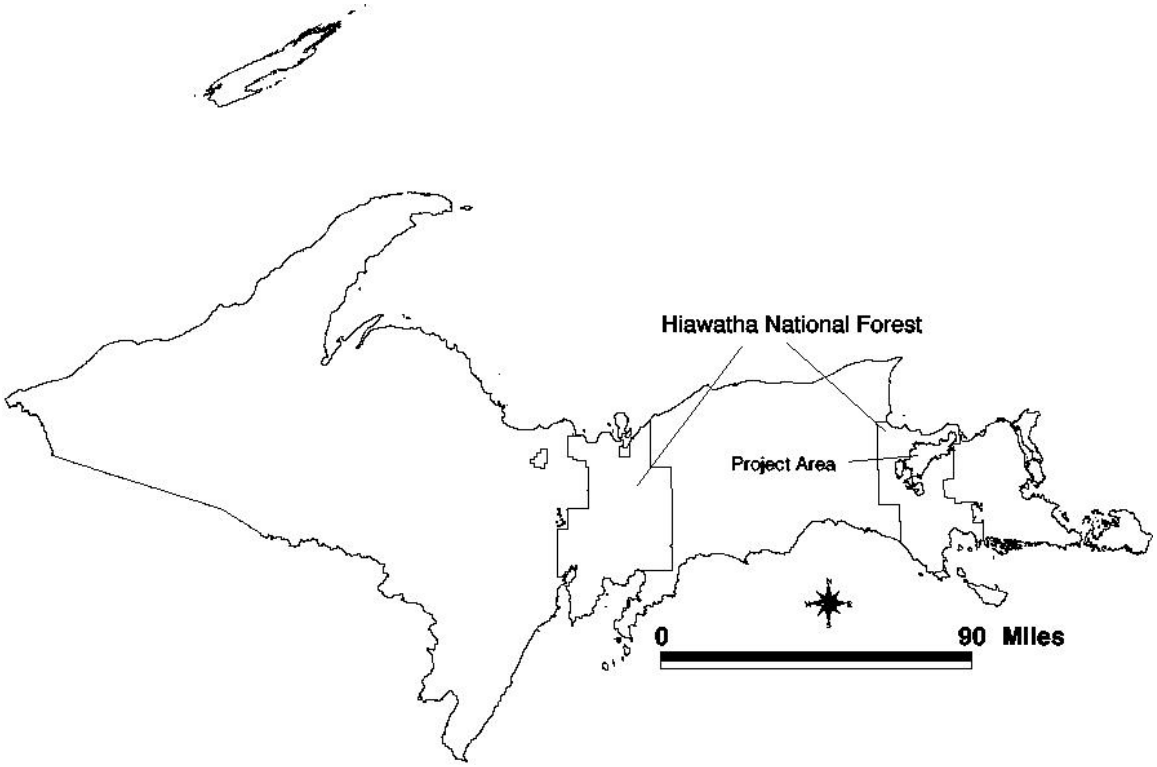
RACO PLAINS ECOSYSTEM MANAGEMENT ENVIRONMENTAL ASSESSMENT



Sault Ste. Marie Ranger District
Hiawatha National Forest
Chippewa County, Michigan
USDA Forest Service, R-9

Responsible Official:
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June 2004

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Table of Contents

List of Tables

List of Figures

CHAPTER 1. PURPOSE OF AND NEED FOR ACTION

INTRODUCTION

The Eastside Administrative Unit (Sault Ste. Marie and St. Ignace Ranger Districts) of the Hiawatha National Forest (HNF) is proposing a project in the Raco Plains Landtype Association (LTA) in Chippewa County, Michigan to determine the best way to manage a jack pine ecosystem on the Sault Ste. Marie Ranger District. The Raco Plains project area is located approximately 20-30 miles southwest of Sault Ste. Marie, Michigan (figure 1-1). The HNF prepared this environmental assessment (EA) in order to examine the probable effects of the proposed activities as well as alternatives identified during the assessment process.

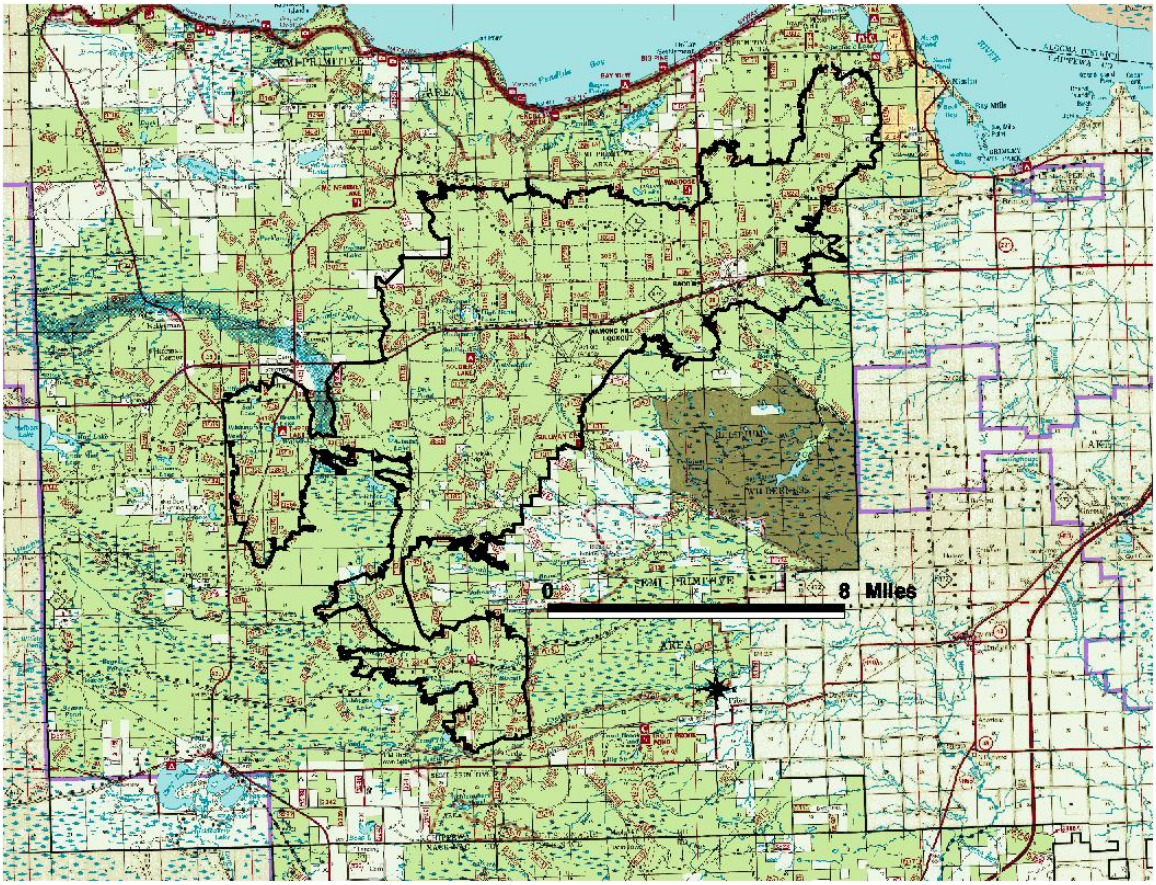

Figure 1 - 1. Vicinity Map.

The legal description of the project area is T44N, R4W, sections 5-8, & 18; T44N, R5W, sections 1-5, & 9-12; T45N, R4W, sections 4-9, 17-19, & 30; T45N R5W, sections 1-36; T45N, R6W, sections 13, 24, & 25; T46N, R3W, sections 2-9, 16-19, 30, & 31; T46N, R4W, sections 1-34; T46N, R5W, sections 12-15, 22-28, & 32-36; and T47N, R3W, sections 22, 23, 26, & 27, Chippewa County, Michigan.

This EA is tiered to the *Final Environmental Impact Statement of the Land and Resource Management Plan for the Hiawatha National Forest, Record of Decision* (Forest Plan) dated October 24, 1986. It was prepared pursuant to the National Environmental Policy Act (NEPA), National Forest Management Act (NFMA), and other applicable laws and regulations (see appendix I). The Forest Plan describes the desired future condition of the HNF and lists standards and guidelines to address how these conditions can be achieved.

On the basis of the material in the project file and analysis in this document and the project biological evaluation (BE), the Forest Service needs to determine whether the Proposed Action, or an alternative meeting the basic project purpose, is in the public interest and consistent with management of the Raco Plains project as specified in the Forest Plan. In making this determination, the Deciding Official will make the following set of decisions:

- Whether or not to proceed with an action alternative, and if so identify the site-specific location of appropriate management activities.
- The District Ranger must decide if the project would have no significant effects to the human environment or if an environmental impact statement must be prepared.

There are approximately 63,000 acres in the project area that is delineated by the Raco Plains LTA boundary. The Forest Service is evaluating options to implement the Forest Plan by designing a variety of resource management activities that include timber harvest and regeneration, changes to the transportation system, timber stand improvement, fuels management, wildlife habitat improvement projects, and others. In the Raco Plains project area much of the jack pine is more than 60 years old and trees are showing needle defoliation caused by the jack pine budworm *(Choristoneura pinus pinus*). Jack pine stands host cyclical populations of jack pine budworm (JPBW) and older trees are more susceptible to defoliation and mortality. To minimize the impacts of budworm defoliation, the Forest Service is looking at ways to improve the vigor of jack pine stands and develop more evenly distributed jack pine age-classes. The recommendations include activities that would likely begin in 2004, if an action alternative were selected.

BACKGROUND INFORMATION

A planning document, *Preliminary Landscape Assessment, Raco Plains Ecosystem Management Project* (10/21/03), was recently prepared by staff of the HNF. The intent of the document was to provide background information pertinent to future resource management and decisions in the Raco Plains LTA. The preliminary assessment provided background information including a comparison of the existing condition and the Forest Plan Management Area direction for several resource areas. The preliminary assessment also provided purpose and need statements and possible management activities to implement the Forest Plan in the Raco Plains area. The information in the document provided the foundation for the Purpose and Need section and the proposed activities in this EA. The preliminary assessment document is housed in the project file and the background information is summarized below.

Jack pine with serotinous cones and flammable resins is well adapted to wildfire and depends on wildfire for reproduction and survival. The jack pine budworm and fire are natural processes in the life-cycle of jack pine forests. As caterpillars feed on jack pine needles, mature and over-mature trees become stressed and portions of trees or entire trees die. Over time, the three-way relationship among jack pine, JPBW, and fire perpetuates regeneration of jack pine, ensuring the continued availability of hosts for the budworm (McCullough 2000).

Prior to the middle 1800s the dry nature of the Rubicon soil, the natural flammability of jack pine foliage, and other factors produced a landscape prone to the periodic wildfire that sustained jack pine forests on the Raco Plains over the millennia. Fires varied in frequency, duration, and intensity. In some places fire opened cones and revegetated the areas to jack pine. In other areas more frequent fire burned away succeeding plants to leave grassy openings called pine barrens (appendix G–Maps; figure G – 5, Pre-settlement Vegetation). Perhaps the most dramatic change in the Raco Plains landscape over the last 150 years has been the reduction of open-land over time due primarily to fire suppression and reforestation efforts, starting with the Civilian Conservation Corp work in the 1930s. Jack pine, red pine, and open-land dominated the Raco Plains in the pre-settlement era as they do today, but the relative proportions have changed over time (figure 1-2). Pre-settlement vegetation information is presented (Comer et al. 1998) as a general reference point to compare broad-scale landscape changes over time.

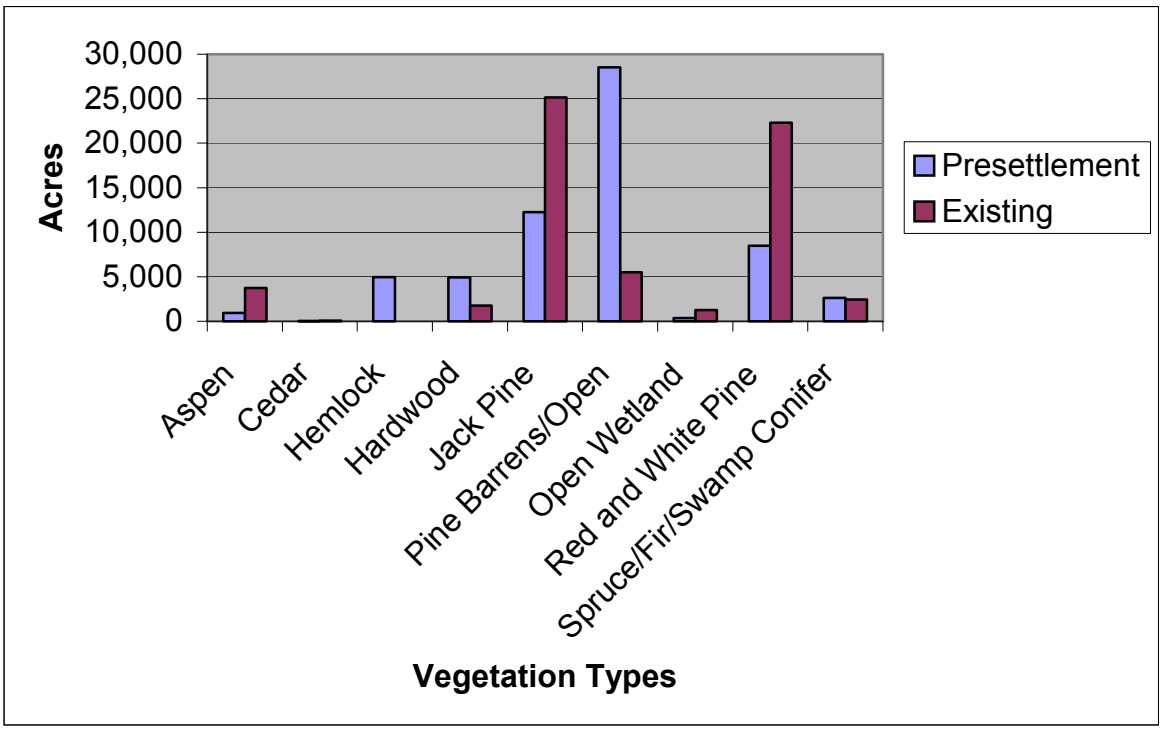

Figure 1 - 2. A Comparison of Pre-settlement and Existing Vegetation in the Project Area.

Three recent large resource management projects have been implemented in the Raco Plains LTA. The *Raco Plains Jack Pine Budworm Ecosystem Project EA* was signed in June 1993, the *Betchler Marsh Project EA* was signed in June 1996, and the *Brimley Grade Project Set EA* was signed in April 1997. These EA projects together generated approximately 15,000 acres of silvicultural treatments within the LTA, with a primary objective of clearcut-salvage in jack pine stands showing budworm mortality. The resulting landscape is a patchwork of non-forest, young regenerating forest, and mature forest (appendix G-Maps; figure G – 6, Existing Vegetation).

In spite of the recent jack pine clearcut-salvage projects in Raco Plains there is still a large amount of jack pine over the age of 60 years (figure 1-3).

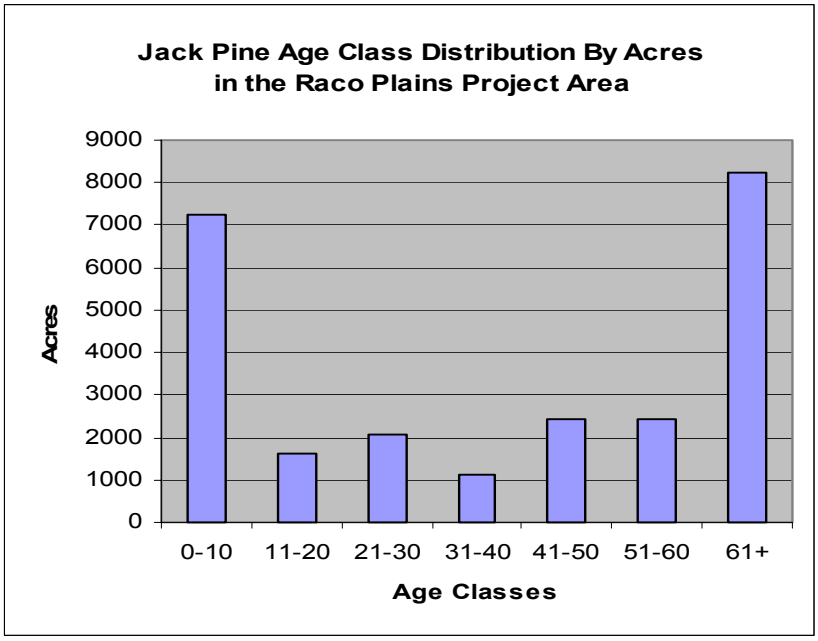

Figure 1 - 3. Jack Pine Age-class Distribution (10-year classes) in Raco Plains LTA, December 2003.

The jack pine budworm is a small needle-feeding caterpillar that feeds almost exclusively on jack pine. Forest managers can expect periodic outbreaks of this native North American insect to occur every six to ten years and persist for two to three years. A model was used to rank jack pine stands in the Raco Plains project area according to hazard of economic loss. The model: The Lake States Jack Pine Budworm Decision Support System (McCullough et al. 1998) was developed to estimate jack pine budworm impact in jack pine stands and to assist forest managers in decision making. Jack pine stands in the project area were also mapped according to existing degree of stand mortality using data collected during recent compartment examinations where the non-living proportion of jack pine stands were recorded as dead trees (snags) or "spikes" with a dead upper canopy. Based on the hazard and mortality factors a total of 8,480 acres of budworm affected jack pine stands in the project area were prioritized and mapped.

Using the priority for budworm treatment map as a base, stands were evaluated for spatial criteria. For example, the HNF has a 300-acre temporary opening size limit in sharp-tailed grouse habitat (Forest Plan page IV-33 and appendix P). The Preliminary Assessment Team made the assumption that an adjacent stand must be at least 20 years old (20 years has been shown locally to be the age at which regeneration harvests that created openings, are no longer openings, as defined in the Forest Plan) to be considered no longer a temporary opening. It became evident that it would be necessary to exceed this 300-acre limit to manage the budworm situation, and provide quality wildlife habitat and fuel breaks. Fuels management and wildfire safety were important considerations in developing the recommendations.

Stands recommended for treatment were also evaluated for wildlife and threatened, endangered, or sensitive species (TES) criteria. There is a good opportunity for managers to integrate jack pine salvage with fire-ecology, open-land restoration, and TES management. While the HNF has met the minimum vegetative composition objectives for red pine and jack pine, there is still a need for more permanent upland openings. Other wildlife and TES considerations included:

- Ability to consolidate and restore large openings and barrens habitat.
- Ability to consolidate jack pine habitat and create optimal jack pine spatial distribution.
- Ability to protect and enhance management indicator species (MIS) and TES habitat.
- Ability to prevent the spread of noxious weeds and favor native species in openings.

A roads analysis for the project area was conducted in conjunction with the EA. The roads analysis is not a decision document but is necessary to make an informed decision. At a minimum, the roads analysis identifies: needed and unneeded roads; road-associated environmental and public safety risks; site-specific priorities and opportunities for road improvements and decommissioning; areas of special sensitivity, unique resource values, or both; and any other information that may be needed to support project-level decisions.

There are opportunities to coordinate and integrate recreation management with silvicultural and fuels treatments, especially around high use areas such as Soldiers Lake.

DESIRED CONDITION

The desired future condition (DFC) is a long-term vision for what the HNF should look like (Forest Plan; chapter IV 1-207). There are four Forest Plan Management Areas (MA) within the project area and each MA has its own set of goals, objectives, DFC, and standards and guidelines (figure 1-4 and table 1-1). The project area MAs have guidelines for vegetative composition and age-class-distribution of various forest types. Management areas also provide guidelines for salvage, old growth designations, non-forest composition percentages, visual quality, etc. There are proposed activities in only two of the four MAs within the project area (MAs 4.2 and 4.4). No activities are recommended in MAs 4.3 or 8.1 due to limited amount of budworm outbreak. Bounding the project with an LTA line will facilitate a complete analysis of a single ecological unit.

