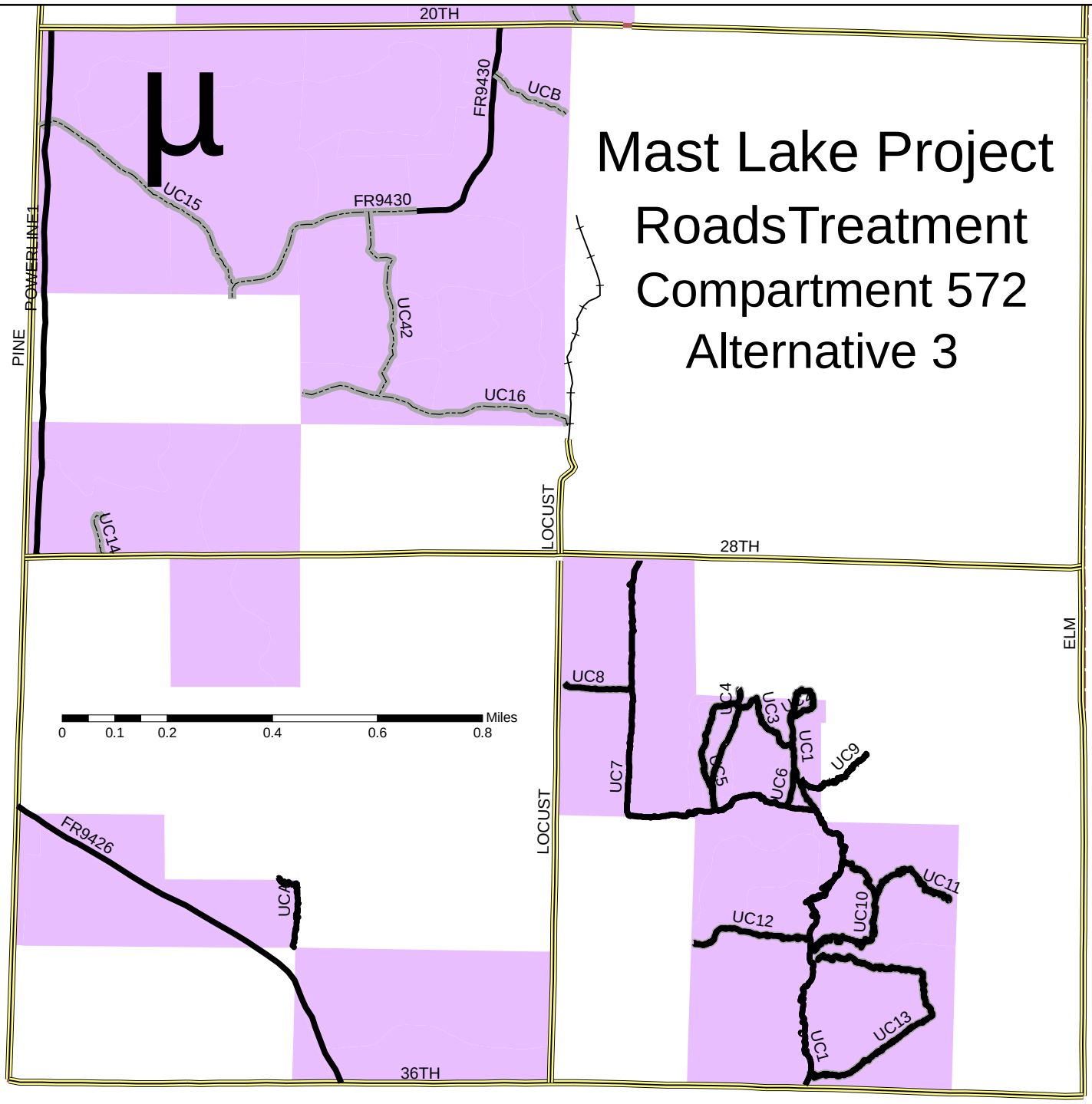


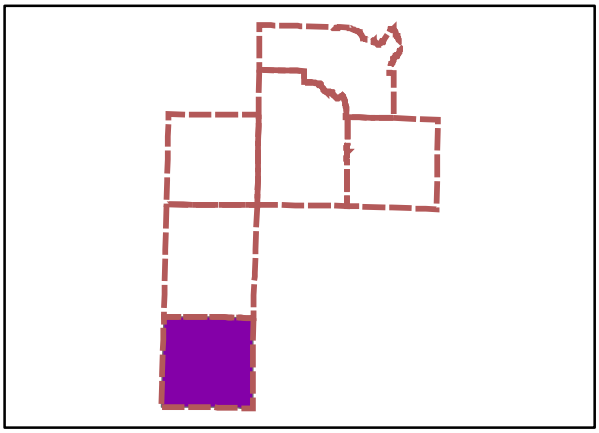


Roads

- CLOSE
- COUNTY
- OPEN
- PRIVATE
- Compartments
- NF Land

Mast Lake Project
RoadsTreatment
Compartment 572
Alternative 3





Roads

- CLOSE
- COUNTY
- OPEN
- PRIVATE
- Compartments
- NF Land

APPENDIX B
PRAIRIE VEGETATIVE SPECIES LIST

Prairie Vegetative Restoration Species List

Prairie habitats restored through timber and fuels treatment would be expected to return to a near natural condition within three years, as determined through ocular inspection for the presence and abundance of expected herbaceous and shrub species. The following represents a suite of species expected to be found in open prairie/barrens conditions in the vicinity of the Project Area. Presence of representatives from this suite of plants needs to occur within 60% of the treated stand. Less than a 5% presence of non-native invasive plant species is necessary to qualify as successfully reaching the desired future condition.

Prairie/Barrens - Desired Ground Cover Layer Plant Species		
Anaphalis margaritacae	Andropogon geradii	Antennaria howelii
Antennaria parlinii	Antennaria parvifolia	Apocynum androsaemifolium
Apocynum cannabinum	Anemone canadensis	Aquilegia canadensis
Arabis canadensis	Arabis divaricarpa	Arabis glabra
Arabis hirsuta	Arabis laevigata	Arabis missouriensis
Arctostaphylos uva-ursi	Asclepias syriaca	Asclepias tuberosa
Aster spp.	Astragalus canadensis	Astragalus neglectus
Brachyelytrum erectum	Calystegia spithamaea	Campanula rotundifolia
Carex spp. (pensylvanica <30%	Cirsium hillii	Cirsium hillii
Comptonia peregrina	Coreopsis lanceolata	Danthonia spicata
Deschampsia cespitosa	Deschampsia flexulosa	Elymus canadensis
Elymus virginicus	Epigaea repens	Epilobium angustifolium
Eragrostis spectabilis	Euphorbia corollata	Gaultheria procumbens
Geranium bicknellii	Geranium maculatum	Geum triflorum
Gnapthalium macounii	Gnapthalium obtusifolium	Gnapthalium uliginosum
Hedeoma hispida	Hedeoma pulegioides	Helianthemum canadense
Helianthus divaricatus	Helianthus occidentalis	Helianthus pauciflorus
Helianthus strumosus	Heliopsis helianthoides	Hieracium gronovii
Hieracium kalmii	Hieracium scabrum	Hieracium umbellatum
Hieracium venosum	Houstonia longifolia	Juncus dudleyii
Juncus tenuis	Koeleria macrantha	Krigia biflora
Krigia virginica	Lechea spp.	Liatris spp.
Linaria canadensis	Linum sulcatum	Lithospermum spp.
Lobelia inflata	Lobelia spicata	Lupinus perennis
Lycopodium spp.	Melampyrum lineare	Milium effusum
Mitchella repens	Monarda fistulosa	Monarda punctata
Oenothera biennis	Oenothera clelandii	Oenothera fruiticosa
Oenothera parviflora	Oenothera perennis	Opuntia humifusa
Oryzopsis asperifolia	Oryzopsis pungens	Panicum implicatum
Panicum columbianum	Panicum depauperatum	Panicum latifolium
Panicum virgatum	Pedicularis canadensis	Penstemon digitalis
Penstemon hirsutus	Poa salutensis	Polygala paucifolia
Polygala polygama	Polygala sanguinea	Polygala verticillata
Polgenella articulata	Potentilla anserina	Potentilla norvegia
Potentilla simplex	Pycnanthemum spp.	Pyrola spp.
Rosa spp. (native)	Rubus alleghaniensis	Rubus canadensis
Rubus flagillaris	Rubus occidentalis	Rubus parviflorus
Rudbeckia hirta	Schizachyrium scoparius	Senecio aureus
Senecio obovatus	Senecio pauperculus	Senecio plattensis

Prairie/Barrens (continued) – Desired Ground Cover Layer Plant Species		
Sisyrinchium spp.	Smilacina racemosa	Smilacina stellata
Smilax spp.	Solidago spp.	Sorghastrum nutans
Spiranthes spp.	Vaccinium spp.	Verberna stricta
Viola spp.		

APPENDIX C
MAST LAKE SCOPING COMMENTS

Mast Lake Scoping Comments

Chris:

Just a quick note of support for the above proposed projects in the forest. Without question, the diversity created in these areas will be a benefit to a large number of forest dwelling wildlife species, including the wild turkey. We support your efforts and especially like shelterwood cuts, openings and regeneration cuts.

If we can be of any help in the future, please feel free to give me a shout!

Thanks for all you do for the resource!

Mrs. XXXX and her husband own 40 acres in Compartment 564 (Map 1 of 3). She called to ascertain what types of treatments were going to be proposed in the area that is near their property. This area is east of Cypress Road and north of Two Mile Road. I explained the treatments that were proposed in that area as mainly wildlife habitat improvement activities and the management of the transportation system. She informed me that she had documentation from the Newaygo County Road Commission that they had abandoned Thrush and Birch Roads and that these roads were currently being used by people for dumping large quantities of trash in the area and for the establishment of long-term hunting camps and she would like to see the roads properly closed. She also stated that there were many permanent hunting stands in this area and that is was not uncommon for her and her husband to see bear and bobcat in the area around their house. She inquired as to what she could do to be heard out on the topics. I informed her of the public process involved with our analysis and that if she knew of specific problem areas with trash and hunting stands, she should include their locations with her written response to scoping.

XXXX is a private property owner in Compartment 564 (Map 1 of 3). His property is west of Cottonwood Road and south of Two Mile Road. He inquired as to the specific treatments that would be occurring in this area and was concerned about the impacts that logging operations would have on the condition of Cottonwood Road and turkey hunting. I explained that the purchasers typically utilized the roads that were best suited for hauling purposes, and that the treatments in this area would likely be occurring during the winter months, after turkey season.

On 1/11/2008, I had a phone conversation with XXXX, representing XXXX. He requested the following comments be recorded as his response to scoping on this project.

1. He is concerned about the types of red pine and aspen proposed for harvest; in particular, what is the mix of 1st vs. other thinnings and harvests in red pine? And what is the age class mix of the aspen that is proposed for harvest? Is the oldest aspen proposed for harvest?

2. When will those stands, otherwise available for harvest, but not proposed in this project, likely be included in another project?

He is concerned about FR closures, and supports maximum public motorized access within the project.

With the exception of XXXX, all of these individuals own property in Goodwell Township (Map 1 of 3). Most of these property owners were calling to obtain further information on the proposed Mast Lake project. These questions included going over the proposed treatments that were on the maps, how close the treatments would be to their property, how these treatments would impact wildlife in the area, and how often the Forest Service conducted such activities. Many of the property owners mentioned that bears were prevalent in the area, with most either having seen them or knowing someone who had. The majority of these owners were OK with the presence of bears in the area; however, XXXX had concerns over this and admitted that she no longer felt safe to go into the woods in this area. She had heard that the DNR had released nuisance bears in this area and she was upset that this could be true. I informed her that was likely not the case, but that a bear study had been conducted on the Forest years ago. It was possible that people mistook this study with the release of nuisance bears. I informed her that I would check to find out what areas the study was conducted in and let know if this areas was one of them. She was also not in favor of the proposed timber treatments in this area and thought that we should allow nature to take its course. The remaining callers were satisfied with out proposal for timber treatments and the location, citing that they were glad we had decided not to treat the oak in the area north of 2 Mile Road.