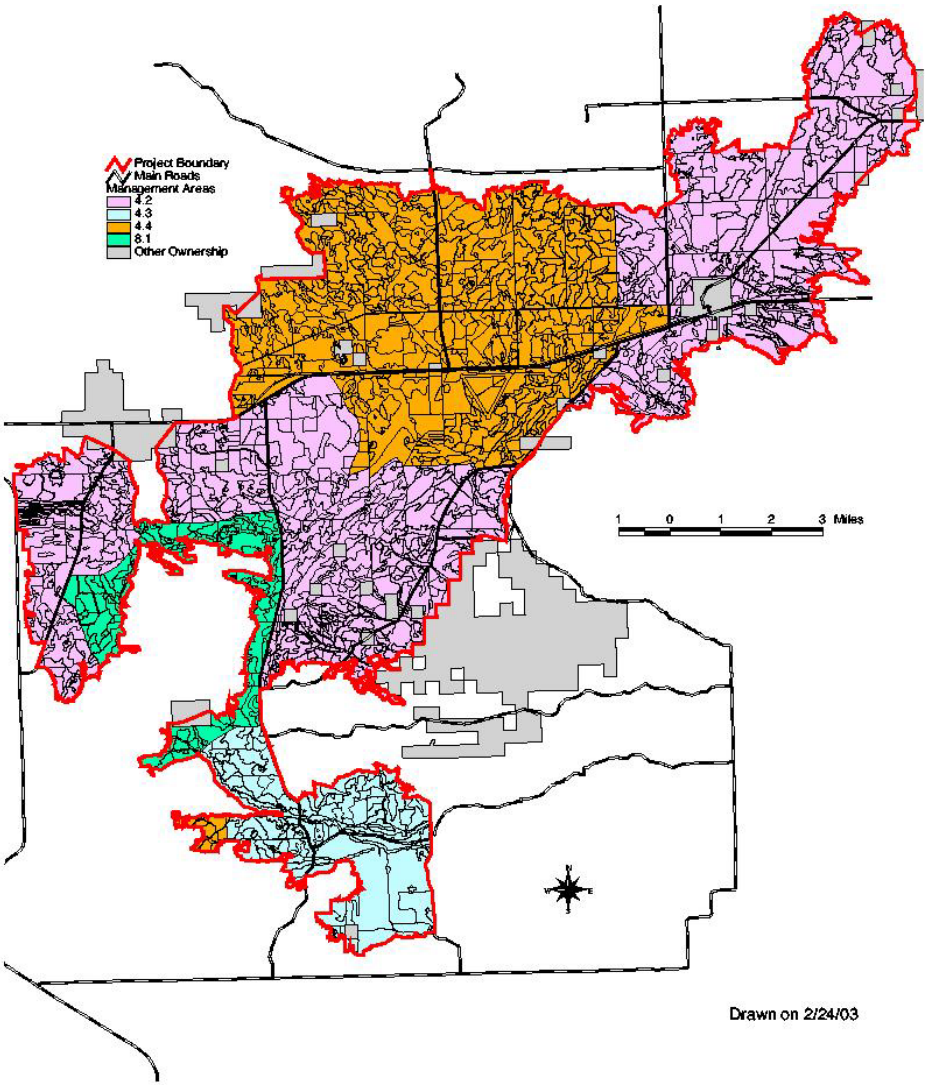

Figure 1 - 4. Management Areas.

Table 1 - 1. The Project Area Encompasses Four Management Areas.

MA	Summarized Purpose of MA	Acres within Project Area	Activities Proposed in MA
MA 4.2	The emphasis is to produce conifer sawlogs, and provide conifer stands that are favored by wildlife species.	31,902 acres	Yes
MA 4.3	The emphasis is dispersed recreation, fish outputs, developed recreation, conifer management for sawlog production, non-game wildlife outputs.	6,533 acres	No
MA 4.4	The emphasis is habitat production for upland wildlife species, conifer management for fiber production, dispersed recreation.	20,983 acres	Yes
MA 8.1	The purpose of this area is protection of significant biological, geological, or cultural features.	3,785 acres	No
Total		**63,203 acres**	

Using the Forest Plan and the ecological and social characteristics of the Raco Plains project area, the Interdisciplinary (ID) Team has articulated the following desired future condition for the area.

The landscape is predominantly level across the sandy outwash plains. The area is dominated by coniferous forest (jack pine, spruce-fir/swamp conifer, and cedar), open lands, and small amounts of wetlands (riparian areas, marshes, fens, forested swamps, shrub swamps).

The Raco Plains ecosystem is healthy and diverse. The natural productivity of the soil types, ranging from low to moderate, is maintained or improved to allow for a full range of vegetation successional pathways. Trees of all ages (young to old) are present in the area. There is evidence of the influence of natural processes on the area, primarily wetland fluctuations, wind throw, and fire (both controlled and wildfire). Hydrology is functioning in a natural manner and supports the range of potential ecosystem characteristics represented in vegetation and soils. Jack pine budworm is recognized as a native insect that is a member of a healthy, functioning jack pine ecosystem. Management of jack pine budworm focuses not on eliminating it but rather on reducing timber loss. The age-class distribution of jack pine stands is such that the potential for future outbreaks is reduced and the forest and wildlife are healthy, vigorous, and sustainable.

Management activities are directed toward restoring a natural (historical) fire regime across the Raco Plains landscape. The area will move towards a Fire Regime Condition Class (FRCC) rating of 1 (defined by the Healthy Forest Act of 2003). The area will be within the natural range of variability in terms of vegetation composition, fuels, fire frequency, severity, and pattern. Jack pine forests are recognized as highly flammable fire-dependent ecosystems. Fire in these systems can provide resource benefits, but fire risk is managed primarily to protect property and human safety. Prescribed burns are used where possible to maintain open areas for wildlife benefits where soils support marginal tree growth. These open areas function as firebreaks and provide some protection to stands downwind. Vegetation in openings is comprised of native species of grasses and sedges, forbs, and low shrubs such as blueberries. These fuel breaks also provide habitat for area-sensitive open land species such as northern harrier, sharp-tailed grouse, and upland sandpiper. They provide potential habitat for sensitive plant species characteristic of pine barrens, such as Hill's thistle, under a more natural disturbance regime.

Many of the jack pine stands are managed for dual benefits, for timber harvest, and habitat for Kirtland's warbler (KW), a Federally-listed endangered species. Jack pine regeneration is increased to about 1,089 trees/acre in blocks of 100 to more than 700 acres to provide suitable habitat for KW breeding when the stands are from 5 to 23 years old. Stands are harvested at normal rotation age of 50 years. The HNF as a whole contributes habitat for many breeding pairs to help meet the recovery goal of at least 1,000 pairs for KW. Adaptive management of

jack pine regeneration seeks techniques for dense regeneration on suitable sites. About one quarter of the area in potential KW habitat is maintained as openings for use of the breeding birds. These openings also function as potential habitat for sensitive plant species such as Canada rice grass. The reduced road densities found in jack pine managed in larger blocks helps to reduce fragmentation of wildlife habitat and aids in prevention of weed introduction.

Habitat is available for other wildlife species associated with jack pine, including spruce grouse, red squirrel, and others such as neo-tropical migratory songbirds. There are also small amounts of wetland habitat used by invertebrates, amphibians, reptiles, birds, and mammals. The swamp conifer habitat provides habitat for deer, fisher, pine marten, bobcat, and potentially lynx.

Portions of the forest are retained and allowed to become old growth. Old growth characteristics such as large amounts of dead and down woody material, large diameter and old-age trees, and super canopy trees are common within the old growth system.

Lakes, ponds, rivers, streams, and riparian areas provide quality habitats for a variety of aquatic and aquatic-dependent plant and animal species. Large woody debris is common, creating structurally diverse habitats capable of sustaining productive cold and warm-water communities. Management practices provide the physical and chemical properties necessary for a productive, self-sustaining cold-water community and protect against the introduction of sediment and invasive exotic or otherwise unwanted species.

Habitats for threatened, endangered, sensitive, and management indicator plant and animal species are protected and populations contribute to maintaining viable populations for the species across their range.

Exotic plant species are not introduced and current populations are controlled or eliminated. Locally native or desired non-native plant materials are used for revegetation projects.

The transportation system is the minimal system required that best serves current and anticipated management objectives and public use in a safe, efficient manner. Road densities given in the Forest Plan by MA are not exceeded. Temporary roads used for management are decommissioned after use and returned to a vegetated state.

Recreation opportunities fit within the landscape and ecosystem. A variety of plants and animals are present for viewing or consumptive uses. Dispersed recreation activities are predominant and depend upon land, water, and snow resources. Recreation activities common in the area are berry picking, hunting, trapping, camping, snowmobiling, and bird watching. The North Country Trail (NCT) is maintained to the standards established for the trail by the National

Park Service. Snowmobile trails are maintained. Trails and recreation sites are maintained to standard and have minimal impact on the natural resources of the area. Heritage resources are protected.

A diversity of views are managed for, including openings, vistas, mature forests, young forests, park-like old-forest stands, and areas where natural forces are evident. The scenic integrity of views from highways, lakes, trails, and recreation sites in the long term, is retained or restored.

Jack pine is managed for a balanced age-class structure to provide wildlife habitat, and timber products. Red pine stands are thinned as needed to improve growth. Aspen and hardwoods remain a minor component of the overall system and are managed to provide wildlife habitat and timber products. High levels of snag, den, and seed trees (biological legacies) are retained in managed areas to provide wildlife habitat, recycling of nutrients, and ecological structure.

PURPOSE OF AND NEED FOR ACTION

The following statements are the purpose of and need for the project.

1. Reduce impacts of jack pine budworm, improve vigor, increase growth rates in jack pine stands, and create a more evenly distributed age-class.

Approximately 8,100 acres of the jack pine in the project area is more than 60 years old. In MA 4.4, the Forest Plan (p. IV-122) directs that for desirable age-class distribution in jack pine (in stands managed for timber purposes) no stands older than 60 years of age be retained. Jack pine stands generally begin to lose vigor and disintegrate after 55 to 60 years. Many jack pine stands were impacted by the budworm during the 1991/1992 outbreak and have high mortality and many dead tops. Many of these stands are showing some defoliation from the 2000/2003 outbreak. In the areas where jack pine would be harvested, site preparation to reduce slash and to expose mineral soil would be required soon after harvest to ensure adequate regeneration. Site preparation would be performed prior to reforestation. There is a need to create a more evenly distributed age-class structure to provide a steady flow of timber products. There is a need to improve the vigor of jack pine stands and to develop stands that have a high basal area in order to reduce mortality from budworm infestations, increase growth rates, and provide wildlife habitat. Due to the extensive budworm harvests conducted recently with the *Raco Plains Jack Pine Budworm Ecosystem Project, Betchler Marsh Project*, and *Brimley Grade Project Set* EAs, and the large existing acreage over 60 years of age, there is a need to create temporary openings larger than 300 acres.

2. Manage vegetation to restore and improve habitat for Threatened and Endangered, and Region 9 Sensitive Species (TES); and Hiawatha National Forest Management Indicator Species (MIS).

There is a need to meet guidelines established in the Lynx Conservation Assessment and Strategy for Canada lynx. There is a need to provide large blocks of jack pine regeneration well-stocked to an average of 1,089 trees per acre for Kirtland's warbler. There is a need to explore jack pine regeneration techniques to develop cost-efficient methods to provide high quality and well-stocked stands of jack pine regeneration that is suitable for KW. There is a need to retain some mature and over-mature stands of jack pine or other forest types to provide habitat to maintain viable populations of black-backed woodpecker, spruce grouse, red-shouldered hawk, and goshawk.

There is a need for more acres of upland openings to meet Forest Plan direction and provide wildlife habitat. Openings and pine barrens provide optimum habitat to maintain viable populations of area-sensitive wildlife (species that use large patches of habitat) such as sharp-tailed grouse, sandhill crane, merlin, and northern harrier. There is also a need to maintain existing barrens habitat in a high quality condition using prescribed burning and mechanical tools. There is a need to provide suitable habitat for Forest Plan MIS.

There is a need to prevent or control the spread of noxious weeds which can impact ecosystem integrity and crowd out viable populations of native species and species-at-risk.

Due to the extensive budworm harvests conducted recently with the *Raco Plains Jack Pine Budworm Ecosystem Project, Betchler Marsh Project*, and *Brimley Grade Project Set* EAs, the large existing jack pine acreage over 60 years of age, the historic barrens nature of the LTA, and the habitat requirements of area-sensitive openland species, there is a need to maintain and create large permanent openings and savannas.

3. Provide useable wood products to local markets; improve timber age-class distribution, vigor, and growth rates on merchantable stems; and ensure a more even flow of wood products in the future.

The Forest Plan identifies a maximum annual total timber-sale program quantity of 75 million board feet (mmbf) (Forest Plan EIS appendix G-8). This project would contribute to the planned annual timber supply from the HNF to meet the demand for wood fiber within northern Michigan. This project has the potential to generate receipts through the sale of timber products that would produce returns to the U.S. Treasury and local counties.

There is a need to increase red pine representation in the 71-120 age-class and to conduct final harvests in red pine plantations as described in the Forest Plan. There is a need to regenerate mature red pine sites to young pine using natural regeneration methods such as seed tree retention, seeding, and prescribed burning where possible. There may be a need to plant pine on the sites where burning is not feasible or unsuccessful. There is a need to improve red pine growth by thinning over-stocked stands and implementing timber stand improvement (TSI) to meet Forest Plan guidelines.

4. Manage an efficient transportation system through construction, reconstruction, maintenance, and decommissioning of roads.

A roads analysis for the project area has been conducted and tiers to the Forest wide Roads Analysis Process. The roads analysis is not a decision document but is necessary to assist the decision maker in making an informed decision. At a minimum, the roads analysis identifies: needed and unneeded roads; road associated environmental and public safety risks; site-specific priorities and opportunities for road improvements and decommissioning; areas of special sensitivity, unique resource values, or both; and any other information that may be needed to support project-level decisions. The Roads Analysis Process focuses on the two MAs where projects are proposed but may also address roads across the project area.

5. Reduce the potential impacts of wildfire in specific areas to protect residents, visitors, and facilities.

There is a need to restore components of a natural (historical) fire regime across the Raco Plains landscape. There is a need to move the area to a better Fire Regime Condition Class rating (Healthy Forest Act of 2003). There is a need to manage fuel accumulations and increase fire-fighting options in specific areas such as near recreation areas and homes. There is a need to conduct vegetation treatments that would have multiple purposes that include fuels reduction. For example, clearcut-salvage treatments provide temporary firebreaks and reduce long-range spotting potential by removing tall flammable jack pine trees. Long range spotting is a characteristic of extreme wildfire behavior and makes wildfires difficult to control. Although young jack pine stands are also flammable, especially in spring, long range spotting and extreme fire behavior is reduced since the trees and subsequent flame length are shorter. Permanent openings and savannas provide effective firebreaks, anchor points, and safety zones that help firefighters control wildfires. Fuels reduction projects in conjunction with vegetative management activities are designed to reduce the likelihood or potential severity of wildfire to protect human life and property value.

6. **Improve recreation experiences by management of vegetation and access around high-use recreation sites.**

The jack pine stands around Soldiers Lake Campground, North Country Trail, and snowmobile trails are showing mortality due to jack pine budworm and old-age. There is a need to treat these stands to salvage the dying jack pine, to reduce fuel accumulation and flammability, and to increase aesthetics or recreational values.

THE PROPOSED ACTION (ALSO REFERRED TO AS ALTERNATIVE 2)

Temporary opening size limitations were established in the Forest Plan, under National Forest Management Act direction. The Proposed Action would have temporary openings created by even-aged timber management greater than 300 acres, which if implemented, would exceed the limits set in the Forest Plan (see appendix G, Maps; figure G-1). Larger size openings are needed to meet Purpose and Need statements #1, #2, and #5. For example, jack pine stand size needs to be large to support KW and sharp-tailed grouse breeding. Harvest blocks should simulate the scale of natural disturbances, such as fire, if

KW and sharp-tailed grouse are to use the habitat. Stand size can range from a minimum of 150 acres to several thousand acres.

The proposed activities are described in tables 1-2 and 1-3, and mapped in appendix G– Maps; figure G – 1, Alternative 2 (Proposed Action).

Table 1 - 2. Proposed Activities for Alternative 2.

Activity	Acres	Primary Resource*	Comments
Jack pine clearcut-salvage	6,358	tm, wl, fuel	High priority budworm damaged stands (note several units are larger than 300 acres).
Site prep for natural regeneration of jack pine	2,826	tm, wl, kv	Chop/chain/seed.
Site prep for planting of jack pine	3,064	tm, wl, kv	Chop/chain bracke or just bracke.
Natural regeneration of jack pine – standard stocking	1,654	tm, wl, kv	Target approximately 800 trees/acre.
Natural regeneration of jack pine – higher stocking	1,172	tm, wl, kv	Target approximately 1,089 trees/acre to provide suitable KW habitat.
Plant jack pine – standard stocking	1,281	tm, wl, kv	Target approximately 800 trees/acre.
Plant jack pine – higher stocking	1,783	tm, wl, kv	Target approximately 1,089 trees/acre to provide suitable KW habitat.
Jack pine seedtree cut and underburn – higher stocking	145	tm, fuel, wl	Regenerate jack pine, target approximately 1,089 trees/acre. Remove seed trees after regeneration is established.
Jack pine removal cut	94	tm, rec, fuel	Around Soldiers Lake.
Create savanna and restore barrens habitat	366	wl, fuel	Convert from jack pine and also create fuel breaks. Retain all red/white pine, hardwood, and some jack pine.
Create upland opening	23	wl, fuel, kv	
Maintain upland opening	2,500	wl, fuel, kv	Maintain existing open areas with prescribed fire, brushog, etc.
Red pine thinning	797	tm	
Red pine clearcut and plant	131	tm, kv	Plant red pine.
Red pine shelterwood or seedtree cut and burn	294	tm, kv, fuel	Convert from jack pine with salvage-clearcut and burn to regenerate red pine on 166 ac. 128 ac. existing red pine stands. Remove shelterwood after regeneration is established.
Jack pine clearcut-salvage, site prep, and red pine plant	302	tm, kv, fuel	Convert from jack pine with salvage-clearcut.
Weed removal and monitoring	20	wl, kv	
Monitor reforestation and KW	7,324	kv, wl	Costs, success, failure.

*tm=timber management, wl=wildlife, fuel=fuels management, rec=recreation program, kv=sale receipts

Table 1 - 3. Proposed Transportation Activities for Alternative 2.

Activity	Miles
New classified road construction	1.0 miles
Add unclassified road to system	3.0 miles
Temporary road construction	13.0 miles
Road decommissioning	10.1 miles
Road decommissioning after use	3.7 miles
Road maintenance	25.5 miles
Road reconstruction	0.4 miles

DECISION FRAMEWORK (DECISION TO BE MADE)

Given the purpose and need, and DFC the Deciding Official reviewed the alternatives and the environmental consequences in order to make the following decisions:

1. Whether or not to clearcut-salvage and harvest timber and if so, the selection and site-specific location of appropriate timber management practices (silvicultural prescription, logging system, fuels treatment, and reforestation); road construction/ reconstruction/maintenance/decommissioning necessary to provide access and protect resources.
2. Whether or not to maintain existing wildlife habitat and/or create new habitats.
3. What, if any, specific project monitoring requirements would be needed to ensure design criteria are implemented and effective.
4. Whether or not to adopt the design criteria and mitigation measures.

PUBLIC INVOLVEMENT

Scoping for the *Raco Plains Ecosystem Project EA* involved several different types of activities intended to identify specific resource issues and concerns associated with the project area. In December 2003, the ID Team conducted scoping to identify issues and concerns. On December 8, 2003 over 500 letters were mailed to adjacent landowners and to individuals and organizations on the HNF Eastside mailing list. A notice appeared in the Sault Ste. Marie *The Evening News* newspaper on December 10, 2003 along with a short article regarding the proposed project. Team members interacted by phone, fax, and email, and participated in periodic conference calls to discuss the project. The scoping process resulted in a variety of responses to the Proposed Action (Alternative 2) and comments concerning the Raco Plains project area in general. About 33 responses were received. The issues were identified and how they were addressed in developing the EA is summarized in the following subsections. Since the project exceeded the 300-acre Forest Plan limit, the public also had an opportunity to comment directly to the Regional Office on the clearcut size proposals. The 30-day notice and comment period will take place separately from the scoping period.

ISSUES CONSIDERED AND ADDRESSED IN THIS ANALYSIS

Issues represent discussion or debate regarding environmental effects of the proposed activities. They are developed from comments within and outside the Forest Service. Key issues are used in the analysis for formulating alternatives, developing design criteria, and tracking effects. Analysis issues were used to track issues through the process but did not have alternatives developed.

The scoping comments received in response to the Proposed Action (Alternative 2) were carefully reviewed by the ID Team and categorized (see appendix C, Response to Scoping Comments). Some comments were addressed in appendix C, some were addressed through the analysis process, and some were used to develop issue statements. The key issues are described below and were used to develop alternatives. Alternatives may be designed to address more than one issue.