XXXX owns property in Big Prairie Township (Transportation Map 3 of 3). His property is in Compartment 572 at the western terminus of UC16. He has concerns over the proposed closure of this road, as it currently serves as his means of access to his property. He currently has no Special-Use Permit for this road and does little to no maintenance on the road. I directed the call to Kathy Bietau. She informed him that he should contact other adjacent landowners to determine whether or not he could obtain access to his property from them before beginning the process of obtaining a Special-Use Permit.

All of the callers were encouraged to write down any further comments that they may have on the project and send them in before the end of the scoping period.

XXXX and her daughter own property in Goodwell Township (Map 2 of 3) and were curious about the activities proposed for that area. After going over the maps, we determined that the only activities proposed for the area of concern were related to the closing of a loop road in that area. She also stated that the area is very diverse and there is a lot of wildlife in the area. I encouraged her to fill out the enclosed comment sheet and send it in before the end of the public scoping period.

1) Concerned about "over" thinning of trees.
2) Use of remote trails for management in those areas could actually increase their use by quads, bikes, etc.
3) What will protect ground plants (lady slippers, etc.) from damage?
4) Who do you hire to do this work?

Dear Mr. Frederick,

My name is XXXX. My family and I won 20 acres adjacent to a small portion of the proposed Mast Lake Project (i.e. T13N,R11W,Section 6, Compartment 570. Our property borders the proposed red pine thinning located on your map where 4th Street meets Locust. We are thrilled to hear thinning will take place. Our forest floor is covered with fuel fire needles along with very little sunlight to heat the soil enough for other vegetation to take root.

Back in the early 1990's, a thinning project took place in the same spot, but very little benefit was observed because in my opinion a east-west cut was performed vs a north-south cut. I believe with a north-south cut more sun time will be gained allowing soil temps to increase. Our main concern with the project is pg.5 quoted: "Use temporary and/or reopen closed roads for access to the harvest units; these would be closed after harvesting is completed".

The early 1990 project ended without the access roads being permanently closed, resulting in trash dumping (i.e. concrete, asphalt, shingles, metal shed, 50 gallon drums, and large piles of insulin needles) among many other items. Also illegal vehicle access resulted in land degradation, trespassing, vandalism, and theft to adjacent private property, along with a greater amount of illegal hunting activity. Because this section of public land "Harness Marsh" is less than 300 hundred acres unsafe hunting conditions occurred during the firearm season. Way to many hunters in a confined space left many of us threatened by random shooting, due to over-crowded hunters.

Two years after the project started, I was lucky enough to get into contact with CO Lawrence Stillwell at the White Cloud Office. I explained the problem in detail; CO Stillwell was truly professional and treated my concern extremely important. He made a trip to investigate and imminently called me back and fully agreed with my assessment. I was given permission to use my vehicle and load up as much trash as possible, dumping it off at the White Cloud yard. My son and I removed 7 truckloads before CO Stillwell had all three access points bermed. He also added fiberglass "no motor vehicle" signs curbside at each access point. It took many years to bring this small parcel back to some sort of peace which is where we are today. We respectively ask that an impassable closure be put in place imminently after the project is complete.

As I earlier stated, we are thrilled to hear of the project and look forward to the end result of a more thriving forest for all to enjoy. Please feel free to contact us at anytime we are also available to volunteer if help is needed.

Sincerely,
XXXX

Grateful to see this project start. We border Compartment 564 and fully support these efforts. Habitat improvement, removing dump sites, and road closures top our list in our area. Thanks for letting us know about this effort.

Sir:
This sounds like a good thing – any plans on controlling invasive insects?

Thanks

---

hello my name is XXXX and i own property that borders the forest project property. My location is on mape #1 of 3 in the 566-compartment. my 40 acres is on cottonwood between 1&2 mile road. the furthest north privateparcel on the west side of cottonwood. i am excited to hear of the many proposed improvements to the area. on the map #1 shows open maintenence with oak shelterwood. i was wondering what exactly this means.i have also planted many trees,shrubs,and food plots on my property to help wildlife habitat. i would be very interested to talk with you to further educate myself on the project & its goals. our e-mail is XXXX & would like to recieve forthcomming document relating to this project area.

Let me start by expressing appreciation for the active role the Forest Service is taking in the management of forest areas surrounding my property and the Baldwin-White Cloud Ranger District. I firmly believe that it is our responsibility to care for our wildlife and forest areas. Do understand that I fully support hunting and consider it a part of wildlife management. In addition, I understand the need to clear cut/burn as necessary with new plant replacement.

My areas of interest are in the cleanup of trash/dump sites and road management. The referenced letter does provide intent and identifies general areas where actions are to occur, however, it doesn't provide

specifics. Is there anything that can be provided to me that identifies the trash/dump sites to be cleaned and the road management that will occur in Compartments 564, 566, 567?

Specifically, I'd like to know the following:

1. What is the plan for 2 Mile Road? Are the intentions to improve this road and what would those improvements be?
2. What is the plan for Cottonwood? Are the intentions to improve this road and what would those improvements be?
3. What is the plan for Cypress? Are the intentions to improve this road and what would those improvements be?
4. What is the plan for Thrush Drive? Are the intentions to improve this road and what would those improvements be?
5. What is the plan for classified Forest system roads by specific designator as identified in Mast Lake Project Transportation Map 1 of 3?
6. What is the plan for unclassified road by specific designator as identified in Mast Lake Project Transportation Map 1 of 3?
7. Where are the specific sites where trash dump cleanup will occur in Compartments 564, 566, and 567? My purpose here is to compare what is identified by the Forest Service with sites that I am aware of and to identify them to the Forest Service.
8. Again, I want to express my appreciation for the efforts of the Forest Service. As a long time resident Michigan, I feel is all our responsibility to protect the resources of our state.