ISSUES USED TO DEVELOP ALTERNATIVES

Issue #1. Roads and Accessibility. Scoping has pointed to an issue related to the type and amount of roadwork proposed by the Forest Service. Some people believe all Forest roads currently open to traffic should remain open unless there are reasons for the roads to be closed. Others express the opinion that the Forest Service should close and/or decommission more roads. There were some comments where specific roads were proposed for decommissioning or closure (see appendix C; Response to Comments).

Methodology: The ID Team developed alternatives that have varying levels and types of road construction and decommission. A Roads Analysis Process (project file) was used to identify road management opportunities in the Raco Plains LTA. Major factors that affected the alternative design include the amount and spatial arrangement of various types of road construction and decommission actions across the project area, as they relate to needed access.

Issue Evaluation Criteria: The criteria used to evaluate the components of this issue and the variations between alternatives include:

- *Defining the road activity proposed.*
- *Explaining the reasons for the road activity proposed.*
- *Summarizing road density by MA using Forest Plan guidelines.*
- *Comparing miles of roadwork by maintenance, decommissioning, new construction, temporary, and reconstruction.*
- *Discussing impacts of roads on Sullivan Creek Fish Hatchery water quality.*

Issue #2. Kirtland's Warbler Habitat. Scoping has pointed to an issue related to the amount of jack pine habitat proposed by the Forest Service. Some people think there should be more acres of young jack pine managed to provide habitat for Kirtland's warbler (KW). Kirtland's warbler require large stands of well-stocked young jack pine.

Methodology: The ID Team developed alternatives that have varying levels and types of vegetation and age objectives to achieve a desired landscape design across the Raco Plains project area. Major factors that affected the alternative design include the amount, spatial arrangement, stocking levels, and age-class-distribution of jack pine habitat suitable for KW.

Issue Evaluation Criteria: The criteria used to evaluate the components of this issue and the variations between alternatives include:

- *Defining the relationship between fire, habitat, and populations.*
- *Explaining the relationship between jack pine and KW and suitability of Raco Plains for KW.*
- *Explaining the age-class-distribution and sustainability of jack pine forest type.*
- *Displaying acres of harvest and type of treatment for various forest types.*
- *Displaying the economic and physical implications of creating additional KW habitat.*
- *Discussing the adaptive management design criteria (chapter 2).*
- *Evaluating trees/acre stocking survey data for Raco Plains LTA generated from recent projects (Brimley Grade, Raco Plains Jack Pine Budworm Ecosystem Project, and Betchler Marsh EAs, etc.) to predict success of planned treatments.*
- *Displaying results of growth and yield models run at different stocking levels.*

Issue #4. Openland Wildlife Habitat. Scoping has pointed to an issue related to the amount of openland habitat proposed by the Forest Service. Some people think there should be more permanent openland habitat created for wildlife species that use non-forested savannas and early successional forest stages.

Methodology: The ID Team developed alternatives that have varying levels and types of openland vegetation created to achieve a desired landscape design across the Raco Plains project area. Major factors that affected the alternative design include the amount and spatial arrangement of openings.

Issue Evaluation Criteria: The criteria used to evaluate the components of this issue and the variations between alternatives include:

- *Displaying acres of harvest and type of treatment for the various forest types.*
- *Comparing amount of permanent and temporary openings created or restored.*
- *Displaying acres of habitat created or restored for TES and Management Indicator Species that use openland.*
- *Discussing the relationship between permanent and temporary openings as habitat.*
- *Discussing the relationship between fire, habitat, and populations.*

Issue #5. Amount of Jack Pine Harvest. Scoping has pointed to an issue related to the type and amount of timber harvest proposed by the Forest Service. There are differences of opinion concerning the effects of the jack pine budworm outbreak and harvesting's impact on other resources (visuals, wildlife, vegetative composition, timber, fire ecology). Some people want natural processes like jack pine budworm outbreaks to be allowed to run their natural course in the area and want less acres of harvesting in jack pine and believe the effects of harvesting on other resources are not acceptable. Some people think the coarse

woody debris resulting from untreated stands with jack pine budworm, would benefit the soil and species that use snags and trees that have fallen.

Methodology: The ID Team developed alternatives that have varying levels and types of jack pine harvest to achieve a desired landscape design across the Raco Plains project area. The ID Team will evaluate the amount of coarse woody debris in harvest units of the Raco Plains LTA. Major factors that affected the alternative design include the amount, spatial arrangement, and age-class distribution of the jack pine types and the amount of acres or structures of coarse woody debris created or maintained.

Issue Evaluation Criteria: The criteria used to evaluate the components of this issue and the variations between alternatives include:

- *Displaying acres of harvest and type of treatment.*
- *Comparing age-class-distribution of jack pine forest type by alternative.*
- *Displaying proportion of stand affected by budworm.*
- *Discussing Visual Quality Objectives.*
- *Discussing and quantifying coarse woody debris, diversity, biological legacies, and residual basal area.*
- *Discussing impacts of budworm salvage on wildlife that use budworm stands.*
- *Discussing Forest Plan den and snag guidelines (IV-48).*

Issue #7. Timber Harvest Near the North Country Trail. Scoping has pointed to an issue related to the type and amount of harvesting activity along the North Country Trail (NCT). Some people think the visual corridor along the NCT should be managed to provide for a continuous forest, instead of clearcuts and signs of logging. The applicable standards and guidelines are documented in the Forest Plan (page IV-19).

Methodology: An alternative to prohibit timber sale harvest within ¼ to ½ mile of the NCT was considered but dropped from detailed analysis since it would not meet Forest Plan standards and guidelines established for the NCT. The ID Team developed a design criteria that allows for jack pine salvage, but retains all other tree species within approximately 1/8 mile of the trail, for all action alternatives.

Issue Evaluation Criteria: The criteria used to evaluate the components of this issue and the variations between alternatives include:

- *Displaying number of trail miles with adjacent harvesting by silvicultural treatment type.*
- *Comparing quality of appearance of activities along NCT.*
- *Discussing Forest Plan Visual Quality Objective guidelines.*
- *Discussing Recreation Opportunity Spectrum guidelines for resource management.*

Issue #8. Amount of Red Pine to Manage. Scoping has pointed to an issue related to the management of red pine. Some people think the Forest Service should thin more acres of red pine in MA 4.2. Some people think the Forest Service should not underburn red pine stands since the burn scorch may reduce the commercial value of the residual trees. Some

people think more acres of red pine in MA 4.2 near human developments should be converted to hardwoods in order to reduce fire hazard and fuel loading.

Methodology: An alternative to thin more acres of red pine in MA 4.2 was considered but dropped from detailed analysis since all the silviculturally available red pine is included in Alternative 2 (Proposed Action), or being considered in a concurrent EA analysis (East Red Pine II). An alternative to prohibit underburning in red pine stands was considered but dropped from detailed analysis since only a small portion of the available red pine would be scorched and underburning could be a valuable tool for red pine regeneration. A small portion of red pine stands up-wind (west) of developments such as Soldiers Lake Campground will be evaluated to provide a higher percentage of hardwood.

Issue Evaluation Criteria: The criteria used to evaluate the components of this issue and the variations between alternatives include:

- *Displaying change in fire regime condition class or acres of fuelbreak.*
- *Displaying acres of red pine underburn.*
- *Comparing acres of proposed red pine thinning to acres available for red pine thinning.*

ISSUES ADDRESSED THROUGH ANALYSIS

Issue #3. Cost of Kirtland's Warbler Habitat. Internal Forest Service scoping has pointed to an issue related to the cost of establishing and growing KW habitat. Kirtland's warbler require young jack pine in large stands with trees stocked at approximately 1,089 trees per acre. Jack pine stocking levels to meet timber management objectives are generally set at approximately 900 trees per acre. Some people think there will be additional cost associated with achieving the higher jack pine stocking densities used by KW, and the additional cost is too high and may not be economically feasible.

Along with potential costs of higher stocking levels, there is an issue related to the potential reduced growth of jack pine at stocking densities suitable for KW. Some people think the jack pine stocking densities used by KW are too high for optimal tree growth, resulting in a reduced economic return at harvest, which should not be incurred.

The project design includes an adaptive management proposal (chapter 2 – project design criteria and mitigation measures) to further explore this issue and help with future management of the jack pine ecosystem.

Methodology: The ID Team developed alternatives that have varying levels of jack pine stocking densities in harvest units of the Raco Plains LTA. Major factors that affect the alternative design include the amount of acres of habitat created at varying stocking densities. The cost of creating this habitat, and the growth and economic yield of jack pine at various initial stocking densities, have been compared.

Issue Evaluation Criteria: The criteria used to evaluate the components of this issue and the variations between alternatives include:

- *Comparing the cost of reforestation.*
- *Displaying trees/acre stocking survey data for Raco Plains LTA generated from recent projects (Brimley Grade, Raco Plains Jack Pine Budworm Ecosystem Management, and Betchler Marsh EAs) by the various soil types and treatments.*
- *Displaying results of growth and yield models.*

Issue #6. Noxious Weed Control. Scoping has pointed to an issue related to the need for more noxious weed control. Some people think there should be more effort towards controlling existing and new occurrences of noxious weeds.

Methodology: The ID Team determined there is a lack of information on locations of existing non-native invasive plants (NNIP) and a lack of funding and proven control techniques for NNIP. Based on these factors the ID Team decided to maintain 20 acres of control in all action alternatives. A project design criteria was added to monitor the impacts of prescribed burning on NNIP.

Issue Evaluation Criteria: The criteria used to evaluate the components of this issue and the variations between alternatives include:

- *Displaying acres of noxious weed controlled by treatment type.*
- *Discussing (qualitatively) the effects of various weed types on the Raco Plains ecosystem.*
- *Discussing the effectiveness of prescribed burning in control of NNIP.*

ISSUE TRACKING

Two tables have been developed to assist the reader in tracking the issues and purpose and need through the EA. The first is table 1-4, Issue Tracking Matrix and the Effects Analysis. This table is designed to help the reader track which resource sections in chapter 3 address the Key Issues and is found at the end of this chapter (chapter 1). The other is table 2 – 2, Comparison of Alternatives by Purpose and Need. This table is designed to help the reader track the differences between the alternatives based on the purpose and need and is found near the end of chapter 2.

Table 1 - 4. Issue Tracking Matrix and the Effects Analysis. This table is designed to help the reader track which resource sections in chapter 3 address the issues.

Effects Analysis of Issues	Issue 1: Roads and Accessibility	Issue 2: Kirtland's Warbler Habitat	Issue 4: Openland Wildlife Habitat	Issue 5: Amount of Jack Pine Harvest	Issue7: Timber Harvest Near the NCT	Issue 8: Amount of Red Pine to Manage	Issue 3: Cost of Kirtland's Warbler Habitat	Issue 6: Noxious Weed Control
Air Quality			X			X		X
Soils and Hydrology	X		X	X				
Fire Ecology		X	X	X		X		X
Vegetation: Silviculture		X		X	X	X		
Vegetation: TES Plants	X		X	X		X		X
Non-native Species	X		X	X				X
Wildlife	X	X	X	X			X	
Fisheries	X							
Visuals	X	X	X		X			
Recreation	X	X			X			
Transportation	X			X	X			X
Economics				X		X	X	

CHAPTER 2. ALTERNATIVES CONSIDERED

INTRODUCTION

This chapter describes Alternative 1 (No Action) and all action alternatives. Then, summarized from chapter 3: Affected Environment and Environmental Effects, this chapter presents a summary of the predicted effects of all alternatives on the quality of the human environment in comparative form, providing a clear basis for choice among the options for the decision maker and the public.

HISTORY AND PROCESS OF THE FORMULATION OF ALTERNATIVES

The formulation of alternatives to the Proposed Action complies with Section 102(e) of the National Environmental Policy Act (NEPA), which states that all Federal agencies shall study, develop, and describe appropriate alternatives to recommend courses of action in any proposal that involves unresolved conflicts concerning alternative uses of available resources. Such unresolved conflicts identified through the scoping process are the issues related to the Proposed Action.

The National Environmental Policy Act and the Multiple Use/Sustained Yield Act (MUSYA) both stress integrated resources management. In addition, the Eastern Region's (Region 9) approach to Forest Plan implementation is based on movement toward a DFC, which is the overall, integrated, long-term management goal identified for a given area.

Adherence to Forest Plan standards, initiation of mitigation design criteria, and accomplishment of the assigned monitoring program are parts of Forest Plan implementation. The HNF must either meet these requirements or change them through a Forest Plan Amendment. Except where noted, the Forest Plan's standards, guidelines, and monitoring requirements are common to all action alternatives. Implementation of the Forest Plan is monitored on a sample basis. This information is available to the public in the HNF Monitoring and Evaluation Report (M&E Report) and has been incorporated by reference.

The ID Team designed the Proposed Action (Alternative 2) to meet the needs and objectives of the project, as described in chapter 1. The Council on Environmental Quality (CEQ) regulations requires Alternative 1 (No Action). It provides an essential part of the baseline needed for the comparison of effects in chapter 3. The ID Team developed two action alternatives to respond to issues raised during public scoping.

DECISION CRITERIA AND MITIGATION MEASURES

As with all good land-management designs and decisions, the overall goal is to achieve the project objectives while avoiding substantial adverse impacts to other resource values. With this overall goal in mind, the District Ranger has identified the following criteria with which to make a decision between the alternatives:

- The degree to which each alternative reduces the impacts of jack pine budworm and improves age-class distribution and jack pine health.
- The degree to which each alternative improves habitat for TES/MIS species (including Kirtland's warbler, lynx, wolf, and sharp-tailed grouse).
- The degree to which each alternative contributes to sustaining long-term timber productivity of acres suited for timber management.
- The degree to which each alternative meets the other objectives (Purpose and Need) identified in chapter 1, reduces the potential impacts of wildfire, provides an efficient transportation system, and improves experiences around developed recreation sites.
- The degree to which each alternative would affect other resource values, specifically but not limited to, visual quality, soil productivity, the North Country Trail, old growth, coarse woody debris, economics of jack pine regeneration, red pine harvest, noxious weeds, etc.

DESIGN CRITERIA AND MITIGATION MEASURES COMMON TO ALL ACTION ALTERNATIVES

In addition to Forest Plan standards and guidelines these site-specific activities would be applied to all action alternatives. These design criteria are intended to minimize, lessen, or reduce the impacts of our activities and address the issues raised during public scoping. Many of these activities would be implemented as part of project design or as provisions in the timber sale contract.

Water and Soil

Best Management Practices (BMPs) have been developed by each of the states in accordance with their Clean Water Act authority and responsibility and are designed to minimize adverse impacts to the "nation's waters." Research used to develop the references below demonstrated that when these standards, guidelines, handbook direction, and practices are followed, impacts to the soil and water resources are minimized (Phillips et al. 2000; Whitney 1992).

1. *Water Quality Management Practices on Forest Land* issued by the Michigan Department of Natural Resources, 1994.
2. *Soil Survey of Chippewa County, MI.* (USDA Soil Conservation Service) Whitney 1992.
3. Forest Plan standards and guidelines for water and soil resource management (IV 33-40).
4. *Soil Resource Inventory, Sault Ste. Marie and St. Ignace Ranger Districts.* (Hiawatha National Forest) Davis and Frey 1984.

Windrowing of slash created by logging operations would not occur in order to improve the distribution of cones and nutrients across the entire harvested unit. Some windrowing of slash may occur as part of reforestation treatments.

In some areas where jack pine is being harvested site preparation to reduce slash and to expose mineral soil would be required to ensure adequate regeneration. Using prescribed fire

as a method of site preparation is desirable in some stands to reduce the amount of mechanical site preparation necessary and to re-introduce fire into this system in a controlled manner. If suitable burning periods do not present themselves within three years of harvest operations, mechanical site preparation would be performed.

All final harvest in stands on Rubicon soils would leave all non-merchantable material and treetops would be left on the site to decompose. See appendix D for additional soil design criteria and mitigation measures.

Roads

New road construction would consist of three actions:
1. Permanent system road construction where ongoing access would be required.
2. Miles of road added to the system by changing unclassified roads to classified roads.
3. Temporary road construction where entry would not be required for long-term resource management.

All new permanent system roads constructed would be for harvest activities only and closed to general traffic. This would minimize maintenance costs, minimize resource impacts, and provide non-motorized corridors for recreation use. The unclassified roads added to the road system are currently open to traffic and would remain open.

All temporary roads would be obliterated upon completion of vegetative management activities. At a minimum, obliterating temporary roads would include removing culverts, eliminating ditches, out sloping roadbeds, removing ruts and berms, establishing drainage control (water bars), and removing fill. Where the temporary road would likely get continued unauthorized use after timber management activities the road would be further obliterated by site preparation during revegetation or use would be discouraged by piling slash and stumps on the abandoned roadway.

Road maintenance is proposed where an existing road is in need of upkeep to retain or restore it to the approved road management objective. This upkeep would include a range of work such as: brushing, clearing and grubbing, reshaping the base, placing aggregate, replacing culverts, and providing adequate turn-arounds. Maintenance may also include improving sight distances for safety on these roads, and providing turnouts (passing areas).

Road decommissioning may include removing culverts, eliminating ditches, out sloping the roadbed, removing ruts and berms, seeding, tree planting, and stabilizing the roadbed and slopes. Road decommissioning may also include piling slash and stumps on the abandoned roadbed to further discourage motor vehicle use.

Use existing corridors to the greatest extent possible when laying out temporary roads.

Wildlife and Fish

Reserve 1-3 acre linear green islands per 80 acres of clearcut (one island per 80 acres) to meet Forest Plan objectives for den and snags and to maintain components of a fire ecosystem (i.e., Horizontal Roll Vortex strips found after large hot wildfires).

Leave a minimum of one large red or white pine tree (where available) for each acre in all clearcuts to provide stand diversity, maintain small openings, and maintain components of a fire ecosystem (i.e., large red pine trees frequently survive wildfire).

Reserve most dead trees in harvest units that are not a safety hazard to meet Forest Plan objectives for den and snag trees and to maintain components of a fire ecosystem (i.e., standing and down coarse woody debris found after wildfires).

Create red pine snag trees on each acre of red pine thinning by clipping off the crown or girdling, where needed to meet Forest Plan objectives for den and snag trees.

Retain all oak, white pine, hemlock, and black cherry in all harvest units to maintain stand diversity and food sources for wildlife, except where access is needed for roads, skid-trails, and landings.

Treatments that are designed to create a savanna would have a jack pine removal only prescription and almost all other trees would be retained in these units.

If maintenance of the road crossing Sullivan Creek includes more than minor maintenance actions, measures will include erosion controls to prevent sediment from entering the stream. More than minor actions would include applying road gravel and/or replacing culverts or reconfiguring the road prism, ditches, or culverts. Erosion controls may include, but are not limited to the use of silt fence and/or sediment basins to collect sediment before entering the stream channel. Work with the fish hatchery on timing of work on Sullivan Creek crossing upstream of hatchery.

TES Species

Protect any new TES locations using approved recovery plans and other guidelines available. Protection measures for new locations of TES animals would be reviewed on a case-by-case basis to determine appropriate action. Guidelines in the Forest Plan and existing recovery plans would be followed.

The following guidelines are used on the HNF to consistently implement measures for the conservation and maintenance of goshawk and red-shouldered hawk territories. Crucial in these considerations are protection of nest areas and consideration of post–fledging areas (PFAs):

Nest Area

- Defined as a 30-acre area around an existing goshawk nest. The nest is typically the center of a circular area approximately 1,320 feet across (660 ft. radius from the nest).
- No timber harvesting will be permitted within this area, regardless of nest status.
- Actions related to timber harvest, such as hauling or use of existing temporary roads would only be permitted outside the nesting season (March 1 to August 31).
- Forest Service local roads within 960 feet of the nest will be seasonally (March 1 to August 31) restricted or closed. Minimal human presence will be permitted during the same period.

Post-Fledging Area (PFA)

- Defined as a 400-500 acre forested area, typically the center of a circular area, approximately one mile in diameter (1/2 mile radius from the nest). This area should contain a mosaic of vegetative structural stages in small patches.
- All sale activity within the PFA will only be permitted outside the nesting season (March 1 through August 31).
- No more than 20% of the PFA will be in upland openings and/or in the 0-9 yr. age-class.
- Small openings are important and required. Openings should be less than 400 feet across and range from 1/3 to 4 acres in size.
- Sixty percent of the PFA should be in 30+ year age-classes (100 year rotation) within the long rotation conifer types. Management prescriptions that have emphasis areas (Kirtland's warbler or grouse) will strive for 44% in 30+ year age-classes (55 year rotation).

Dead and Down

- An important component in goshawk prey base management.
- Snags: at least two large (>10 in. dbh and >10 ft. in height) snags per acre will be left or created throughout the foraging area.
- Downed logs: at least three large (>10 in. diameter at midpoint and >10 ft. in length) downed logs per acre will be left or created throughout the PFA.

Adjust sale boundaries or place reserve areas as follows to ensure habitat is provided for black-backed woodpecker, spruce grouse, goshawk, red-shouldered hawk, and lynx:

- Retain 10-acre patches of mature forest around known breeding habitat of black-backed woodpecker and spruce grouse (surveys identified occupied habitat in approximately eight stands for a total of about 80 acres).

In order to meet ESA responsibilities a portion of the total jack pine harvest area would be initially treated to achieve a higher stocking density suitable for Kirtland's warbler (KW). Kirtland's warbler require young jack pine stands with an average stocking density of 1,089 trees per acre including small non-forest inclusions (20-25% open per acre). This can be accomplished with planting or natural regeneration (roller chop/chain/seed) method. Natural regeneration is best if site preparation (roller chop/chain) occurs while tree-slash is green, before the cones on the slash open, so that seeds fall and germinate on mineral soil. Jack

pine sales that would have chop and chain reforestation treatments should be sold in different years, or spread out over time, to ensure skidder time is available to complete chop and chain activities immediately after harvest, if possible. Pre-commercial thinning or release treatments in any pine stand would be delayed until after age 23.

The action alternatives include an adaptive management implementation and monitoring project to provide increased jack pine stocking density suitable for use by KW. Various regeneration techniques would be used to learn more about costs, success, and failure in providing higher jack pine stocking densities. The total number of acres that would be silviculturally treated to establish higher stocking densities varies by alternative.

In all action alternatives, approximately one-half of the jack pine area harvested would be targeted for higher stocking densities suitable for KW (appendix G project maps of alternatives). Approximately one-half of the area targeted for higher stocking would have fill-in planting or other treatments as needed to meet the higher density stocking objective (project file list of specific stands). On the other half targeted for higher stocking, a decision to perform follow-up treatments, if needed, would be made based on monitoring information gained from ongoing reforestation efforts. Monitoring would be conducted on all sites to locate KWs and evaluate techniques that result in accomplishing higher stocking level objectives. Adaptive management would be used to compare four different reforestation techniques on various sites and under various weather conditions:

1. Plant 1,089 trees/acre with 20% - 25% opening.
2. Chop/chain/seed green slash.
3. Chop/chain green slash then plant 900 trees/acre with 20% - 25% opening.
4. Burn under seed trees.

Reforestation Practices

Due to recent reforestation successes and economic considerations, adaptive management will be utilized to determine the optimal reforestation practices. If ongoing monitoring shows natural regeneration continues to be very successful, the reforestation activities could be modified to consider more acres of natural regeneration as a less-expensive alternative to planting.

Approximately 3 years after the stands have been regenerated to red pine, the red pine seed trees would be harvested with a seed-tree removal cut. The existing roads, skid trails, and log landings from the initial shelterwood or seedtree cut would be used during the removal cut, if possible, to protect as much of the red pine regeneration as possible. Directional felling, limbing where the trees were felled, and designated skid trails would be used to also protect as much of the red pine regeneration as possible.

Non-native Invasive Species

Gravel and sand borrow for roadwork shall come from pits where a non-native invasive plant (NNIP or weed) eradication program is in place. If gravel or sand is proposed from sources other than the HNF pits, a qualified botanist would be consulted to determine if an adequate

weed eradication program is in place. The botanist may conduct an onsite weed inspection. A recommendation would be made to approve or disapprove the proposed material source based on the results.

If new populations of weed species on the priority list for Raco Plains are found in the project area, eradication efforts would be initiated before they have a chance to spread. For revegetation, use appropriate locally native seed and/or annual cover crops such as oats in seed mixes approved by the HNF Botanist. Any mulch used should be non-seed bearing such as straw. Hay mulch would not be used.

Visuals and Recreation

Retain a 300 ft. to 500 ft. forested strip of trees along M-28 near Rexford Road to provide a visual screen of trees between M-28 and the proposed savanna to the north.

There would be no harvesting within 1/8 mile of campgrounds, campground entrance roads, and the North Country Trail (NCT) between May 15 and September 15. This is to maintain a quality recreation experience, reduce potential conflicts, and eliminate potential safety hazards to recreationists that could result from timber harvesting activities. Slash would not be allowed on the NCT or other developed recreation facilities and roads. Reserve trees will be marked with blue diamonds and carsonite posts that mark the NCT and ensure trail is locatable before, during, and after harvesting.

In all stands with harvest activity adjacent to the NCT the harvest prescription calls for salvage of jack pine trees only within 1/8 mile of the trail. All other tree species would be retained within this zone. This would allow for larger existing red pine and hardwood trees to be left along the trail and reduce the amount of harvest directly adjacent to the trail. In Compartment 78, Stands 15 and 18, hemlock and white pine would be underplanted to provide a longer-lived forest type along the trail.

Seasonally close Forest Road (FR) 3602 & 556C into the back of Soldiers Lake Campground to make it correspond with the closed season of the campground.

No skidding would be allowed down the NCT unless the trail is also a system road.

If crossing the NCT with logging equipment is necessary, the number of crossings would be limited and would be designated by the Timber Sale Administrator.

For safety, signs would be posted along the NCT when there was active logging.

There would be no log decking along the NCT and slash disposal would be required as follows: Logging debris, i.e. slash, would be completely removed within 25 feet of the trail and would be reduced to within 4 feet of the ground for a distance of 25 to 50 feet of the trail, within one year (Forest Plan page IV-19).

Heritage Resources

Any potentially eligible archaeological sites that are located in or adjacent to proposed activities would be protected through the use of reserve areas (RAs) and/or project boundary adjustment. If these measures are implemented, this project should comply with 36 CFR 800 and not affect any resources eligible for the National Register of Historic Places. A minimum of 1 chain (66 ft.) RA of uncut trees between site boundaries and project areas has been found to be necessary for site protection. We have a Memorandum of Agreement with the Michigan State Historic Preservation Office that indicates we may consider projects to have "no effect" and proceed with implementation (pending submittal of our annual survey and evaluation reports) if surveys are completed and all potentially eligible sites are protected from earth disturbing activities.

ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL

The ID Team discussed three alternatives that were eliminated from further consideration. Alternatives that will not be evaluated in detail were dropped for one or more of the following reasons: technologically infeasible, could not be implemented, duplication within the existing range of alternatives, failure to meet the Purpose and Need, decision already made in the Forest Plan, would cause unreasonable environmental harm, or would be illegal.

Harvest More Red Pine

A member of the public asked us to consider more harvesting in the red pine forest type. They asked us if our intent was to "neglect" these red pine stands. They said, "I see that only approximately 1,230 acres of red pine in MA 4.2 is proposed for treatment in which MA 4.2 contains 31,902 acres in the project area." All red pine stands in the project area were considered for harvesting as part of the proposed action. There are a variety of reasons why other red pine stands were not included:

- Too young to have a commercial thinning.
- Currently under timber sale contract.
- Thinned within the last 10 years and sufficient growth has not occurred to support another thinning at this time.
- Four red pine stands that fall within the Raco Plains project area are under consideration for thinning in the East Red Pine II project (Compartment [C] 113/Stand [S] 16, C113/S18, C114/S42, C114/S41). Compartment examination done in fall 2003 indicated these stands are ready for a thinning.

We considered developing an alternative to harvest more red pine stands. We did not fully develop this alternative and consider it in detail because we do not have additional red pine stands which are silviculturally ready for thinning. Red pine stands will continue to be considered in future Forest Service decisions.

The 31,902 acres is the total number of acres on National Forest System lands in MA 4.2. Not all of these acres are suitable for red pine even though the emphasis for this MA is conifer sawlogs, and providing conifer stands that are favored by wildlife species. All red

pine stands that have a stocking at or above the "S" curve level as described on page IV-29 (Forest Plan) are proposed for thinning harvests. Only 131 acres were proposed for red pine clearcutting and planting, and 294 acres for red pine natural regeneration using the shelterwood method because most red pine stands are not yet at rotation age.

Don't Underburn Red Pine

A member of the public asked us not to underburn in the proposed red pine shelterwood treatments because most red pine consumers in the Lake States will not accept sawlogs or pulpwood with charred bark. We are aware there may be market concerns with trying to sell the red pine that is charred by the underburning. However, current scientific thought is that underburning red pine in a shelterwood or seedtree cut is essential to reduce the impact of the red pine cone borer.

We considered developing an alternative that regenerated red pine naturally without burning but it may not be technologically feasible.

Approximately 67% of the red pine trees in these stands would be harvested before the prescribed burning would be implemented. Of the red pine seed trees that would be underburned for natural regeneration, only the butt logs of these trees would be charred. Approximately 11% of the logs would be charred which would only damage the slabs on these sawlogs.

No Logging Along the North Country Scenic Trail

A member of the public said, "Forest policy should be written to avoid logging and earth disturbance with a quarter to half mile distance from trails located in the HNF portion of the North Country Trail."

The Forest Plan standards and guidelines include the following guidelines for management of the North Country Trail: "Timber activities may be seen along portions of the trail in Retention and Partial Retention; however, any temporary openings will generally not be greater that 5 acres in Retention and not greater than 10 acres in Partial Retention, as seen from any point along the trail. An exception to this may be salvage operation of overmature jack pine or aspen type" (p. IV-19). Thus, the Forest Plan has already made the decision that timber harvesting will be allowed along the North Country Trail. We considered developing an alternative which would allow no logging within a half mile of the North Country Trail but that would not be consistent with the Forest Plan.

However, the design criteria section does include specific measures for timber harvesting along the North Country Trail.

ALTERNATIVES CONSIDERED IN DETAIL

The alternatives are displayed in different ways to help aid in understanding the differences between them:

1. Descriptions and individual summary tables.
2. Comparison chart of alternatives by activity, comparison chart of alternatives by Purpose and Need (at end of this chapter).
3. Stand by stand silvicultural prescriptions (appendix E).
4. Maps of each alternative (appendix G).

ALTERNATIVE 1 (NO ACTION)

This alternative fulfills CEQ requirements for a no action alternative and serves as a baseline for comparison to the action alternatives. This alternative proposes no new ground disturbing activities. This alternative does not preclude future NEPA decisions.

Current activities, which are ongoing, would continue such as dispersed recreation use, annual road maintenance, snowmobile trail use and maintenance, and suppression of wildfires. See appendix G – Maps for existing resource conditions.

No new timber harvesting would take place on Forest Service lands within the project area. Trees would continue to get older. Some would lose vigor, growth rates would slow, and mortality would occur. Wildlife habitat would favor species that prefer older stands with large amounts of coarse woody debris and would not favor species that prefer younger stands and temporary openings.

Further adjustments to the HNF road system needed to provide an efficient transportation system would not occur at the project level. Decommissioning of unneeded roads would not occur.

No new wildlife habitat improvement projects would occur. The "Need" in chapter 1 would not be satisfied and progress toward the Forest Plan DFC would be stalled.

ALTERNATIVE 2 (PROPOSED ACTION)

This alternative is displayed in maps and tables (tables 2-1 and 2-2, appendix G, figure G – 1 Alternative 2, and appendix E, Stand by Stand Silvicultural Prescriptions.

Alternative 2 was specifically developed by the ID Team to meet the Purpose and Need described in chapter 1 and to move the area towards the DFC also described in chapter 1. Jack pine budworm outbreaks were considered. Forest fragmentation was considered during project design at a variety of levels from landscape scale to size of stands proposed for harvest. Past activities of managing jack pine stands in this area were not limited to 300-acre openings. This contributed to existing large open areas. This alternative was spatially designed to avoid proposing many small harvesting units, thus reducing fragmentation of the area. Prior to timber management practices, stand replacing fires were often very large

(1,000+ acres). Regenerating larger units of jack pine would benefit wildlife species, mimic the size of regeneration patches common prior to timber management, design a vegetative pattern to promote long term forest health, minimize permanent roads, and reduce costs. The activities proposed herein, would emulate past disturbance regimes in the jack pine type.

This alternative emphasizes:

- Creation of temporary harvest-created openings that are similar in size to stands created by wildfire and which are large enough to meet the needs of wildlife species associated with openland habitats (including Regional Forester Sensitive sharp-tailed grouse).
- Reduction in the impact of jack pine budworm by salvaging trees and regenerating healthy stands.
- Using predominantly temporary roads to maintain lower permanent road densities.

ALTERNATIVE 3

This alternative is displayed in tables and maps (tables 2-1 and 2-2, appendix G, figure G – 2 Alternative 3, and appendix E, Stand by Stand Silvicultural Prescriptions.

Alternative 3 was specifically developed by the ID Team to meet Forest Plan guidelines pertaining to opening (non-forested areas) size. With this alternative, the size of new temporary openings (clearcut-salvage units) would be less than 300 acres. This alternative was spatially designed to maintain many small harvesting units, thus increasing the amount of edge or fragmentation in the area. This alternative also addresses Key Issue #4 by creating more acres of permanent openings. It addresses Key Issue #5 by having less jack pine harvest.

This alternative emphasizes:

- Creation of temporary openings that are less than 300 acres to meet existing Forest Plan guidelines.
- Creation of smaller permanent openland or savanna habitat areas.
- Reduction in the impact of jack pine budworm by salvaging trees and regenerating healthy stands.
- Using predominantly temporary roads to maintain lower permanent road densities.
- Improvement to FR3132 stream crossings to reduce sediment input to Sullivan Creek, Swieger Creek, Black Creek, and North Pine River.

ALTERNATIVE 4

This alternative is displayed in maps and tables (tables 2.1 and 2.2, appendix G, figure G - 3, Alternative 4, and appendix E, Stand by Stand Silvicultural Prescriptions.

Alternative 4 was specifically developed by the ID Team to meet the Purpose and Need, move the area towards the DFC, and address Key Issue #1 by proposing more decommissioning of roads and Key Issue #2 by creating more KW habitat. This alternative is similar to the Proposed Action (Alternative 2), but would create more Kirtland's warbler

habitat, decommission more miles of roads, convert one stand of jack pine to white pine, and provide a fuel break west of Soldiers Lake Campground.

This alternative emphasizes:

- Creation of temporary openings that are similar in size to stands created by wildfire and which are large enough to meet the needs of wildlife species associated with openland habitats (including Regional Forester Sensitive sharp-tailed grouse).
- Establishment of more acres of Kirtland's warbler habitat through reforestation.
- Reduction in the impact of jack pine budworm by salvaging trees and regenerating healthy stands.
- More decommissioning of unneeded roads.
- Improvement FR3132 stream crossings to reduce sediment input to Sullivan Creek, Swieger Creek, Black Creek, and North Pine River.

SUMMARY COMPARISON OF THE ALTERNATIVES

This section provides a summary of the alternatives:

- Comparison of Alternatives by Activity (table 2-1).
- Comparison of Alternatives by Purpose and Need (table 2-2).

Information in the tables is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives. All acreages and mileages in these tables are approximate. The information is summarized in these tables to help the reader see the comparisons at a glance. For the complete information, refer to the information provided in chapter 3 and the appendices of this document.

Table 2 - 1. Summary of Alternatives by Activity.

Activity	Alt. 1 (ac, mi, crossings)	Alt. 2 (ac, mi, crossings)	Alt. 3 (ac, mi, crossings)	Alt. 4 (ac, mi, crossings)
Jack pine – salvage	0 ac	6,358 ac	2,484 ac	6,257 ac
Jack pine – seedtree/burn for jack pine, heavy stocking	0 ac	145 ac	115 ac	145 ac
Jack pine – salvage/underplant white pine	0 ac	0 ac	0 ac	101 ac
Jack pine – removal by Soldiers Lake	0 ac	94 ac	0 ac	94 ac
Jack pine – removal (mitigation of activity 114 w/in 1/8 mi of NCT) (acres included in the jack pine – salvage totals)	0 ac	350 ac	107 ac	350 ac
Create savanna from jack pine stands	0 ca	366 ac	528 ac	366 ac
Prescribe burn salvaged jack pine to regenerate red pine	0 ac	166 ac	93 ac	166 ac
Site prep for seeding jack pine in salvaged jack pine	0 ac	2,826 ac	895 ac	2,725 ac
Site prep for planting jack pine in salvaged jack pine	0 ac	3,064 ac	1,285 ac	3,064 ac
Site prep for planting red pine in salvaged jack pine	0 ac	302 ac	211 ac	302 ac
Site prep for planting white pine in thinned jack pine	0 ac	0 ac	0 ac	101 ac
Seed jack pine in salvaged jack pine – normal stocking	0 ac	1,654 ac	383 ac	859 ac
Seed jack pine in salvaged jack pine – heavy stocking	0 ac	1,172 ac	512 ac	1,866 ac
Plant red pine in salvaged jack pine stands	0 ac	302 ac	211 ac	302 ac
Plant jack pine in salvaged jack pine stands – normal stocking	0 ac	1,281 ac	728 ac	829 ac
Plant jack pine in salvaged jack pine stands – heavy stocking	0 ac	1,783 ac	557 ac	2,235 ac
Plant 100 red pine/acre in salvaged jack pine & convert to hwds.	0 ac	0 ac	0 ac	21 ac
Underplant white pine in thinned jack pine	0 ac	0 ac	0 ac	101ac
Red pine – clearcut	0 ac	120 ac	120 ac	120 ac
Red pine shelterwood	0 ac	89 ac	89 ac	89 ac
Red pine seedtree	0 ac	39 ac	39 ac	39 ac
Red pine thinning	0 ac	797 ac	797 ac	797 ac
Prescribed burn to naturally regenerate red pine	0 ac	128 ac	128 ac	128 ac
Site prep for planting red pine in clearcut red pine	0 ac	120 ac	120 ac	120 ac
Plant red pine in clearcut red pine	0 ac	120 ac	120 ac	120 ac
Monitor reforestation	0 ac	6,751	2,847 ac	6,751
Create upland opening in jack pine	0 ac	23 ac	0 ac	23 ac
Maintain existing upland opening	0 ac	2,500 ac	2,500 ac	2,500 ac
Weed removal and monitoring	0 ac	20 ac	20 ac	20 ac
New classified road construction	0 mi	1.0 mi	0.7 mi	0.7 mi
Add unclassified road to system	0 mi	3.0 mi	3.0 mi	3.0 mi
Temporary road construction	0 mi	13.0 mi	6.7 mi	12.9 mi
Road decommissioning	0 mi	10.1 mi	20.2 mi	18.5 mi
Road decommissioning after use	0 mi	3.7 mi	3.2 mi	3.8 mi
Road maintenance	0 mi	25.5 mi	23.9 mi	26.5 mi
Road maintenance: stream crossings on FR3132	0 crossings	0 crossings	4 crossings	4 crossings
Road reconstruction	0 mi	0.4 mi	0.4 mi	0.4 mi

Table 2 - 2. Comparison of Alternatives by Purpose and Need (Chapter 1).