Sincerely,
XXXX

We have adjoining property and lots of Autumn Olives.
What are you using to eradicate the Autumn Olives on your project and could we use the same thing?
Are you doing anything about the Emerald Ash Borer?
I hope you don't have to use any black plastic retaining fence – that is a big joke!

We live on the corner of 1 Mile and Locust. For the past two years we've encountered a pair of bald eagles feeding and perhaps nesting close by. Also spotted palliated wood peckers and bear. We hope your project will not interfere with their habitat.

Date: 1-31-08
From: Karl T. Stressman
4177 Laurel
White Cloud, MI, 49349
Phone: 231-652-9453
Form: Letter
I agree that these sections of woods should be managed by US Forest Service. However, the removal of non-native plants is where I disagree. This nation is a melting pot for people, why not plants? Personally, I pick and use the Barberrys and don't know of any other place they grow. I have also used the autumn olive berries. What do these plants hurt? I also disagree with blocking off public land. I know some people don't use properly, but some of us do. I welcome comments from you.

Will regulations be made for or on private property?
We must make wise decisions in caring for our natural resources. We would like to encourage you in this process.

Dear Sirs,
First, regarding trash dumping using Thrush Drive is currently and historically abused by residents getting rid of household garbage, automobile parts, tires, etc. as well as squatters who set up camp in early Fall (September) with motor homes, camping trailers, and tents and leave sometime after November often leaving a disgraceful accumulation of debris. At one point in the not so far past the Forestry Department removed an abandoned RV and camper trailer that were no longer livable. Instead of being hauled away by the owners this clean up effort was at the cost of the Department.

My family has heard shots after dark coming from the Federal land to the north of us knowing that poaching is also a problem using the privacy of Thrush Drive to conceal illegal taking of game. At this time we can sight at least 10 permanent tree stands within Section 22 that are used year after year by the same "hunters". These permanent structures are illegal, destructive to the trees and also encourage people who have constructed them to continue because no action has been taken to stop them.

The desired future of the Federal land that is divided by Thrush Drive is an ideal forest to support natural wildlife and plant life and to accommodate responsible and respectful people. This planned future could be accomplished by identifying and removing garbage that is visible from Thrush Drive then physically blocking access and closing Thrush Drive to vehicles.

I have documentation (enclosed) that Thrush Dirve was abandoned by the county on January 6, 2006 and therefore has not been maintained by the County.

Again as a property owner I would ask the Federal Forestry Department take action to ensure that the area known as Section 22 be naturally preserved for wildlife, plants, and trees without the burden of irresponsible humans and their vehicles.

I can be reached at XXXX if you have questions regarding this letter.
Thank you in advance for your sincere attention,

I agree to the enclosed following letter.

I was wondering if there are any plans to plant wildlife plots for the deer, turkeys, etc. after the tree removals?
Is there a specific timetable for the section between Pine, Locust, 20th, and 28th?
Are there any studies that would support the wildlife would prosper and increase due to these activities?
Is any monitoring done to check that?

Due to the increasing population, hunting should be restricted to limit high power rifles from being used. No where can you even see for a mile here, let alone the 5 miles that most rim fire weapons reach.

Re: Mast Lake Project Scoping Letter

Please accept the following comments on behalf of the XXXX

Request 1
Place Scoping on HOLD and reissue the 30 day Comment Period on May 1, 2008.

Reason

It is inappropriate to release projects that involve the transportation system for Scoping immediately preceding or during the winter season. Snowfall obscures the transportation system, soil conditions, and most vegetation. This prohibits a reasonable investigation of the Project Area for the formulation of substantive comment.

Request 2
We suggest the National Forest Service review the road mileage calculation criteria to formulate a method that prevents a road segment from being counted more than one time.

Reason
Roads on the Project Area Boundary that have NFS ownership both inside and outside the Boundary are being counted twice. Once for the Project for which adjacent ownership is inside the Project Area and again for the future project that will include the adjacent NFS ownership outside of the boundary.

Request 3
Include road segment mileages in Scoping Letter.

Reason
It is not possible for the public to accurately comment about road density issues if the distance a roads is adjacent to NFS ownership is unknown. This can be accomplished by placing the corresponding mileage on the maps with the segment's name or number (UC15 – 0.4 mile, Locust – 2.0 Miles, etc.), or in a list format.

While we are unable to issue substantive comments about conditions in the Project Area due to current snow cover, review of the included Transportation Maps indicates the following:

Map 1

- UC27, FR9612, and FR9613 Make a continuous loop providing access through the Forest
- Acquire a reciprocal easement for the eastern ¼ mile of FR9613 if a current easement is absent.
- FR5374, FR9613, and the unlabeled road traveling NW/SE between the two, represent a preexisting road that appears on *many* maps, including Garmin's Mapsource.

Map 2

- UC 18 appears on many maps, including Garmin's Mapsource, as the southern end of Locust. Reinstating this road would greatly aid rustic access through the Forest.

- FR9610 should access both Two Mile Road and Elm Street to aid access through the Forest.

- The creation of Level 2 Roads from Locust through to 8th, from 8th through to M20, from M20 to Locust, and from M20 to FR9610 (As indicated on the included Map) would improve rustic access through the Forest.

Map 3

- UC16 is a preexisting road that appears on *many* maps, including Garmin's Mapsource. The western half falls on private property and is now obstructed to public use. UC42 and UC15 are now the only east/west access through this section of Forest. The intersection of UC42 with FR9430 improves travel by also allowing for north/south rustic access through the Forest.

The abundance of User Created Routes in the Project Area serves as a clear indication that the NFS is failing to provide enough rustic access to the Forest. Inclusion of the routes discussed above would serve

to alleviate this situation, reducing illegal use, improving the public's desired access (rustic), while allowing for the rehabilitation of the most degraded sites.

These comments are respectfully submitted by:

XXXX

Form: Letter
Dear Christopher and Interdisciplinary Team,
I own the 38.58 acre parcel at 7800 East Four Mile Road. I bought it because it was next to USA land on its eastern and northern borders. The USA land was and is hardwood forest. That is the sole attraction this land has for me. I would like to see stability in management for these lands in particular.
Aspen is a pioneer tree. Getting replaced by other species is what this tree does. Maintaining aspen stands is from the dream-scape of the paper and pulp industry.

ORVing in good clean fun. To presume that this "damage" is bad and needs fixing means that one group of people can't use the land. Camping and hunting can't be the only "A" list activities.

Road closures means reducing access, which means that fewer people will be able to use the land. One of life's great thrills is being able to drive through or to beautiful land.

Trash pickup is essential. Disrespectful people dumping trash is a problem.

I, XXXX, am all for this project. The only problem I see with it is the closing of the road UC16 off from Locust. That is the only way that I and my father have to our land. Between the break-ins that are graciously to be blessed with and the land beautiful projects, (piles of garbage), I would love to see the road closed and blocked. The Off-Road Vehicles need to stay out also due to the roads that appear through the middle of nowhere. If the roads are to be closed, I would like to build two gates to be installed by myself with locks, one our, one yours. The gates would be placed at the end of Locust also the end of FR9430. I spend much time back in there with the family, that will also be my retirement home. I would like to be kept informed of the findings and the outcome of this survey. Thank you.

Compartment 570 Stand 18
I am very happy you are going to maintain this section. I tried to plant trees on my property (pine trees), but 4-wheelers and snowmobiles destroyed them. There are 4-wheelers every weekend in the summer in the dunes. There is all kinds of trash and tires also. I have called police and the Forest Service about 4-wheelers destroying dunes. I quit calling a couple of years ago. It did no good.

- I hope the property lines will be surveyed to ensure woods from private will not be harvested.
- The property on Baseline Road (Big Prairie Twp.) has pink lady slipper orchids growing on it. What will be done to protect these "protected plants"?
- Where will a "staging area" for harvesting red pine be when this property is only accessible from Baseline and the Pines are on the back of property (no roads on this property).

I see no problem with your plan. My brother and I own property in the #572 Compartment of the Master Lake Project. Our 10 acres is part of the red pine plantation. It has rows or red pines, scotch pines, some white pines, and a few oak trees. We have cleared some of the property, so we can use it for camping. I would like to know where we can get some of the prairie seed mix so we can plant some on our property. I think your idea of thinning the pine trees is a good idea. I think we should do some thinning also, so we can have some green ground cover for fire protection.

I would like to see some areas opened up for ATVs, dirt bikes, etc., with some restrictions.

I applaud any reduction in road densities other than what is necessary to maintain Project Areas. The amount of illegal dumping is a sad commentary on our recreational users and ORV owners.
What is the effect of glyphosate and picloram on wildlife and desirable plant species? Are these the only chemicals that will be used to control invasive plants?
Commercial timber operations are profit driven and while clearcutting is expedient it is not a good management policy for the land.

In regards to the Thrush Drive situation, I agree completely with the neighboring property owners and would like to thank Denise Gordy and the U.S. Forest Service for pursuing the clean-up and blocking off of this "disgusting secluded dumping road." If I can help with any clean up or public comment, I would be happy to do so. Thank you again for your consideration in this matter.

I have 80 acres and cabin in Goodwell Twn – I agree with the plans you are proposing.

APPENDIX D
HERBICIDE INFORMATION

History of Limitations on the HMNF

Herbicides are chemicals that are utilized to suppress or kill unwanted vegetation. They are used primarily for the reduction of weeds in cropland, forests, rangelands, and many other situations, such as roadsides and right-of-ways where weed growth may be problematic. The use of herbicides as a vegetative control tool on the Huron-Manistee National Forests was halted in 1990 as part of a coordinated "Lakes States position", in which no use would be permissible under Environmental Assessments. This applied to the Chippewa, Superior, Chequamegon-Nicolet, Ottawa, Hiawatha, and Huron-Manistee National Forests. In 2003, this position was reviewed and a determination was made that herbicides could be used in the control of non-native invasive species and unwanted vegetation at administration sites. The completion of the Huron-Manistee National Forest Plan (2007) brings with it increased restoration efforts for a variety of Endangered, Threatened, and Sensitive species that require savannas, barrens, and prairies. To aid in accomplishing these goals, the Huron-Manistee National Forests sought and received approval for the inclusion of herbicides as a potential tool for the prevention of increased amounts of post-harvest regeneration in areas where efforts of recovery are occurring for the Karner blue butterfly.

Use of Herbicides in the Mast Lake Project

Invasive species are defined as alien species whose introduction does, or is likely to, cause economic or environmental harm or harm to human health (Executive Order 13112 of February 3, 1999). The use of herbicides in the Mast Lake Project is limited to the control of non-native and/or invasive species occurring within the Project Area boundaries. While some of these have been identified in areas that were surveyed prior to the analysis for this project, there are others species and individuals that will undoubtedly emerge as a result of the activities associated with prairie restoration efforts. It is not possible to accurately determine the number and/or types of seeds that have remained dormant in the soil seedbanks in these areas. As a result, the Mast Lake Project has allowed for the chemical treatment of the NNIS that may emerge as the existing trees are cleared and the soils become exposed through the prairie restoration processes.

Registration

Herbicides cannot be distributed or sold in the United States without being registered with the Environmental Protection Agency (EPA). Before registering a new pesticide, or a new use occurs for an existing registered pesticide, the EPA must first ensure that the pesticide (including any adjuvants, surfactants, or other ingredients comprising the product contents), when used according to label directions, can be used with a reasonable certainty of no harm to human health and without posing unreasonable risks to the environment. To make such determinations, the EPA requires more than 100 different scientific studies and tests from applicants.

The EPA classifies these as either general or restricted-use. The criteria for restricted-use include:

1. Danger or impairment to of public health;
2. Hazard to farm workers;
3. Hazard to domestic animals and crops; and
4. Damage to subsequent crops by persistent residues in the soil.
5. No restricted-use herbicides would be proposed for use under any of the alternatives for this project.