Purpose and Need Statement	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3	Alternative 4
Reduce impacts of jack pine budworm, improve vigor, increase growth rates in jack pine stands, and create a more evenly distributed age-class.	No jack pine salvage or regeneration of red and jack pine	Salvage 6,597 acres of jack pine and regenerate 6,503 acres of red and jack pine	Salvage 2,599 acres of jack pine and regenerate 2,599 acres of red and jack pine	Salvage 6,597 acres of jack pine and regenerate 6,402 acres of red and jack pine
Manage vegetation to restore and improve habitat for Threatened and Endangered and Region 9 Sensitive Species and Hiawatha National Forest Management Indicator Species.				
• **Kirtland's Warbler**	Dependent on natural process	3,100 ac. max.	1,184 ac. max.	4,246 ac. max.
• **Sharp-tailed Grouse**				
o **Create temporary openings (jack pine harvest)**	0 ac	6,358 acres	2,484 acres	6,257 acres
o **Create new openings and savannas**	0 ac	389 acres	528 acres	389 acres
o **Permanent opening maintenance**	0 ac	2,500 acres	2,500 acres	2,500 acres
• **Canada Lynx**	Maximum den habitat	Convert den to future snowshoe and simulate ecosystem process	Convert den to future snowshoe	Convert den to future snowshoe and simulate ecosystem process
• **MIS**	More habitat for late successional species	More habitat for early successional species	Small blocks limit suitability for early successional species	More habitat for early successional species

Purpose and Need Statement	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3	Alternative 4
• **Provide useable wood products to local markets**	Does not harvest wood	Harvests 50.6 million board feet	Harvests 25.1 million board feet	Harvests 50.4 million board feet
• **Improve timber age-class distribution and vigor**	Does not improve age-class and stand vigor	Even-aged regeneration on 6,845 acres	Even-aged regeneration on 2,847 acres	Even-aged regeneration on 6,845 acres
• **Improve growth rates on merchantable stems**	Does not improve growth rates	Even-aged regen. acres plus thins 797 acres of red pine	Even-aged regen. acres plus thins 797 acres of red pine	Even-aged regen. acres plus thins 797 acres of red pine
• **Ensure a more even flow of wood products in the future**	Does not improve the flow of wood for the future	Provides for future wood by improving age-class	Provides for future wood by improving age-class	Provides for future wood by improving age-class
Manage an efficient transportation system through: • **construction,** • **reconstruction,** • **maintenance, and** • **decommissioning of roads** • **improve stream crossings on FR3132**	 0 miles 0 miles 0 miles 0 miles ……..0 crossings	 14 miles 0.4 miles 25.5 miles 13.8 miles 0 crossings	 7.4 miles 0.4 miles 23.9 miles 23.4 miles 4 crossings	 13.6 miles 0.4 miles 26.5 miles 22.3 miles 4 crossings
Reduce the potential impacts of wildfire in specific areas to protect residents, visitors, and facilities (Fire Regime Condition Class ranking; 1 is highest, 3 lowest).	2.7	1.8	2.0	1.8
Improve recreation experiences by management of vegetation around high-use recreation sites.	0 acres	94 acres	0 acres	94 acres

IDENTIFICATION OF THE PREFERRED ALTERNATIVE

The deciding official for this document is the District Ranger of the St. Ignace and Sault Ste. Marie Ranger Districts. The preferred alternative is Alternative 4.

RECOMMENDED MONITORING

The HNF conducts monitoring at intervals established in the Forest Plan on a sample basis to determine how well objectives have been met and how closely management standards and guidelines have been applied. The results of these efforts are documented annually in the M&E Report of the HNF. The report from Fiscal Year 2000 (the latest available) covers: Forest Plan amendments, aquatic resources, fisheries, fire, heritage resources, landscape ecology, plant ecology, recreation, soil resources, transportation, timber, vegetative management, wildlife, wild and scenic rivers, and the HNF budget.

Currently, the Eastside of the HNF is using three techniques to monitor the jack pine budworm: in-house, detection flights, and Michigan State University (MSU). In-house monitoring occurs by field going personnel. When caterpillars or defoliation is observed, samples are collected and sent to the Forest Service entomologists in the Forest Health Protection section of Northeastern State and Private Forestry. Forest Health Protection responds with a written report and recommendations. If necessary, field visits and follow-up actions are also provided. The second level of monitoring is defoliation flights conducted annually by Forest Health Protection. About June of each year, a team of technicians flies over every square mile of the HNF recording observations of defoliation and disease. This information is then provided to the HNF with recommended actions. In addition to Forest Service insect and disease monitoring, we have had a cooperative agreement with MSU regarding damage to the forest from the jack pine budworm. This has been ongoing since 1992. From 1992 to 1998, research assistants from MSU annually monitored jack pine damage across the Raco Plains.

When possible, inventory understory plants before and after implementing prescribed burns. Particular attention needs to be paid to invasive species that could be enhanced through the disturbance of burning. The pre and post burn inventories are necessary to determine the full effects of burning on the site. Eastside fire staff should coordinate inventories with Eastside Botanist to insure inventory information is included in the Burn Plan.

Develop a monitoring plan to learn more about the impacts of prescribed burning on NNIP. Conduct pre and post burn plant monitoring where prescribed burns are planned, to identify burn locations with NNIP concentrations and study the effect of burning on NNIP.

Monitor selected populations of MIS and TES species to document the effectiveness of habitat management activities.

Additional monitoring projects are described above under the design criteria section.

CHAPTER 3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL EFFECTS

INTRODUCTION

This chapter is divided into sections that correspond to a specific resource that could affect or be affected by the proposed activities. The sections begin with a description of the existing conditions or affected environment.

Following a description of the affected environment are the environmental effects. The environmental effects form the scientific and analytic basis for the summary comparison in chapter 2. This chapter presents the predicted effects of Alternatives 1, 2, 3, and 4 focusing on the project objectives (purpose and need) and the issues. The predicted effects include:

- Direct, indirect, and cumulative effects.
- Adverse environmental effects that cannot be avoided.
- Relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity.
- Irreversible and irretrievable commitments of resources that would be involved if any of the alternatives were to be implemented.

AIR QUALITY

Summary of Effects

Measure	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Reduction in mature jack pine (risk of crown fire that could temporarily impact air quality).	None	2 and 4 greatest reduction	Moderate reduction	2 and 4 greatest reduction
Effects to Class I Airshed	None	None	None	None

Mitigation Measures

The Forest Service routinely implements the mitigations required by prescribed fire plans (USDA Forest Service Manual [FSM] 5100): planning for smoke management to reduce temporary effects to populated areas and to avoid planned ignitions when smoke dispersal is not within smoke management parameters.

AFFECTED ENVIRONMENT

Geographic regions of the country are given air quality classifications that designate the level of protection areas receive. The classification denotes the level of air quality deterioration that would be regarded as significant and consequently, not allowed. Class I allows the least deterioration. Class II is much less restrictive than Class I and Class III is the least restrictive.

The HNF (including the Raco Plains project area) is considered by the State of Michigan to be a Class II attainment area under the Clean Air Act (PL 88206) as amended (Forest Plan 1986).

The wilderness area within Seney National Wildlife Refuge is the nearest Class I attainment area and is located approximately 50 miles west of the project area. The prevailing winds are from the west. To monitor Class I Attainment Standards, the Midwest Regional Planning Organization assisted by the Air Quality Division of Michigan Department of Environmental Quality (MDEQ) has established a visibility quality monitoring site at the Seney National Wildlife Refuge for continuous monitoring for ozone, fine particulates, and meteorological measurements. This site along with other sites in the Midwest can be accessed via the Internet (MDEQ 2002).

According to the State of Michigan, all areas of the state are currently in compliance with the criteria pollutant health standards (MDEQ 2001).

The project area is currently subject to air pollutants from mobile sources, i.e. vehicles, equipment, snowmobiles, and chainsaws. Due to dissipation by wind, pollutants from these sources typically do not attain high enough concentrations to warrant measurement or to result in degradation to sensitive resources. Wildland fires occur in the area but are usually contained when they are only a few acres in size. Larger fires have occurred at longer intervals. Wildfires occur throughout the spring, summer, and fall. Spring typically has the highest fire danger. In the spring, summer, and fall private landowners occasionally burn brush piles.

All management ignitions/prescribed burns require thorough planning before implementing the action. Part of the planning process for these burns is a smoke management plan. The actual conditions (weather, moisture, personnel, equipment) must be within ranges described in the burn plan before management ignition is implemented.

DIRECT AND INDIRECT EFFECTS

Alternative 1 (No Action)

Under Alternative 1, there would be no new activities so there would be no additional effects from prescribed fire. However, as in all jack pine systems, it is likely that there would be wildfires. Within the project area, wildfires have been suppressed by the Forest Service and generally kept small. However, not all wildfires can be contained quickly. The location, size, and timing of the fire cannot be predicted, so only potential effects can be described. Wildfires generally burn under more extreme burning conditions than prescribed burns due to heavier fuels, higher winds, and lower fuel moistures. These burning conditions lead to greater consumption of heavy fuels and therefore produce more smoke. Depending on wind and weather conditions, wildfire smoke tends to dissipate quickly (within hours) in the flat terrain areas like Raco Plains. Under little or no wind conditions, smoke can stay in the local area for a longer time.

The major pollutants from wildland burning are particulate, carbon monoxide, and volatile organics. Nitrogen oxides are emitted at rates from 1 to 4 g/kg burned, depending on combustion temperatures. Emissions of sulfur oxides are negligible (EPA 1995).

Depending on the location of a wildfire, smoke from the fire could impair visibility in the project area, including highways. Smoke could also drift into the towns of Raco, Strongs, and Trout Lake along with recreation areas at Soldiers Lake and Highbanks Lake.

Alternative 2 (Proposed Action)

Approximately 350 acres of jack pine slash, up to 2,500 acres of existing upland openings, and 23 acres of new opening construction would have prescribed burning applied to prepare seedbeds or maintain open grassland; and would underburn approximately 128 acres of red pine for natural regeneration. This would reduce the available fuels on the sites and burn through the duff layer in some patches to expose mineral soil. The burn plan for each burn would specify the required smoke reduction strategies, including avoiding sending smoke to the towns of Raco, Strongs, Trout Lake, and recreation areas at Soldiers Lake and Highbanks Lake. Several individual units would be burned one at a time. More than one unit may be burned at one time depending on conditions. Several days would be required to complete all burning planned for the project area. Emissions would not be as high as an uncontrolled wildfire. Prescribed fire could have a temporary impact on air quality, as particulates are released by burning. However, particulate emissions from wildfires would be reduced by the prescribed burning, timber harvest, wildlife opening maintenance, and mechanical treatments of slash under this alternative.

There would also be effects to air quality from the temporary increase in harvest activities and log hauling which would temporarily increase emissions of hydrocarbon, carbon monoxide, nitrogen oxides, sulfur oxides, and particulate matter. However, it is expected that these emissions would not be in high enough concentrations to measure.

Alternative 3

Approximately 247 acres of jack pine have prescribed burn prescriptions to burn slash to prepare sites for seeding. An additional 2,500 acres of upland openings may be prescribe burned to maintain the open grasslands. This alternative would underburn approximately 128 acres of red pine for natural regeneration. The details of planning, emissions, and effects for this alternative are the same as Alternative 2 except there are 126 acres less of prescribed burning prescriptions.

Alternative 4

Alternative 4 proposes the same amount of burning and harvest as Alternative 2 and the effects would be similar as described under Alternative 2.

CUMULATIVE EFFECTS

Alternative 1 (No Action)

The geographic boundary for this analysis is Chippewa County. Past actions such as brush burning, wildfires, and prescribed fires have produced smoke emissions which quickly dissipate. Present actions include logging on Federal, State, county, and private lands.

Depending on fuel moisture and weather, smoke from wildfires can last for days after the fire is controlled. Given the distance and prevailing winds, it is unlikely that this alternative would affect the Class I attainment area of the wilderness area at the Seney National Wildlife Refuge.

Cumulative Effects Common to All Action Alternatives

Prescribed burning would produce smoke that would have only short-term effects to air quality. The reduced probability of a crown fire in mature jack pine due to harvesting would reduce the probability of heavy smoke from a crown fire.

FIRE ECOLOGY AND FUELS

Summary of Effects

Alternative 1 (No Action)		Alternative 2 (Proposed Action)		Alternative 3		Alternative 4	
Acres Treated	Current FRCC	Acres Treated	Post Treatment FRCC	Acres Treated	Post Treatment FRCC	Acres Treated	Post Treatment FRCC
0	2.7	10,901	1.8	6,799	2.0	10,901	1.8

Measure	Alt. 1 (No Action)	Alt. 2 (Proposed Action)	Alt. 3	Alt. 4
Amount of mature jackpine	most	least	more than 2 and 4	same as 2
Amount of temporary opening as fuel break	least	most	less than 2 and 4	same as 2
Amount of permanent opening as fuel break	least	more than 1, less than 3	most	same as 2
Amount of noxious weed control	none	20 ac. plus monitoring	20 ac. plus monitoring	20 ac. plus monitoring

Fire and the use of prescribed burning were not identified as alternative driving issues during the scoping process. This section of the EA will discuss the effects of the alternatives on fire ecology and fuels emphasizing the following issues from the EA:

- Key Issue #2: Kirtland's warbler habitat
- Key Issue #4: Openland wildlife habitat
- Key Issue #5: Amount of jack pine harvest
- Key Issue #6: Noxious weed control
- Key Issue #8: Amount of red pine to manage

In addition to issues, chapter 1, Purpose and Need section identified a need to "Reduce the potential impacts of wildfire in specific areas to protect residents, visitors, and facilities."

AFFECTED ENVIRONMENT

Fire is a natural component of the Raco Plains ecosystem. Records of fire occurrence on the Sault Ste. Marie Ranger District began in 1925. In the last 80 years, there have been a total of 259 wildfires in the Raco Plains area burning a total of 854 acres. This translates to an average of only 3.3 acres per fire, and approximately 10 acres per year on average. One large fire accounted for 300 acres; the 1988 East Soldiers Lake Fire (Fire history spreadsheet, HNF, 2004). From this information, it is clear that fire suppression has been very effective over the last 80 years in the Raco Plains LTA. It is also clear that the pre-settlement role of fire in the project area has been modified and reduced.

The potential for a large wildfire is gradually decreasing due to the amount of jack pine harvest conducted since 1993. The existing mature jack pine is nearing the end of its life cycle and is ready for stand replacement. The natural processes for dealing with over-mature jack pine is for wildfire to burn it and create a new stand of young jack pine. Timber management is replacing the natural fire regime and reducing fuel loads and the potential for large wildfires (appendix G, figure G - 8; mature jack pine in relation to permanent and temporary openings; pine less than 20 feet tall).

Estimates in red and white pine forests place low to moderate intensity surface fires at a 20 to 40 year interval with high intensity, stand replacing events at 150 to 350 years (Carey 1993). Estimates of fire intervals in jack pine forests are usually less than 50 years. Jack pine forests that burn more frequently than every 5 to 10 years become pine barrens (Snyder 1993). Historically, very large acreages burned during fire events. Pre-settlement vegetation maps indicate that 100 to well over 1,000 acres were probably not uncommon.

Fire suppression activities have also affected stand size. According to HNF fire histories (Fire history spreadsheet, HNF, 2004) since 1925, one fire was over 100 acres, 22 were over 10 acres, 52 were over one acre, and the remaining 184 were less than one acre. Since 1988, one fire reached over 300 acres, four were over 10 acres, 7 passed the one acre size, and 9 were kept under one acre. In the period from 1953 to 1988, no fires reached 10 acres in size.

One of the objectives of fire management is to reduce the amount of fuel available so that if a fire does occur then it will burn with less intensity than if nothing was done. Strategic placement of fuel breaks around and near population settlements and other developments can reduce the risk of wildfire to people and investments. In general, mature jack pine contains more fuel than young vigorous jack pine due to the size of the trees and the amount of coarse woody debris. A crown fire in a mature jack pine stand will burn hotter, have higher flame lengths, release more smoke, and be harder to control than a fire in grass or young jack pine. Therefore, reduction of mature jack pine fuels through timber sales and post sale treatment would tend to reduce fire intensity, if a fire were to occur on that site. Fire behavior is reduced and control options are expanded as mature jack pine is replaced by young pine and openings. Firefighters can directly attack a fire like this and have a much greater chance for controlling it. The Raco Plains LTA is primarily a xeric jack pine ecosystem and elimination of fire is not a goal for this system. Fire is an integral component of Raco Plains where fire is managed, to the extent possible, to protect human safety and provide resource benefits.

Crown fires and low intensity ground fires have a positive impact on soils by releasing nutrients and by the release of nitrogen. High intensity fires such as slash, where the heat source is present for a longer period of time may have a negative affect on the organic layer of the soil. Most of the jack pine in this area was planted by the CCC (Civilian Conservation Corp) in the 1930s. The stands are now over mature with branches and tops of the trees breaking off and contributing to the fire hazard and fuel buildup.

According to General Land Office (GLO) original survey notes, the Raco Plains area included many grassy openings or low stocking of red and jack pine. Fires burned at short intervals to perpetuate these areas in an open grassland condition. Areas with low stocking of red pine would also be in a frequent fire regime of 5 to 30 years to keep the understory free of younger, less fire resistant trees.

Mature red pine is fire resistant. Mature trees survive fire because they have thick bark, branch-free boles, moderately deep rooting habit, and often occur in moderately open stands (Brown 1973). Fire is necessary for red pine regeneration because it prepares a seedbed, opens up the canopy by killing some trees, and reduces brush and understory species which shade out and compete with saplings (Van Wagner 1971). Saplings are killed by moderate-severe fires and young stands are highly flammable because the crowns are still near the ground (Van Wagner 1971). Once the canopy closes, the lower branches die, and a large gap develops between the ground and the crown. The natural fire regime in red pine forests is characterized by alternating stand-replacing fires and non-lethal fires. Low and moderate intensity fires occur at 20 – 40 year intervals, and high severity fires occur at 150 – 200 year intervals. Most moderate severity fires do not kill canopy trees. The high severity fires kill trees and thus create openings in the stand, ideal for red pine recruitment (Bergeron 1990). Thus, thinning red pine plantations somewhat mimics the natural function of fire by eliminating some trees. Currently, the amount of red pine over 50 years of age being thinned does not affect fire potential for the area except for a few years immediately following the activity when the presence of

slash would increase fire intensity. There would be little difference between young red pine and young jack pine stands (from age 0 to 20 – 30 years of age depending on site) from a flammability view.

Clearcut/salvage treatments provide temporary firebreaks and reduce long-range spotting potential by removing tall flammable jack pine trees. Long range spotting is a characteristic of extreme wildland fire behavior and makes wildfires difficult to control. Although young jack pine stands are also flammable, especially in spring, long range spotting and extreme fire behavior is reduced. During the first decade following harvest, wildfires are primarily surface fires due to the young jack pine tops being separated from each other. For the next 10 to 15 years the crowns are touching and crown fire potential exists although the potential for long range spotting is reduced from that of a mature stand since the trees are shorter and available fuel loads are less. From age 20 to 50, the crowns are separated from the surface fuels due to lower limb pruning and reduced ground fuels through shading.

Prescribed fire may be used for wildlife openings and in timbered stands to accomplish a number of objectives including:

1) Reduction of live and dead fuels and unwanted brush:
    a.) Reduce risk of wildfire to private and public developments.
    b.) Ecosystem restoration.
2) Site preparation for natural regeneration.
3) Encourage blueberry production.
4) Reduction of pathogens for red pine seed production.
5) Food base diversification for wildlife.
6) Opening maintenance.

Private structures are located adjacent to the high risk (see appendix B, Glossary) jack pine stands. Our objectives for fire safety for the area are to decrease the risk and fuel accumulation through management of the vegetation. The fuel accumulation can be reduced by breaking up the single age-class (70+ year old) jack pine into younger age-classes of jack pine and replacing the jack pine adjacent to private land with red pine or hardwood. Creation of openings for wildlife would also act as fuel breaks (see appendix B, Glossary). Fuel breaks can be used as safe locations from which firefighters initiate action on wildfires.

The developments at Soldiers Lake Campground, Highbanks Lake Summer Home Group, private developments on private lands interspersed through the analysis area, the community of Raco, and Raco airfield (special use permit to Smithers Scientific Services) all represent properties at risk.

The Healthy Forests Restoration Act of 2003 defines an “at risk community” as:

1. A group of homes and other structures with basic infrastructure and services (such as utilities and collectively maintained transportation routes) within or adjacent to Federal land
2. in which conditions are conducive to a large-scale wildland fire disturbance event

3. for which a significant threat to human life or property exists as a result of a wildland fire disturbance event.

A fire regime condition class (FRCC) is a classification of the amount of departure from the natural regime. They include three condition classes for each fire regime. The classification is based on the relative measure describing the degree of departure from the historical natural fire regime. This departure results in changes to one (or more) of the following ecological components: vegetation characteristics (species composition, structure stages, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and other associated disturbances (i.e. insect and disease mortality, grazing, and drought). There are no wildland vegetation and fuel conditions of wildland fire situations that do not fit within one of the three classes. Fire Regime Condition Classes include:

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

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

Fire regime condition class (FRCC) is used as an indicator of how far the current condition of an area is from the expected natural/historic condition of the area with relation to fire occurrence and fuels. Therefore, a unit of measure to determine the magnitude of direct and indirect effects of the alternatives considered would be the number of acres with an improvement in FRCC. Activities are not expected to move the condition class full steps in the FRCC classification but would show a trend towards a new FRCC level. For analysis purposes in this document, the trends in FRCC classifications and other measures are shown for the acres affected by the alternatives (table 3-1).

Other measures of potential fire effects include:

- Acres of openland treatments utilized as fuel breaks for communities at risk.
- Acres of jack pine harvested (temporary openings) utilized as fuel breaks for communities at risk.
- Size of openings.

Table 3 - 1. Comparison in Fire Regime Condition Class (FRCC) and Acres Treated by Alternative.