Toxicity

Herbicide product labels specify how the material can be used safely and effectively. They are considered to be legal documents. All labels must show the following information:

- product trade name
- name of registrant (usually the manufacturer of the product)
- net weight or measure of the product
- EPA registration number

- registration number of the formulation plant or factory
- an ingredients statement containing the name and percentage of the active ingredient of the product
- percentage of the inert ingredients
- use classification (general or restricted)
- a warning or precautionary statement

Warning and precautionary statements on the product label are concerned with human toxicity and environmental, physical, and chemical hazards associated with each material. Measurements of these hazards are typically described as LD50 or LC50. The LD50 is defined as the dose or quantity of a substance that will be lethal to 50% of the organisms in a specific test situation. It is expressed in weight of the chemical (mg) per unit of body weight (kg). Toxicants may be fed (oral LD50), applied to the skin (dermal LD50), or administered in the form of vapors (inhalation LD50). The LC50 is the concentration of a substance in air or water or continual exposure in the diet that will kill 50% of the organisms in a specific test situation. Each herbicide is assigned a toxicity category based on levels of hazard indicators, with I being the most toxic and IV being the least. The characteristics of each category are displayed in the following table.

Table E.1: Toxicity Categories and Hazard Indicators of Pesticides (1)

	Toxicity Indicators			
Hazard Indicators	**I**	**II**	**III**	**IV**
Oral LD50	Up to and including 50 mg/kg	From 50 through 500 mg/kg	From 500 through 5,000 mg/kg	Greater than 5,000 mg/kg
Inhalation LC50	Up to and including 0.2 mg/L	From 0.2 through 2 mg/L	From 2 through 20 mg/L	Greater than 20 mg/L
Dermal LD50	Up to and including 200 mg/kg	From 200 through 2,000 mg/kg	From 2,000 through 20,000 mg/kg	Greater than 20,000 mg/kg
Eye Effects	Corrosive, corneal opacity; not reversible within 7 days.	Corneal opacity; reversible within 7 days; irritation persisting for 7 days.	No corneal opacity; irritation reversible within 7 days.	No irritation.
Skin Effects	Corrosive	Severe irritation at 72 hours	Moderate irritation at 72 hours	Mild or slight irritation at 72 hours

Source: Radosovich, etal., 1997.

The following table provides a summary of the herbicides that are being proposed for use in the Mast Lake Project.

Table E.2: Basics on the Herbicides Being Considered for Use

	Glyphosate (1)
Chemical Formula	N-(phosphonomethyl) glycine
Herbicide Family	none recognized
Target Species	most annual and perennial plants
Forms	salts
Mode of Action	amino acid synthesis inhibitor
Adsorption Potential	high
Sorption Potential	-
Primary Degradation Mechanism	slow microbial metabolism
Average Soil Half-Life	47 days
Mobility Potential	low
Dermal LD50 for Rabbits	>5,000 mg/kg (Category III)
Oral LD50 for Rats	5,600 mg/kg (Category IV)
LC50 for Bluegill Sunfish	120 mg/L
Common Trade Names	RoundUp®, RoundUp-Pro®, Rodeo®, GlyPro®, Accord®, Glyphomax®, and Touchdown®
Manufacturers	Monsanto, Cenex/Land O' Lakes, Dow AgroSciences, Du Pont, Helena, and Platte.

(1) Tu et al. Weed Control Handbook: Glyphosate. The Nature Conservancy. 2001. http://tncweeds.ucdavis.edu/handbook.html

The information contained in the tables in the following sections has been adapted from EXTONET (Extension Toxicology Network). This is a Pesticide information project of Cooperative Extension Offices from Cornell University, Oregon State University, the University of Idaho, the University of California at Davis, and Michigan State University. This database can be found at http://extonet.orst.edu. The information contained in this database is easily adapted to give the public a general understanding of the herbicides being proposed for use in the Mast Lake Project. In addition, the Forest Forest Service has conducted Risk Assessments on both glyphosate. This is also available on-line (http://www.fs.fed.us/foresthealth/pesticide/risk.shtml).

Glyphosate

Glyphosate is a broad-spectrum, non-selective systemic herbicide used for the control of annual and perennial plants. These plants may include grasses, broad-leaved weeds, and some woody plants. It may

be used on cropland and non-cropland alike. While it is an acid, it's most common form for use is as a salt. It is generally distributed as water-soluble concentrates and powders. The following information refers to the technical grade of the acid form, unless otherwise noted and it should be noted that the Forest Service is in no way involved in the tests that are carried out to determine these effects. For more specific findings, conducted by the Forest Service, the individual Risk Assessments should be consulted.

Toxicological Effects	
Acute Toxicity	Glyphosate is practically non-toxic by ingestion and skin exposure. Some formulations may cause much more extreme irritation of the skin and eyes.
Chronic Toxicity	Studies of glyphosate, lasting up to 2 years, have been conducted with rats, dogs, mice, and rabbits, and with few exceptions, no effects were observed.
Reproductive Effects	Laboratory studies show that glyphosate produces reproductive changes in test animals very rarely, and then only at very high doses. It is unlikely that the compound would produce reproductive effects in humans.
Teratogenic Effects	In a teratology study with rabbits, no developmental toxicity was observed in the fetuses at the highest dose tested (350 mg/kg/day), indicating that glyphosate is not teratogenic.
Mutagenic Effects	Mutagenicity and genotoxicity assays performed on glyphosate have been negative, indicating that the compound is not mutagenic.
Carcinogenic Effects	Rats given oral doses of up to 4,500 mg/kg/day did not show any signs of cancer, indicating that glyphosate is non-carcinogenic.
Organ toxicity	Some microscopic liver and kidney changes, but no observable differences in function or toxic effects, have been seen after lifetime administration of glyphosate to test animals.
Fate in Humans and Animals	Glyphosate is poorly absorbed from the digestive tract and is largely excreted unchanged by mammals. At 10 days after treatment, there were only minute amounts in the tissue of rats fed glyphosate for three weeks. Cows, chickens, and pigs fed small amounts of glyphosate had undetectable levels (<0.05 ppm) in muscle tissue and fat. Levels in milk and eggs were also undetectable (<0.025 ppm). Glyphosate has no potential to accumulate in animal tissue.

Ecological Effects	
Effects on Birds	Glyphosate is slightly toxic to wild birds, with the dietary LC50 in both mallards and bobwhite quail being greater than 4,500 ppm.
Effects on Aquatic Organisms	Technical glyphosate acid is practically non-toxic to fish and may be slightly toxic to aquatic invertebrates. Some formulations may be more toxic to fish and aquatic species due to differences in toxicity between the salts and the parent acid or to surfactants used in the formulation. There is a very low potential for the compound to build up in the tissues of aquatic invertebrates or other aquatic organisms.
Effects on other Organisms	Glyphosate is non-toxic to honeybees. The reported LC50 values for earthworms in soils is greater than 5,000 ppm.

Environmental Fate	
Breakdown in Soil and Groundwater	Glyphosate is considered to be moderately persistent in the soil, with an estimated half life of 47 days. Reported field half-lives range from 1 to 174 days. It is strongly adsorbed to most soils, even those with lower organic and clay content. Therefore, even though it is highly soluble in water, field and laboratory studies show it does not leach appreciably, and has low potential for run-off (except as adsorbed to colloidal matter). One estimate indicated that <2% of the applied chemical is lost to run-off. Microbes are primarily responsible for the breakdown of the product , and volatilization or photodegradation losses will be negligible.
Breakdown in Water	In water, glyphosate is strongly adsorbed to suspended organic and mineral matter and is broken down primarily by micro-organisms. It's half-life in pond water ranges from 12 days to 10 weeks.
Breakdown in Vegetation	Glyphosate may be translocated throughout the plant, including to the roots. It is extensively metabolized by some plants, while remaining intact in others.

Vegetation – The effects of glyphosate on plants include an inhibition or cessation of growth, cellular disruption, and, at sufficiently high levels of exposure, plant death (USDA Risk Assessment – Glyphosate). The time course for these effects can be relatively slow, depending on the plant species, growth rate, climate, and application rate (USDA Risk Assessment – Glyphosate). Glyphosate is absorbed primarily through the foliage, and the absorption is rapid. Glyphosate is not extensively metabolized or detoxified in plants (USDA Risk Assessment – Glyphosate), and is harmless to most plants once in the soil (Hance 1976). Glyphosate binds readily with soil particles, which limits its movement in the environment (Tu et al. 2001). Adsorption to soil particles prevents glyphosate from being taken-up by the roots of plants (Tu et al. 2001). Because glyphosate binds strongly to soils, it is unlikely to enter waters through surface or subsurface runoff except when the soil itself is washed away by runoff, and even then, it remains bound to soil particles and unavailable to plants (Rueppel et al. 1977, Malik et al. 1989). The half-life of glyphosate on foliage has been estimated at 10.4 to 26.6 days (Newton et al. 1984), while residues dissipated from the fruit of exposed plants with a half-life of ‹13 to ‹ 20 days (Roy et al. 1989b).

Birds and Mammals – Glyphosate is of relatively low toxicity to birds and mammals (Evans and Batty 1986). The LD50 of glyphosate is 5,600 mg/kg for rats and ›4,640 mg/kg for bobwhite quail (USDA Risk Assessment – Glyphosate). Glyphosate may cause weight loss in mammals and birds (USDA Risk Assessment – Glyphosate). Inhibition of oxidative phosphorylation, which consequently reduces food conversion efficiency, has been implicated as a possible mechanism by which glyphosate causes weight loss; however, there is not adequate information about terrestrial wildlife from which to make a further assessment about the importance of this mechanism (USDA Risk Assessment – Glyphosate). Glyphosate has not been shown to effect reproduction in birds (Batt et al. 1980, Hoffman and Albers 1984). However, other studies show developmental and reproductive impacts to animals given the highest dose (Tu et al. 2001).

Terrestrial Invertebrates - Data on arthropods indicate a low potential for a direct toxic effect from glyphosate (USDA Risk Assessment – Glyphosate). The honey bee is the standard test organism for assessing the potential effects of pesticides on terrestrial invertebrates. The LD50 of bees is ›100 ug/bee. Data on other arthropods are less detailed but also indicate a low potential for a direct toxic effect from glyphosate (USDA Risk Assessment – Glyphosate). Field applications of glyphosate had no measurable direct effect - as evidenced by increased mortality or significant changes in populations - on isopods, rove beetles, butterflies, and spiders (Samoe-Petersen 1995; Bramble et al. 1997; Haughton et al. 1999, 2001a, 2001b).

Soils - Glyphosate is readily metabolized by soil bacteria (USDA Risk Assessment – Glyphosate). There is very little information suggesting that glyphosate will be harmful to soil microorganisms under field conditions and a substantial body of information indicating that glyphosate is likely to enhance or have no effect on soil microorganisms (Busse et al. 2001; Wardle and Parkinson 1990a,b; Wardle and Parkinson 1991). Laboratory and field studies have reported direct toxic effects on microflora and microfauna including protozoa, algae, bacteria, cyanobacteria, and fungi (Chakravarty and Sidhu 1987, Chakravarty and Chatarpaul 1990, Wardle and Parkinson 1992b, Wan et al. 1998, Issa 1999, Sannino and Gianfreda 2001). However, some researchers found that microorganisms recovered rapidly from treatment with glyphosate, suggesting the herbicide posed no long-term threat (Roslycky 1982, Tu 1994). Glyphosate has also been reported to have stimulatory effects on microorganisms. Several field studies involving microbial activity in soil after glyphosate exposures note an increase rather than decrease in soil microorganisms or microbial activity (Haney et al. 2002; Hart and Brookes 1996; Laatikainen and Heinonen-Tanski 2002; Nicholson and Hirsch 1998).