Treatment	Alternative 1 (No Action)		Alternative 2 (Proposed Action)		Alternative 3		Alternative 4	
	Acres Treated	Current FRCC	Acres Treated	Post Treatment FRCC	Acres Treated	Post Treatment FRCC	Acres Treated	Post Treatment FRCC
Jack pine salvage Rx burn for natural regeneration of red pine	0	3	166	2	93	2	166	2
Jack pine salvage and seed jack pine (normal stocking)	0	3	1,654	2	383	2	859	2
Jack pine salvage and seed jack pine (heavy stocking)	0	3	1,172	2	512	2	1,866	2
Jack pine salvage and plant jack pine (normal stocking)	0	3	1,281	2	728	3	829	2
Jack pine salvage and plant jack pine (heavy stocking)	0	3	1,783	2	557	3	2,235	2
Jack pine salvage and convert to red pine by planting	0	3	302	2	211	2	302	2
Jack pine seed tree and Rx burn for heavy stocking	0	3	145	1	115	1	145	1
Jack pine thinning and underplant white pine	0	3	0	3	0	3	101	2
Jack pine removal and convert to hardwoods (Soldiers Lake)	0	3	94	2	0	3	73	2
Jack pine removal plant 100 red pine per acre and convert to hardwoods (Soldiers Lake)							21	1

Treatment	Alternative 1 (No Action)		Alternative 2 (Proposed Action)		Alternative 3		Alternative 4	
	Acres Treated	Current FRCC	Acres Treated	Post Treatment FRCC	Acres Treated	Post Treatment FRCC	Acres Treated	Post Treatment FRCC
Jack pine removal (NCT mitigation)	0	3	350	2	107	2	350	2
Jack pine removal create savanna	0	3	366	1	528	1	366	1
Red pine clearcut and plant red pine	0	2	120	2	120	2	120	2
Red pine Shelterwood	0	2	89	2	89	2	89	2
Red pine seedtree, Rx burn to regenerate red pine	0	2	39	1	39	1	39	1
Red pine thinning	0	2	797	2	797	2	797	2
Create upland opening in jack pine	0	3	23	1	0	3	23	1
Maintain existing upland openings	0	2	2,500	1	2,500	1	2,500	1
Weed removal and monitoring	0	3	20	2	20	2	20	2
Total	**0**	**49**	**10,901**	**32**	**6,799**	**37**	**10,901**	**32**
Average FRCC		**2.7**		**1.8**		**2.1**		**1.8**

Alternative 1 (No Action)

Natural processes would be the only management applied to the Raco Plains LTA under this alternative. Ecosystem restoration and reduction of the fire regime condition class would not occur in a controlled condition. It may occur through wildfire at the risk of public health and safety. Permanent upland openings shift towards brush and tree species losing some herbaceous components. Standing dead and down fuels in jack pine stands would continue to accumulate. Fire history in the Raco Plains area indicates that fire suppression activities over the last 80 years have been effective at keeping fires very small (average size at 3.3 acres).

Fuel accumulation is exacerbated by jack pine budworm activity. Budworm is part of the natural reproductive process for jack pine. Budworm break down mature jack pine stands and create fire prone conditions that support jack pine regeneration. Jack pine budworm produce dead needles and frass (insect waste), decrease tree vigor, and add to the tree crown mortality. Increased solar radiation and wind rapidly desiccate fuels on the forest floor when the forest canopy is opened up by budworm activity and tree mortality. The increase in fuels from the budworm activity, tree breakup and accompanying drying of available fuels contribute to an increased fire probability, especially in mature jack pine areas. Since there is no harvest to regenerate the jack pine there is a slight increase in risk of jack pine crown fire in the mature and un-cut stands. Past successful wildfire suppression may not continue as the aging jack pine continues to accumulate fuels increasing the potential fire behavior in uncut stands.

Current FRCC for the jack pine is near 3 and would remain at this level without disturbances occurring (human or natural origin). The red pine is currently at FRCC 2.0 and would move up the scale a bit with the selection of the Alternative 1. No opening maintenance would occur, moving these areas up from the FRCC scale towards the 2.0 level. Overall, the weighted average of the area would change from the current FRCC of 2.67 to 2.72 if no actions were implemented.

From a fire/fuel hazard point of view, the Alternative 1 is the least desirable as the high-hazard fuels continue to develop increasing the risk of wildfire. However recent large clearcuts in the Raco Plains LTA reduced large fire potential. This alternative is the least desirable as no open-land wildlife habitat/fuel breaks are maintained or constructed. No fuel breaks are developed making the control of such wildfires more difficult and decrease public health and safety in the area.

Alternative 2 (Proposed Action)

The higher density of jack pine seedlings used by KW is not outside of what would be expected from fire-regenerated jack pine. Natural stocking levels resulting from wildfire may exceed 7,000 trees per acre. A mature stand of jack pine may have as many as two million seeds per acre stored in unopened cones (Carey 1993). The higher stocking density more closely simulates that found after a wildfire and as such moves the area towards an improved FRCC rating (closer to the historical range of variability). The

denser stocking of jack pine used by KW may result in slightly more available fuel compared to standard forestry stocking levels. However, the additional fuel in KW stocking areas is reduced by the 20%-25% of openings on each acre. Therefore, any potential difference in expected fire behavior between the two stocking densities would be insignificant.

This alternative has both planting and seeding treatments for jack pine reforestation. Seeding may more closely approximate the appearance of naturally (fire) regenerated jack pine. Seeding more closely approximates the appearance and variable stocking density of natural (fire) regeneration of jack pine. Thus, seeding would have slightly more effect on FRCC than planting. Neither prescribed process fully returns the site to a FRCC of 1 without the use of fire. Mechanical means would not be expected to stimulate species such as blueberries and grasses nor reduce the presence of species such as "reindeer" moss to the same extent of fire. The areas where prescribed fire is used for site preparation would be expected to more closely resemble natural processes than those mechanically treated. Prescribed fire may be used for site preparation for either planting or seeding. Natural regeneration would more closely simulate the natural, patchy (non-row) vegetation pattern found after wildfire, and move the area closer to a FRCC rating of 1 in terms of reforestation.

The pre-settlement vegetation of this area included large areas of open-lands – grasses, brush. Such openings have large amounts of fine fuels (grass) that can burn readily during the spring or fall of the year and during periods of extended droughts. These open areas are a naturally occurring piece of the xeric upland ecosystem. Prescribed and mechanical treatments would be utilized to maintain these openings. A scattering of various tree species would also occupy the open spaces unless eliminated through management practices or wildfire. Wildfires could move quickly in these fine fuels but would be relatively easy to control due to low fuel loadings. Such openings would act as effective fuel breaks in the Raco Plains area. Construction and maintenance of these openings would be considered viable hazardous fuel reduction projects and serve a valuable role as fire breaks.

Typically, naturally occurring jack pine stands were very large (greater than 1,000 acres) due to the nature of wildfire in this forest type (Mack Lake Fire, Mio, Michigan, burned about 25,000 acres in one day). When a fire started, the conditions were such that it was able to burn large acreages quickly resulting in very large areas of jack pine regeneration. The large stand sizes proposed by this alternative reflect what would be expected in this ecosystem under natural processes.

The removal of mature jack pine budworm damaged jack pine is a reduction in the hazardous fuels present in the Raco Plains area. Reducing this jack pine fuel load would be considered beneficial to the fuels program.

Fire regime condition class includes non-native/noxious weed removal as part of the fire regime restoration. Many of these plants may be spread through disturbances such as fire. Removal of noxious weeds would allow application of prescribed fire to continue

ecosystem restoration with less concern for spreading and increasing the abundance of these plant species which is an important consideration in fire regime restoration.

All of the action alternatives are identical in the treatment of noxious weeds.

The current weighted average of the FRCC is 2.7 and the post alternative treatment FRCC would be 1.8 for Alternative 2.

Alternative 3

The effects of Alternative 3 are similar to Alternative 2 except that the FRCC for Alternative 3 is 2.0 placing this alternative between the Alternative 1 (No Action) and Alternatives 2 and 4. The difference being the greater number of jack pine acres deferred in this alternative resulting in more jack pine acres remaining in the FRCC 3 condition. Also the smaller block size for the jack pine plantations maintains a higher FRCC. This alternative does less to reduce high hazard fuels than Alternatives 2 and 4. There would be a slightly higher probability for mature jack pine to burn, since more mature jack pine would be left in the project area. There are more permanent openings created with this alternative which contribute to the fuel break program.

Alternative 4

This alternative is essentially the same as Alternative 2 from the stand point of FRCC.

CUMULATIVE EFFECTS

The geographic boundary for the cumulative effects is the Raco Plains LTA. Please see the *Thunderbird EA* (USDA Forest Service 2004) for a discussion of cumulative effects relative to jack pine harvest levels on the HNF, 1986-present.

Table 3 - 2. Past, Present, and Reasonably Foreseeable Future Activities.

Resource Area	Past Activities Raco Plains Area	Present Activities	Reasonably Foreseeable Future Activities
Fire	**1.** Since 1930, 259 fires for 854 acres. **2.** Since 1988, 21 fires for 362 acres. **3.** One "large" fire since 1930 (East Soldiers Lake Fire, 300 acres, 1988).	**1.** Active fire suppression will continue. **2.** Prescribed burning.	**1.** Active fire suppression. **2.** Prescribed burning. **3.** Prescribed burning for ecosystem restoration. **4.** Fuels management for safety and resource management concerns.

The extensive harvesting in the Raco Plains LTA since 1995 has greatly reduced the potential for large catastrophic wildfire (fuels map, project file). Extensive areas of mature and over-mature jack pine have been removed and converted to young jack pine

and red pine. Potential large fire risk is reduced since crown fires in mature jack pine would eventually run into young pine or non-forest, which provide excellent control points for wildfire. This project continues this trend towards reducing mature jack pine and restoring young jack pine, and maintaining existing non-forest fuel breaks.

Alternative 1 (No Action)

This alternative would result in relying on natural processes for ecosystem restoration rather than using more controlled management conditions to achieve restorative results. The area would be a slightly greater health and safety risk due to the gradually increasing fuel loading setting the stage for an increased likelihood of a crown fire in mature jack pine since more mature jack pine would be available.

Alternatives 2 (Proposed Action) and 4

Past actions such as timber harvest and openland construction and maintenance have contributed to reducing the potential of large, intense wildland fires. The proposed activities of Alternatives 2 and 4 would continue these efforts in reducing the wildland fire potential and restoring components of the natural/historic role of fire in this ecosystem.

Alternatives 2 and 4 would accomplish the most of any of the alternatives in moving the Raco Plains LTA towards a safer wildfire condition for public use and towards the restoration of the fire regime condition class.

Alternative 3

The proposed activities of Alternative 3 would continue these efforts in reducing wildland fire potential and restoring components of the natural/historic role of fire in this ecosystem. However, the smaller block sizes of disturbance (jack pine harvest) would fragment the jack pine reducing the effects of management actions on ecosystem restoration. The Fire Regime Condition Class would not move as far towards "1" as the larger block sizes offered in Alternatives 2 and 4.

SOILS

Summary of Effects

Regional soil quality standards require that no less than 85% of an *activity area* is maintained in a non-detrimentally disturbed condition. Severe rutting, an extreme form of detrimental puddling, should be prevented and should be confined to less than 1 percent of the activity area (FSH 2509.18). Monitoring has shown that when mitigation measures are implemented, these standards are met or exceeded (Trudell 2003). However, soils within the project area rated as a severe equipment limitation, have the highest potential for violating the standards.

As an index of relative impacts by alternatives the summary of effects to soils table displays the potential number of acres impacted on soils with a severe limitation rating. The specific parameters presented in the table are indicators of relative risk for impacting the soils resource and should be used as a relative measure for comparison of alternatives. The numbers presented assume mitigation measures applied meet the standards for detrimental disturbance and compaction. The following discussion summarizes the soils resource within the project area; additional soils information is located in the project file (Range 2004).

Soils with severe equipment limitation.

Soil Parameter	Alt. 1 (No Action)	Alt. 2 (Proposed Action)	Alt. 3	Alt. 4
*Acres of treatment proposed on "severe" rated soils.	0	764 (s) 198(w)	237 (s) 184 (w)	764 (s) 198 (w)
Hazard type subtotals				
Compaction acres (.15) x (w)	0	29.7	27.6	29.7
Displacement acres (p.15) x (s)	0	144	63.1	144
Rutting'(.01) x (s+w)	0	9.62	4.21	9.62
Erosion acres (0.15) x (s)	0	115	35.6	114.6
Subsurface drainage acres (w)	0	198	184	198
Severity subscript: s – coarse material (desiccation hazard), w – water Calculations assume mitigation measures applied meet the standards for detrimental disturbance and compaction.				

Mitigation Measures

Mitigation Measures (see chapter 2, appendix D, Soils Limitations and Mitigations): winter harvesting (compacted snow/frozen ground); wetland crossings (rubber mats, slash/ corduroy crossings, freeze down, rock crossings); obliteration of temporary roads; skid trail densities less than 15% of an area; retention of tree top and non-merchantable bole material on site.
Reference data to support effectiveness of mitigation measures.
Purpose of mitigation measures: maintain soil productivity.
Mitigation effectiveness monitoring:
Winter harvesting – Forest Plan standards & guides, Natural Resource Conservation Service (NRCS) soil survey information (Whitney 1992), Davis and Frey (1984), Blind Muffin Timber Sale inspection reports (Carrick 2000-2002), Harvesting Options for Riparian Areas (Mattson et al. in Verry et al. 2000), BMP Effectiveness Monitoring Report (USDA Forest Service, Lolo National Forest, March 2002b). Skid trail densities < 15% - L.Congdon, field notes 2001, FSH 2509.18 Forest Soil Handbook, 1991 Retention of tree top and non-merchantable bole material – Stone et al. 1999, Davis and Frey 1984

AFFECTED ENVIRONMENT

Soils. Soil development and characteristics in the Raco Plains project area over the past 10,000 years when the Wisconsin Glacier receded are the result of complex interactions between the five major soil forming factors: parent material composition, climate, topography, plant and animal life, and time (Davis and Frey 1984, Whitney 1992).

The predominant surficial geologic deposits found in the Raco Plains project area are sand and gravel outwash plains and end moraines (figure 3-1). Fine sand and silt lake sediments are located in the south end of the project area, and deep deposits of peat and muck are near the Betchler Lakes area. The underlying bedrock geology is limestone and dolomite. Soils are predominantly upland and excessively well drained; with a water table that is typically more than 6 feet below the soil surface. Wetland soils and transitional areas between the wetlands and uplands, and complexes of both types, are also present. A summary of soils within the project area is in the project file (Range 2004).

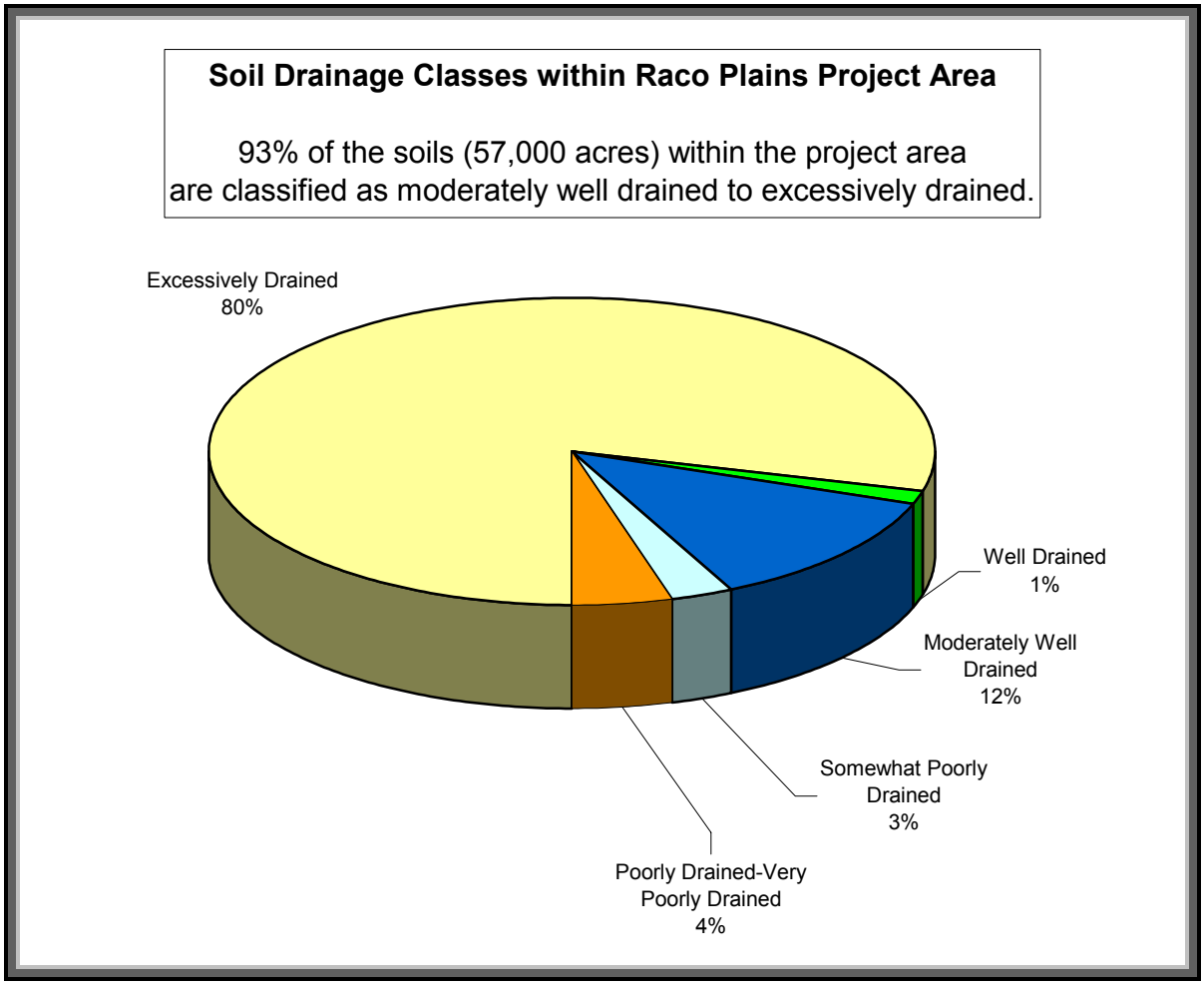

Figure 3 - 1. Soil Drainage Classes within Raco Plains Project Area.

Soil productivity and nutrient cycling. Soil productivity is the capability of a soil for producing a specific plant or sequence of plants under specific management. Productivity is dependant upon the soil fertility, the quality that enables a soil to provide plant nutrients. Climate and the type of parent material from which a soil is formed determine the inherent fertility of the soil. Only a small fraction of the total nutrient amount within the soil is in an exchangeable form and available for plant uptake at any given time. Over time, however, soil weathering makes these nutrients available and the annual uptake by vegetation is considerably less than that available in an exchangeable form. These characteristics and processes are a major factor when determining vegetation types.

The Raco Plains LTA, which is coincidental with the project area, is sand plain with dry, sandy soils. It is a xeric ecosystem that is believed to have been dominated by pine barrens or pine types. Historically approximately half of this LTA was dominated by either pine barrens or jack pine. Other types included red pine/white pine and red pine/jack pine. Current vegetation schemes classify the area as non-forested, mixed conifer, mixed hardwood/conifer, and jack pine. There are however, sites currently supporting jack pine that may have historically supported red pine, white pine, or hardwoods. One reason for this may be logging and subsequent burning that may have occurred in the analysis area around the turn of the 20th century. This practice may have caused a loss of soil productivity due to loss of organic matter. Using geographic information system (GIS) data, a comparison of vegetation within the project area between the 1850 vegetation layer and present day stand typing shows some areas that may have been in red pine, white pine, tamarack, and other tree species is now classified as either jack pine stands or open lands in the stands data. The same data however, indicated the overall trend in the area has been changed from pine barrens/jack pine to red and white pine (*Preliminary Landscape Assessment Raco Plains Ecosystem Management project*).

In addition to xeric conditions, different trees require different amounts of nutrients and soil moisture regimes to survive. For example, aspen takes up to 4 times the amount of calcium when compared to jack pine. Aspen also uses 2-3 times more phosphorus, and magnesium than jack pine (Alban et al. 1978, Weetman and Algar 1983). Most sandy soils are naturally low in soil fertility and species that demand more nutrients, like northern hardwoods (sugar maple) are naturally excluded from these sites, or if present, grow poorly. Conversely, jack pine is able to grow well on nutrient poor sites, and naturally regenerate following wildfires it can create its own monoculture.

DIRECT AND INDIRECT EFFECTS

The following discussion of soil effects will be limited to those issues and concerns described in chapter 2, specifically roads and accessibility, openland wildlife habitat, and amount of jack pine harvest. The scope of the direct and indirect effects analysis is the stand/harvest unit. The digital Chippewa County soils layer and published soil surveys by Whitney (1992), and the soil resource inventory by Davis and Frey (1984) were used to analyze effects. Any differences in acres reported here versus other resource sections

is a result of rounding during GIS analyses. The geographic boundary for the cumulative effects analysis is the project area. This discussion summarizes impacts to the soils resource. Additional soils information is located in the project file (Range 2004).

Alternative 1 (No Action)

Soil productivity and nutrient cycling – **(***Vegetative treatments*). No soil disturbing activities associated with timber harvesting activities would occur in the short (5-10 years) or long (15 years) term that removed organic matter (bole wood only) from the site. As trees die and decompose, the nutrients stored in the various tree components would become available to the vegetation growing at a particular site. Some leaching of nutrients would still occur when trees are not actively taking up water and nutrients. Stands composed of short-lived species like jack pine may succeed to other species. Succession of some jack pine stands could be expected to enhance site productivity by changing the frequency of site disturbance from fire. This would reduce the potential direct, indirect, and cumulative effects on the forest floor.

Based on pre-European settlement vegetation data, some sites would naturally remain in jack pine via wildfires. Wildfires would consume most, but not all, of the finer fuels such as tree needles and small branches, ground vegetation, and the organic litter layer because they would likely occur under drought conditions when fire intensities would be greatest. Assuming the charred trees were not salvaged, the nutrients stored in the wood fiber would be available for the succeeding vegetation over time as they decomposed. Some nutrients would leach below the vegetation root zone. Given that wildfires occur during drought periods, the likelihood of these nutrients being leached away prior to ground vegetation becoming re-established is low. In this case, the probability is low because there would generally not be sufficient rainfall during such a drought period to move the nutrients below the root zone of the vegetation. Rapid re-establishment of vegetation would also protect soils from wind erosion.

Road activities. With the exception of routine maintenance unrelated to this project proposal, none of the proposed road activities would occur. No new road or temporary road construction would occur; neither would commissioning nor decommissioning proposed under the action alternatives. There would be negligible change in the short and long term productivity of soils at these locations.

Roads identified under the road analysis process (RAP) for decommissioning would not be decommissioned and designation as a road would continue. This represents a commitment of soil resources continuing in a non-productive state and is an accepted use. Long-term soil processes and productivity continue at locations proposed for new and temporary roads (which would not occur under this alternative). Soils utilized as roads are not considered an irretrievable or irreversible commitment because they could be brought back into a productive mode once the compaction was removed.

Effects Common to All Action Alternatives

Soil productivity and nutrient cycling. The only difference between Alternatives 2, 3, and 4 relative to soil productivity and nutrient cycling is the amount of area designated for harvested acres and for transportation. The discussion of qualitative effects is the same for all action alternatives.

Vegetative treatments. Under all action alternatives, there would be no decrease in long-term soil productivity or disruption on nutrient cycling as a result of implementing the activities. No long-term direct or indirect effects would be expected relative to soil productivity.

A goal when implementing management activities is to protect long-term soil productivity and soil hydrologic function. Logging can have impacts to the soil resource and decrease long-term productivity of the soil. With the exception of nitrogen, nutrients stored in the portion of the tree harvested are permanently removed from the site. Soil compaction and erosion due to surface disturbance, however, are typically the cause of the major impacts of logging.

Soils identified as potential hazards related to skidding and roads construction have been identified as part of this analysis. Mitigations have been prescribed to protect soils based on their qualities. Mitigations include measures to limit compaction, disturbance, and nutrient loss due to harvest. Soil disturbance associated with tractor logging in the harvest units would result in an unavoidable short-term compaction and increase in on-site soil erosion. Long-term soil productivity on treatment areas would be maintained.

On timber sales detrimental effect is defined as 15% reduction in inherent soil productivity potential (FSH 2509.18). The desired future condition following logging activities is that long term soil productivity and hydrologic function would be maintained on as many acres as possible, but at least 85% of the activity area. Monitoring on the HNF has shown that when mitigations are properly implemented, they have been effective in ensuring these limits are not violated (Trudell 2003).

The impact of nutrient removal due to harvest is dependent on harvest method, the species removed, and the type of soil. Jack pine clearcuts would remove a higher proportion of organic material from the site, relative to harvest methods proposed for other species. Few impacts were associated with nitrogen and phosphorus loss. Nitrogen inputs came from both precipitation inputs and the atmosphere. Phosphorus can also come from precipitation, and does not leach as readily as calcium, magnesium, and potassium. On these sites when only bole-wood is removed, adequate organic material and nutrients would be expected to remain on-site to maintain long-term productivity. Several studies are cited regarding this conclusion.

Weetman and Algar (1983) concluded that few shortages in the macronutrients would be expected on the richer till (loam) soils with a merchantable tree length removal (bole only). An uptake of nutrients provided by soil weathering adequately replaces these nutrients quantities over time (Alban et al. 1978). Alban et al. (1978) also cited Weetman and Webbers' (1972) finding that nutrient inputs from precipitation generally equaled that of tree accumulation in temperate regions, but reported that nutrients that fell outside the growing season might be lost via leaching. In the case of calcium and magnesium, more was leached from the rooting zone than was replaced by precipitation. Potassium is also readily leached from the rooting zone. Clearcuts that only remove the bole wood were found to maintain soil productivity (Davis and Frey 1984).

Road activities. Where roads are decommissioned soils would be returned to vegetation production. Compacted or disturbed areas would gradually be returned to more natural states, and long-term productivity would eventually be restored. The rate of the recovery is dependant on the prescribed restoration treatment, among other factors. Road activities described in chapter 2 would occur and are summarized in table 2-2.

Where new roads would be constructed, existing roads classified, or temporary roads constructed soils would be taken out of production and designated as part of the transportation system. Productivity on these sites is not considered when considering soil quality standards (FSH 2509.18). This represents a commitment of soil resources to a non-productive state and is an accepted use. Soils designated as roads are considered an irretrievable or irreversible commitment. However, they could be brought back into a productive mode once the compaction was removed.

CUMULATIVE EFFECTS

Alternative 1 (No Action)

Within the activity area timber harvesting that removes organic matter would likely occur from other projects. Tree top slash and non-merchantable bole material would be retained where activities occurred on other Forest Service lands where soils conditions dictate. Some sites would naturally remain in jack pine due to wildfires. Wildfires would periodically consume most of the organic layer and finer fuels. The nutrients stored in the charred trees would recycle through the environment with minimal loss in soil productivity.

Effects to soils are stationary and are localized to the activity area. The area considered for cumulative effects is the activity area. Project design criteria and mitigations would ensure that proposed management in a project area does not result in reduced long-term soil productivity. Long-term soil productivity is not affected by adjacent projects. Off-site impacts of sediment are discussed in the Hydrology section of this document.

System roads and trails, and other administrative facilities within or adjacent to the activity area, are not considered detrimentally disturbed conditions for the purposes of this assessment (FSH 2509.18). Transportation activities not related to this project may

occur. Where roads are decommissioned soils would be returned to vegetation production. Where new roads are constructed, existing roads are classified or temporary roads constructed soils are taken out of production and designated as part of the transportation system.

Cumulative impacts to soil productivity are the result of additional projects on the same piece of ground, i.e. additional soil erosion, increased compaction, displacement, etc. The cumulative effects can occur from past management activities, the proposed management activity, and foreseeable future management activities.

Cumulative Effects Common to All Action Alternatives

Please see the *Thunderbird EA* (USDA Forest Service 2004) for a discussion of cumulative effects relative to jack pine harvest levels on the HNF, 1986-present.

Timber harvest activities that removed organic matter would likely occur within the activity area, under future analyses. It is assumed that any project occurring within this area would be Federally administered and the same standards for maintaining soils productivity would be implemented. Soil productivity would be maintained if tree top slash and non-merchantable bole material were retained as soil conditions warrant (as described in the direct/indirect effects section). Nutrient loss would be replaced by nutrients slowly released back into the environment via microorganisms, for use by existing and newly established vegetation. Implementing the mitigations prescribed for project activities would minimize soil compaction and disturbance. Where compaction or disturbance occurs, it would be within soil quality standards (FSH 2509.18), and would recover over time.

Activities have and will occur within the cumulative effects area that may affect long-term soil productivity. In areas where logging and subsequent burning occurred in the past, such as around the turn of the 20th century, compaction and loss of soil productivity effects may persist. An effect of this practice, as discussed in the affected environment section, is a conversion of vegetation types to those that can survive in lower productivity soils.

Transportation systems and administrative sites may be constructed or removed changing the designated use of soils on these sites, but are not considered when analyzing long-term soil productivity. Short-term impacts such as nutrient removal, compaction, and displacement would occur, but long-term soil productivity would be maintained.

The cumulative effects analysis area is the activity area. The intent of project design is to ensure that proposed management on a project area does not result in reduced long-term soil productivity. Long-term soil productivity is not affected by adjacent projects. Cumulative impacts to soil productivity may be the result of additional projects on the same piece of ground, i.e. additional soil erosion, increased compaction, displacement, etc. The cumulative effects analysis considers past management activities, the proposed management activity, and foreseeable future management activities.

System roads and trails, and other administrative facilities within or adjacent to the activity area, are not considered detrimentally disturbed conditions for the purposes of this assessment (FSH 2509.18). Effects to soils are stationary and therefore localized to the activity area. Off-site impacts of sediment are discussed in the hydrology section of this EA.

HYDROLOGY

As an index of relative impacts by alternative, the summary of effects to hydrology table displays the number of acres for roads and clearcut (open) areas. Roads and open areas have the highest potential for impacting watershed resources because these areas have the highest potential for runoff and soil erosion. The specific parameters presented in the table should be used as an indicator of relative risk for impacting watershed resources and is a relative measure for comparison of alternatives. This discussion summarizes the watershed resources within the activity area; additional information is located in the project file (Range 2004).

Summary of effects

Measure		Alt. 1 (No Action)	Alt. 2 (Proposed Action	Alt. 3	Alt. 4
Type of logging and area proposed on National Wetlands Inventory (NWI) wetlands areas, acres	Red pine – clearcut – 113	0.0	0.10	0.0	0.0
	Jack pine – salvage – 114	0.0	15.8	0.50	15.8
	Jack pine – thinning – 220	0.0	7.30	7.30	7.30
	Create savanna from jack pine stands - 270	0.0	0.0	4.60	0.0
	Total	**0.0**	**23.3**	**12.4**	**23.2**
Road activities and area proposed for NWI wetlands areas, acres	Maintenance	0.0	0.039	0.13	0.039
	Decommission	0.0	0.14	0.14	0.14
	Temporary	0.0	0.052	0.0	0.0
Net change in permanent road, miles	New and existing comm.., minus decom. And decom. After use	0.0	-9.8	-19.7	-18.6
% open area within affected watersheds	Permanent open plus clearcut (113) and salvage (114) and savanna (270)	24.4%	29.7%	28.5%	29.7%

Mitigation measures: See soils resource section.

AFFECTED ENVIRONMENT

Climate and weather. The climate in the project area is influenced in winter by the cold continental air mass to the north and west, and in summer by the warm, moist maritime air mass to the south. Most of the time the project area, like much of the entire Eastern Upper Peninsula (U.P.) of Michigan, is affected by these air masses. Lakes Michigan and Superior also exert strong local influences on weather and climate in the U.P., increasing weather variability and contributing to long-term climatic characteristics. For instance, lake-effect snows along the Lake Superior shore in the U.P. are the result of northerly winds that occur after the passage of winter cold fronts. These winds pick up moisture from the much warmer Lake Superior and cause bands of heavy snowfall on downwind land areas.

Data from the National Climate Data Center between 1931 and 1998 suggests an average annual precipitation of 33.26 inches at Sault Ste. Marie. The minimum annual average precipitation occurred in 1961 (25.51 inches), and the maximum annual average precipitation in 1995 (45.84 inches). The average annual precipitation at Rudyard from 1978-1998 was 30.8 inches (about 3.5 inches less than at Sault Ste. Marie). The lesser amount is presumably due to its location further from the influences of the Great Lakes. The Rudyard data may best represent the climatic conditions within this project area. The average minimum and maximum daily temperatures for the month of January at Rudyard are 6.4 and 24.5 degrees Fahrenheit. The average minimum and maximum daily temperatures for the month of July at Rudyard are 51.6 and 78.1 degrees Fahrenheit.

Watersheds. Table 3-3 lists the fifth and sixth level watersheds as they have been delineated on the HNF, total watershed acres, those within the project area, and the percent of each watershed within the Raco Plains project area. A map of the United States Geological Survey (USGS) Hydrologic Unit Code (HUC) 5^{th} and 6^{th} level watersheds and the project area is found in the project file (Range 2004).

The project area contains few streams and lakes. The headwaters of three river systems in the Eastern U.P. are within the project area: Tahquamenon, Pine, and Waiska Rivers. Headwater areas of stream systems represent an integral part of stream system and their function and protection is equally important as downstream areas (American Rivers and Sierra Club 2003).

The current amount of openings in the watersheds is listed in table 3-8 (percentage of openings table). Openings include natural wetland openings as well as those resulting from harvest during the past 15 years. This information will be used in the analysis of effects later in this section.

Fluvial (stream) and lacustrine (lake) systems. The length of stream channels located in the Raco Plains project area is approximately 37.5 miles as mapped using GIS steam courses derived from USGS quadrangles. A map of lake and stream locations is located in the project file (Range 2004).

Designated Uses. Uses of water in the project area include fishing, swimming, and boating (McDonough et al.1999). A fish hatchery is located at or near the project area boundary on Sullivan Creek. The hatchery is within the North Pine River at Prey Creek USGS HUC 6th level watershed.

Designated uses recognized by the State of Michigan include warm water aquatic environments and riparian dependant species habitats (Michigan Water Quality Standards; Public Act 451, Natural Resources Protection Act, 1994). The designated uses of water in the affected watersheds include fish habitat, support of wetland plant communities, and augmentation of flows to the Tahquamenon River, a nationally designated wild and scenic river. The named streams within the project area boundaries are listed in the following table.

Table 3 - 3. Summary of 5th and 6th Level Watershed Geographic Areas within the Project Area.

5th HUC Watershed Name (Total Watershed Acres)	5th HUC Watershed area in Project Area Percent (Acres)	6th HUC Watershed Name (Total Watershed Acres)	6th HUC Watershed area in Project Area Percent (Acres)
Tahquamenon River at mouth (285,590 ac.)	3.4% (9,854 ac.)	East Branch Tahquamenon River at Creek #8 (21,671 ac)	46% (9,854 ac.)
Pine River at mouth (176,949 ac.)	15% (26,624 ac.)	Biscuit Creek at mouth (15,606 ac.) *	2.8% (437 ac.)
		Black Creek at mouth (21,413 ac.)	28% (6,051 ac.)
		North Pine River at Prey Creek (16,176 ac.)	48% (7,716 ac.)
		Pine River above Chub Creek (24,647 ac.) *	6.2% (15,631 ac.)
		Pine River at Lumpson Creek (18,020 ac.)	18% (3,238 ac.)
Waiska River at mouth (18,769 ac.)	15% (28,390 ac.)	Lake drainage to Lake Superior 05 (25,111 ac.)	26% (6,439 ac.)
		Lake drainage to Lake Superior 07 (16,232 ac.)	20% (3,245 ac.)
		Little Waiska Creek at mouth (3,453 ac.)	34% (1,178 ac.)
		Orrs Creek at mouth (13,995 ac.)	68% (9,524 ac.)
		Pendills Creek at mouth (10,016 ac.)	8.3% (830 ac.)
		Waiska River at mouth (16,593 ac.) *	21% (3,448 ac.)
		West Branch Waiska River above White Creek (19,917 ac.)	16% (2,870 ac.)
		West Branch Waiska River at mouth (6,384 ac.)	13% (853 ac.)

* Watersheds within the project area, but no treatments are proposed under any of the action alternatives. No further watershed analysis discussion will be included for these watersheds.

Physical characteristics of project area streams. Hydrology of the Eastside of the Hiawatha National Forest involves interaction between subsurface and surface flows. Stream temperature and alkalinity, and the geomorphic characteristic of stream channel width have been used by the Chequamegon-Nicolet National Forests in Wisconsin as indicators of the potential productivity for riverine systems (Higgins 1997). These characteristics are indicators of several hydrologic/geomorphologic parameters.

Temperature is directly related to the width of the channel and inversely related to channel depth; the mean summer stream temperature is directly related to the type and amount of riparian vegetation. In the eastern U. P. temperature is also a good indicator of the degree of stream/ground water interaction. Cooler stream temperatures in midsummer coupled with a smaller range of water temperatures indicates groundwater inflows.

Alkalinity is a reflection of the physical characteristics of the channel substrate, and the degree that stream flow interacts with groundwater. It also buffers the pH of the stream and is a measure of stream productivity.

Channel width is a result of the order or position of the stream in the drainage network, especially in areas of abundant precipitation, and the drainage density of the watershed. Channel width responds readily to changes in stream flow and other activities, as a result, it is a commonly measured determinant of manipulation, degradation, or variation in stream equilibrium (Lane 1955).

Interpretation of the variables described above allows describing streams in the project area as three distinct hydrologic categories:

Cold-water, groundwater influent. Alkalinity of the stream is very high, exceeding 200 mg/l of calcium carbonate (Trudell 1999). The channel dimensions average about 12 feet wide and 1.7 feet deep, and has very cold summer maximum temperature, rarely exceeding 55 degrees Fahrenheit. The high alkalinity suggests hydrologic connections with the dolomite that forms the Niagara Escarpment LTA immediately to the south. Biscuit Creek is an example of a coldwater stream.

Warm-water, surface water influent. The low alkalinity suggests little ground water input and low natural productivity. Much of the water in the streams comes from poor fen/rich bog headwater wetlands, and is inherently warm. Field data analysis and interpolation from surficial geology maps suggest that Blind Biscuit, Quinn, Hendrie, Naugle, and Kneebone Creeks tend to be small and warm, and have low alkalinities.

Mixed, groundwater/surface water influent. The widths of these channels vary with landscape position, but both are less than 20 feet wide. While the cool temperatures suggest they receive some groundwater, monitoring during 1999 suggests that riparian vegetation helps to maintain cool summer maximum temperatures in cool water channels, and that it is the daily summer warming that keeps them in the cool rather than cold

category. Pine River and Lumpson Creek generally fall in the cool category, with summer high temperatures staying below 73 degrees Fahrenheit.

All surface waters within the project area have been deemed by the State of Michigan to be fully attaining their designated uses. There are no State designated impaired water bodies in the project area listed under section 303D of the Clean Water Act (MDEQ, Surface Water Quality Division, May 2000, 303D List).

Past human activities. Effects attributable to past timber harvest, road building, and other human activities within the affected watersheds have undoubtedly occurred, including rutting in the harvest units, back up of flow from roads and beaver dams, and the persistence of winter roads (USDA Forest Service 2003).

Wetlands. Two GIS sources of information are used to help identify wetlands: soils GIS layer, and National Wetlands Inventory (NWI).

The Forest Plan defines wetlands by their wet soils: "Areas with shallow standing water or seasonal to year-long saturated soils (included bogs, marshes, and wet meadows)" (Glossary, p.19). The term 'wetlands' means those areas that are inundated by surface or groundwater with a frequency sufficient to support and under normal circumstances does or would support a prevalence of vegetative or aquatic life that requires saturated soil conditions for growth or reproduction. Wetlands generally include swamps, marshes, bogs, fens, peatlands, and similar areas such as sloughs, potholes, wet meadows, river overflows, mud flats, and natural ponds.

Based on the digitized soils layer of the Chippewa County soil survey (Whitney 1992), approximately 5% of the soils within the project area are hydric. The remaining 95% of the project area is considered upland soils (Range 2004). In very general terms, hydric soils can be defined as those soils that are poorly or very poorly drained. For additional information about the effects to soils refer to the soils section in this chapter.

The type of logging and road activity, and NWI area affected are summarized in the summary of effects table at the beginning of this section.

Mitigations are prescribed to the project area using GIS data and following soils management recommendations identified in Whitney 1992 and the Forest Plan. These mitigations would minimize effects to wetlands. Mitigations are listed by site (treatment area) in appendix D, Soils Limitations and Mitigations. Due to the relatively minor amount of wetlands within the project area and proposed for treatment, no further discussion of wetlands as a separate issue or resource area to soils or hydrology is included.