Aquatic Species - Glyphosate is of moderate toxicity to aquatic species (Tu et al. 2001). The 96-hour LC50 of technical grade glyphosate for bluegill sunfish and rainbow trout are 120 mg/L and 86 mg/L (USDA Risk Assessment – Glyphosate). The 48-hour LC50 of technical grade glyphosate to Daphnia is 780 mg/L, substantially higher than the 96-hour LC50 values in freshwater fish USDA Risk Assessment – Glyphosate). The toxicity of different glyphosate formulations can vary considerably in large part due to what surfactant is used (Tu et al. 2001, USDA Risk Assessment - Glyphosate). For example, the 96-hour LC50 of glyphosate alone is 962 mg/L for Daphnia, but the LC50 of Roundup® drops to 25.5 mg/L because the surfactant in Roundup® formulations, MON0818®, is more toxic to aquatic organisms (Servizi et al. 1987). Despite higher toxicity levels, researchers applying Roundup® with MON0818® or Rodeo® with the surfactant X-77 Spreader® have found that treatments using these formulations do not significantly affect the survival of aquatic invertebrates (e.g., Daphnia) and algae (e.g., diatoms) (Hildebrand et al. 1980, Simenstad et al. 1996). It appears that under most conditions, rapid dissipation from aquatic environments prevents build-up of herbicide concentrations that would be lethal to most aquatic species (Tu et al. 2001). Deformities in free-living amphibians have increased concern for the effects of xenobiotics like herbicides on populations of amphibians. Perkins et al. (2000) found no statistically significant increase in abnormalities in frog embryos exposed to glyphosate formulations, including those with surfactants, at levels that were not lethal. Bidwell and Gorrie (1995) determined that the 48-hour LC50 values for juvenile frogs were 51.8 mg a.e./L for Roundup 360 and 83.6 mg/L for technical grade glyphosate, and the 48-hour LC50 values for tadpoles were 11.6 mg a.e./L for Roundup 360 and 121 mg/L for technical grade glyphosate. Although tadpoles appear to be somewhat more sensitive than juveniles, the reported LC50 values are in the range of those seen in fish (USDA Risk Assessment – Glyphosate). Cole et al. (1997) report no effect on populations of six species of amphibians (based on capture rates) among clearcut sites with and without glyphosate applications.

Additives

Adjuvants are materials that are mixed spray solutions or suspensions to improve the performance, handling, or application of herbicides. They are chemicals and may be a part of the herbicide solution when it is purchased or they may be added later. Terms used to describe adjuvants include activators, additives, dispersing agents, emulsifiers, spreader, stickers, surfactants, thickeners, and wetting agents. Each is unique and promotes different characteristics in the solution. The proposed herbicide application for this project would occur post-emergence (after the target species has emerged in the spring). As a result, it would be anticipated that surfactants would be used to enhance the herbicide effectiveness. According to Radosovich (1997), it is believed that surfactants intensify the activity of herbicides by:

- ✓ creating uniform spreading or wetting on leaf surfaces
- ✓ increasing spray droplet retention
- ✓ improving spray droplet and leaf surface contact
- ✓ solubilizing non-polar plant substances

- ✓ causing enzymatic denaturation or membrane dysfunction

Methods of Application

There are many types of sprayers that are available for use in the application of herbicides. For the spot-treatments proposed under this project, it is likely that application would occur via hand-held spray bottles or backpack sprayers. These are commonly used to apply small quantities of herbicides in hard to access areas. In areas identified for seeding, broadcast spraying of herbicides may occur to prepare the seedbed. While these areas will not exceed 10% of stand acreage, they may be larger than what can be reasonably treated with either hand-held spray bottles or backpack sprayers. In these locations, mounted boom sprayers may be utilized. For this project, the method of application would be determined on a site-by-site basis and would be selected to provide the maximum benefits with the least amount of residual effects. Following, is a brief description of the equipment mentioned:

Hand-held Spray Bottles – Typically hold up to one quart of spray mixture. There is a spray filter within the bottle (attached to the outlet tube) to prevent impurities from clogging the spray mechanisms. Trigger may be manually or battery operated. Used for spot-treatments in isolated areas or in areas where the type of vegetation requires targeted applications of low volume quantities.

Backpack Sprayers – Compressed air sprayer with a harness that allows it to be carried on the applicators back. Pressure within the tank is obtained through the pumping of a hand-lever. An adjustable spray hose is operated by the other hand. A mechanical agitator plate may be attached to the pump plunger. Some sprayers may generate pressures of up to 100psi or more. The volume capacity of these sprayers is usually 5 gallons. These sprayers are common for the spot-treatment of herbicides in both agriculture and forestry.

Boom Sprayers – These are low pressure sprayers that are often equipped with sprayer booms ranging from 10 to 60 feet in length and containing several nozzles. Typically, the height of the boom is easily adjustable to meet the needs of the job. Many nozzle arrangements are possible, and special-purpose booms are available.

Timing of Application

All of the herbicides being considered for use under this project are considered to be post-emergent. This means that the chemicals would be applied to the foliage or the cut stump after the target plants have emerged. The applied herbicides then translocate from the point of application throughout the plant. Herbicides with this mode of action are referred to as systemic and promote the suppression of root, rhizome, or shoot growth at a considerable distance from the point of application (Radosovich, etal, 1997). The process of contact, penetration and movement of herbicides through plants is called absorption. For the sake of this project, the following three steps of adsorption would be pertinent:

1. retention of spray droplets on the leaf/stump surface;
2. the penetration of the herbicide into plant cells; and
3. movement into the cytoplasm of the plant cell.

The timing of the herbicide application for this project would be partially dependent on the life cycle of the Karner blue butterfly. These considerations would be most applicable in stands showing a surveyed presence of this species and the pertinent mitigation measures would be adhered to. In the stands without a historical or surveyed presence of this species, the timing would be determined based on the likelihood of effectiveness. This varies by target species and recommendations are given in the product label. In addition to the time of year, consideration would also be given to the micro-climate (i.e. soil type, topography, etc.) of the treatment areas and the current and anticipated weather. This would be done to ensure that an adequate spray window was utilized in the right location to maximize effectiveness.

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