Water yield and stream flow regime. Trees have a direct influence over the amount of precipitation input available for stream flow because they transpire water, intercept precipitation which is then evaporated or sublimated directly back into the atmosphere, and modify the understory evapotranspiration environment (Kaufmann et al. 1987).

Following fire or harvest, loss of ground cover and change in vegetation type, such as proposed openings in jack pine stands, will cause changes in infiltration and runoff. Where openings are created, more solar radiation will reach the snow surface and a more rapid snowmelt is expected and transpiration will decrease (Dunne and Leopold 1978).

These changes may or may not increase annual streamflow (yield) or timing of streamflows (streamflow regime), depending on treatment site locations and natural variations in precipitation, snowpack, and rate of snowmelt. A study conducted in Minnesota showed that increasing open areas within aspen stands from 0 to greater than 35, through 60 percent changed the timing of stream flow runoff and actually decreased the peak flows from spring runoff. Beyond 60 percent peak flow values increased (Verry 1986.)

DIRECT AND INDIRECT EFFECTS

The following discussion of hydrology effects will be limited to those issues and concerns described in chapter 2, specifically roads and accessibility, openland wildlife habitat, and amount of jack pine harvest. The scope of the direct and indirect effects analysis is the project area. In addition to information used in the soils analysis, digitized watershed and stand boundaries, and additional vegetation data digitized at the county level are used in the analysis. The geographic boundary for the cumulative effects analysis is the USGS 6th field hydrologic unit code (HUC) watersheds that intersect areas where project activities are proposed. A map of the cumulative effects area is located in the project file (Range 2004).

Alternative 1 (No Action)

Water yield and stream flow regime. The existing condition and trends described under purpose and need and affected environment section would persist. Without implementation of any of the action alternatives the risk of jack pine budworm impacts on vegetation would increase. Road management opportunities identified in the roads analysis would not be implemented and conditions described in the analysis would continue.

Water Quality. The existing condition and trends described in chapter two under purpose and need and affected environment section would persist. Without implementation of any of the action alternatives the risk of jack pine budworm impacts and wildfire on vegetation would increase. Road management opportunities identified in the roads analysis would not be implemented and conditions described in the analysis would continue.

Effects Common to All Action Alternatives

Water yield and stream flow regime. Changes in cover may cause local changes in flow regime and annual water yield, but in most cases they would not be discernable from natural variations at the HUC 6 watershed level. Recovery period, the time for yield to

return to the previous level, is expected in up to 20 years for pine clearcuts (Verry 1986). The actions would also affect peak flows, which are discussed in the watershed cumulative effects section.

Openings have the potential to affect watershed hydrology and water yield. A study done in Minnesota on the effects of hydrology is used to predict impacts of openings on water yield. The study cited references that stated that aspen clearcuts (not included in this proposal) would increase water yield from the affected areas by 9 cm (3.5 inches), while upland pine clearcuts would add another 7 cm (2.5 inches) compared to this total, or 16 cm (appr. 6 inches). Six inches annual yield is equal to 0.44 cubic feet per second per square mile (CFS/sq. mi.) average flow.

A calculation of the percentage of openings was done for all affected watersheds; the results are presented in the graph in the cumulative effects section. Openings include areas managed as permanent and temporary openings. Temporary openings include stands less than 15 years old. Permanent openings include areas outside National Forest lands and include areas such as agricultural and urban areas. Increases in watershed openings vary from 0.6% to 9.3% (lake drainage to Lake Superior 07 (all action alternatives) and Little Waiska Creek at mouth (Alternatives 2 and 4), respectively.

A calculation of daily mean flows was done for two USGS discharge stations for 19 and 38 years of record at Tahquamenon River near Paradise, Mich. and Pine River near Rudyard, Mich. The results show that the average annual daily flow is 0.93 and 1.23 cfs/sq. mi. with a standard deviation of 0.20 and 0.30 cfs/sq. mi., respectively. Using the assumption that all watersheds within the analysis area have similar yields and variations, a calculation of the expected increase in annual water yield due to clearcuts can be made. Under the largest percentage of clearcut proposed for the project area, 9.3%, an increase of 0.041 cfs/sq. mi. within a watershed would be the result (0.44 x .093 = 0.041). This value is within the expected variations indicated by the calculation of standard deviations and therefore, is not expected to be measurable.

Water Quality. Some additional delivery of sediment to stream systems is expected at culverts due to increased hauling and necessary maintenance activity for timber sales. Timber harvest would result in elevated erosion rates in the short-term. Compaction from timer harvest would be within acceptable limits as defined in the soils section and would not greatly affect hydrologic characteristics. Mitigations included as part of project activities would minimize impacts due to harvest and road management and ensure that State and Federal water quality laws are complied with.

Some additional sediment could be delivered to Sullivan Creek, upstream of the fish hatchery, due to additional road maintenance required by hauling activities. It is not expected that harvest activities on site would contribute additional sediment to the creek, due to the distance from the stream channel that would provide adequate buffering.

Harvest Activities. A summary of forest management practices from nation-wide studies shows that forest management practices have the potential to degrade the quality of water in streams by altering temperature, lowering dissolved oxygen concentrations, and increasing the concentration of nitrate-N and suspended sediment. In most cases, retention of buffer strips keeps the maximum increase in stream temperature to less than 2 degrees Centigrade. Depletion of stream water oxygen is also rare in current harvesting operations. Minimizing inputs of fine organic debris into streams prevents creation of high biological oxygen demand. Forest harvesting may increase nitrate concentration, but the summary concluded that harvesting does not degrade water quality by increasing nitrate concentrations in stream water, with the possible exception of the Hubbard Brook forests (northern hardwood forests). The summary concluded the major concern associated with silvicultural practices is suspended sediments. In this study it was concluded that use of BMPs generally minimizes suspended sediment concentrations (Brinkley and Brown 1993).

The State of Michigan booklet, "Water Quality Management Practices on Forest Land," serves as a guide for management of forested land with the goal of maintaining high quality water. On the HNF these practices are applied to harvest operations in the form of stand specific mitigations. A cross reference of Forest Plan standards and guides to the State's practices (as well as other regulations) shows how the HNF implements the State practices. This information is included in the project file. Monitoring of timber sales on the HNF during the past several years has shown that mitigations are effective in preventing and/or minimizing erosion and sedimentation (Trudell 2003). Mitigations are applied with an emphasis on skidding operations. Specific contract requirements that implement mitigations are included in the timber sale contract provisions. These are mainly focused on limiting operations during wet periods and excessively dry periods. Mitigations for action alternatives are listed by site in appendix D, Soils Limitations and Mitigations.

Soils and wetland analysis has been done as part of project analysis. Soils identified as potential hazards related to skidding and roads construction have been identified in the soils section of this EA. Potential NWI areas impacted are summarized in the summary of impacts table at the beginning of this section.

Also included in the analysis are areas where the potential for sediment entering stream systems may be elevated. The particular attributes of interest are soil erosion hazard, proximity to stream channels such as roads crossing stream channels. No new roads would be constructed in NWI areas. The amount of roads in the project area and NWI areas would decrease. Road crossings of stream channels are identified in the roads analysis (RAP) done for this project. Where road reconstruction or maintenance is planned mitigations would be applied to minimize sediment delivery to streams and wetlands.

CUMULATIVE EFFECTS

Alternative 1 (No Action)

The existing condition and trends described in chapter two under purpose and need, and affected environment section would persist. Without implementation of any of the action alternatives the risk of jack pine budworm impacts on vegetation would increase along with subsequent higher risk of unmanageable wildfire. Road management opportunities identified in the roads analysis would not be implemented and conditions described in the analysis would continue.

Cumulative effects are generally considered to be additive or synergistic effects resulting from multiple activities within a defined time and area. The cumulative effects analysis area is the USGS 6th filed HUC boundaries that intersect with proposed activities. The time analysis was done from 1994 to ten years into the future. Past and present management activities in the area include road construction, road maintenance, timber harvest, fuel wood gathering, Christmas tree cutting for personal use, and recreational pursuits such as hunting, fishing, camping, hiking, and trail riding with mountain bikes and off highway vehicles.

Cumulative Effects Common to All Action Alternatives

Please see *the Thunderbird EA* (USDA Forest Service 2004) for a discussion of cumulative effects relative to jack pine harvest levels on the HNF, 1986-present.

The direct and indirect effects of the action alternatives include short-term delivery of sediment to stream channels and perhaps alteration of streamflow regime and peak flows in the affected watersheds. None of the potential changes are expected to be measurable at the 6th field HUC watershed scale. Cumulative effects, due to reaching a known or unknown threshold, would not be expected as a result of implementing any action alternatives.

Cumulative effects could most likely result as direct and indirect effect of excess sediment delivered to stream channels or increased peak flows due to increases of open areas within the affected watersheds. Either one of these changes could destabilize stream channels (changing channel geometry and potentially stream temperature) and cause mobilization of sediments. Excess sediment could also result if the direct and indirect effects were added to other contributors within the analysis area. These effects are discussed in the water quality section. To ensure that project impacts are minimized, all project activities would be implemented with prescribed mitigations. Monitoring of timber sales on the HNF during the past several years has shown that mitigations are effective in preventing and/or minimizing erosion and sedimentation. It is not expected that a measurable cumulative effect would be the result due to additional sediment.

A study on the effects of aspen clearcut, conducted by the United States Forest Service (USFS) North Central Forest Experiment Station research hydrologist concluded that

peak streamflows due to snowmelt are affected when watershed open areas are altered (Verry 1986). The data showed there was little to no change in peak flows until watershed openings exceed 35% of the watershed when compared to mature aspen stands. When 35 to 60 percent of the watershed is open, a reduction in stream flow will occur. In this condition the watershed is differentially shaded and snowmelt will be desynchronized, thus lowering peak flows. After the watershed exceeds 60 percent open area, snowmelt is again synchronized and the additional open areas result in a higher peak runoff. Streamflow peak discharge may double under this condition.

For the purpose of cumulative effects analysis, it is assumed that channel stability (due to increased peak flows) may be affected when the 60% value is reached. Also for the purpose of this analysis, "open" is generally due to silvicultural treatments, natural condition, or other man caused or natural perturbations such as roads, fire disturbances, open agricultural lands, and urbanization. Open areas include clearcut harvest areas less than 15 years old.

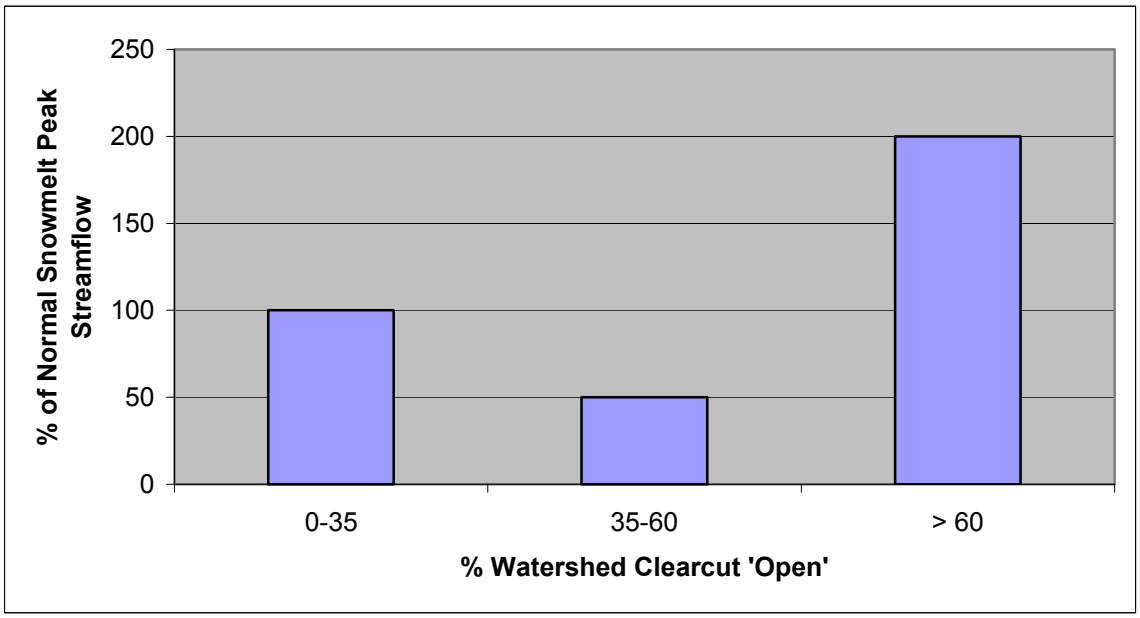

Figure 3 - 2. Anticipated Change in Peak Streamflow During Snowmelt for Aspen Clearcut (Verry 1986). Changes in the percentage of the vegetation overstory within a watershed area cause changes in peak discharges during snowmelt. ("Open" is stand age less than 15 yrs.)

For all alternatives, calculation was done for all affected watersheds for open in 1998, in 2003, and following harvest. The results are summarized in the following graph.

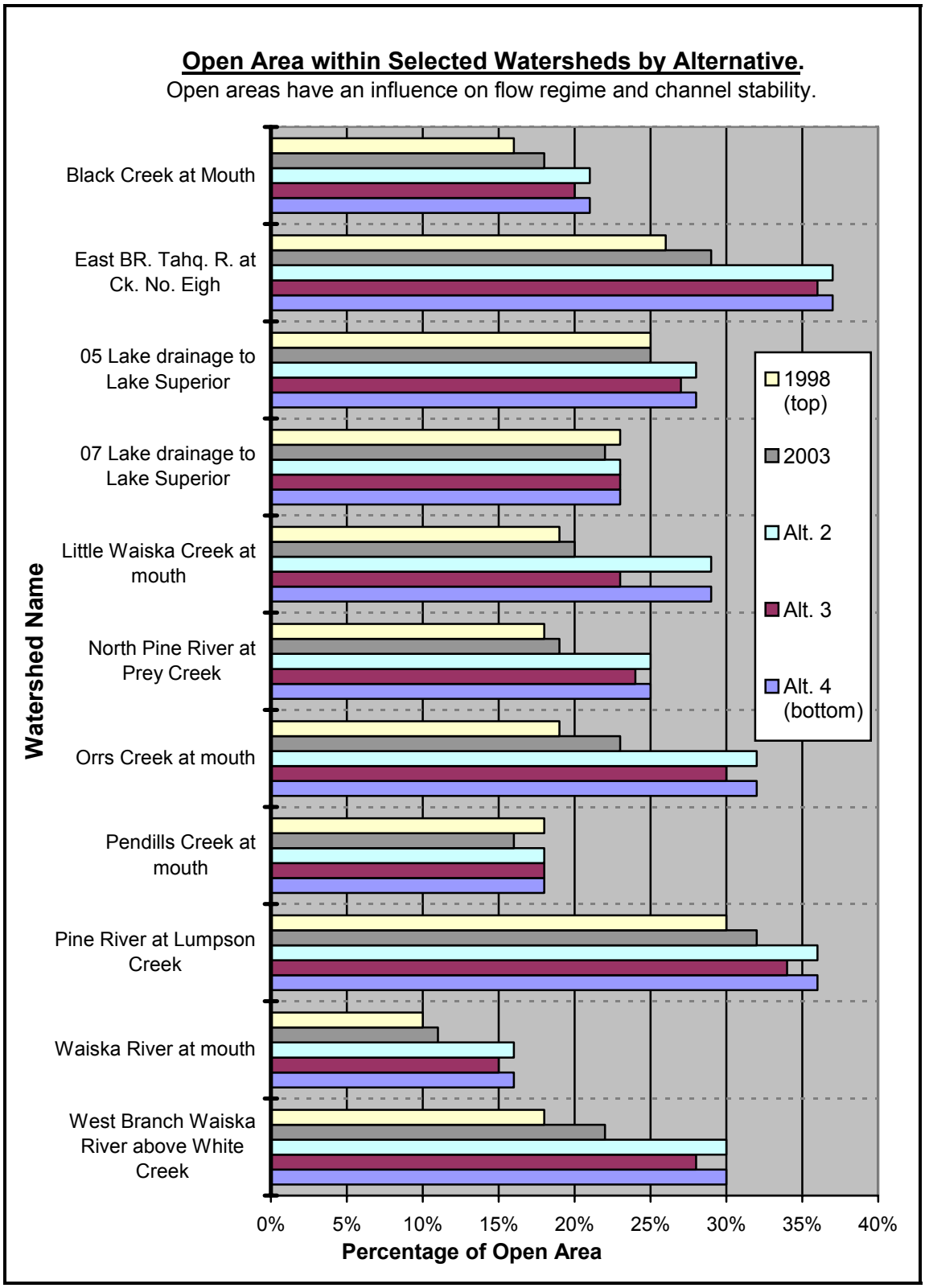

Figure 3 - 3. Open Area Within Selected Watersheds by Alternative.

After review of the data summarized in the graph and considering the previous discussion, it is not expected that any action alternative would result in a change in peak flow large enough to cause a quantum change in channel stability.

Note that none of the watersheds would exceed the 60 "threshold," identified in the model. The largest value occurs under Alternatives 2 and 4, where East Branch of Tahquamenon River at Creek Number Eight reaches 37%. Compared to 1988 and 2003 data this is about a 9% increase. Two of the watersheds would exceed 35% openings, "East Branch..," and "Pine River at Lumpson." This increase in open area is in the range where the model expects that peak runoff may actually decrease. Increases in other watersheds are relatively minor, in the range where more open area would have little effect on peak flows. It is, therefore, not likely any of the changes would be enough to cause stream destabilzation resulting as a cumulative effect due to peak flow increase.

VEGETATION: SILVICULTURE

Summary of Effects

This section of the EA will discuss the effects of the alternatives on vegetation emphasizing the issues from the EA dealing with Kirtland's warbler, harvest near the North Country Trail, red pine, and amount of jack pine harvested.

	Alt. 1 (No Action)	Alt. 2 (Proposed Action)	Alt. 3	Alt. 4
Average percent of mortality in treated stands	NA	30%	30%	30%
Average percent of mortality in untreated stands	30%	22%	30%	22%
Acres of jack pine treated	0 acres	6,963 acres	3,127 acres	6,963 acres

AFFECTED ENVIRONMENT

The Raco Plains LTA consists of a variety of forested and non-forested conditions. Approximately 88% of the Forest Service lands are forested. The remaining 12% are non-forested, which are mostly dry, upland openings. About 16% of the project area is suited old growth and unsuited lands. There are numerous small parcels of privately owned forested lands within the project area. Approximately 50 acres are industrial forest lands that are managed predominately for conifers.

The following table lists acres by species groups (combinations of forest types with similar site and silvicultural requirements) for the Raco Plains LTA.

Table 3 - 4. Forest Types and Openings on Federal Land in the Raco Plains LTA.

Species Group	Acres	Percent of Project Area
Jack pine	25,160	40%
Red-white pine	22,319	35%
Aspen	3,733	6%
Hardwoods	1,779	2%
Cedar	84	1%
Spruce-fir/swamp conifer	2,442	4%
Openings	7,686	12%
Total	**63,203**	**100%**

Spatially, the jack pine and red pine can be found throughout the project area. The aspen and hardwoods are located on the northern edge of the area. The cedar and swamp conifer are found near the Betchler Marsh area.

Specific to the jack pine forest type, 29% is 0-10 years old. This high percentage is the result of past cutting activities related to prior jack pine budworm outbreaks. At the other end of the scale, 33% of the jack pine is over 60 years of age. Currently, there is not an even age-class distribution. As the distribution of jack pine age-classes becomes more diverse, the incidence of jack pine budworm becomes less frequent. This recommends spatial diversity of vegetation and age-classes to reduce the risk of defoliation by budworm and mortality. Figure 1-3 shows the current age-class distribution for jack pine in the Raco Plains LTA. See also *Thunderbird EA* (USDA Forest Service 2004) for age-class distribution across the entire HNF.

Most of the jack pine stands in the Raco Plains project area were impacted by the jack pine budworm. Trees in these stands lost growth for the 2-4 year period during 2000-2003 when the latest budworm infestation occurred. Many of these stands had tree mortality as a result of the infestation. As a result, there is a loss in volume in these stands.

Direct seeding has been implemented in the past on the Raco Plains with mixed results. Forest Plan page IV-27 says the use of direct seeding for natural regeneration of jack pine is preferred where the water table is within 7 ft. of the surface. Rubicon Soil is a droughty soil where the water table is usually deeper than 7 ft. from the surface and planting is usually used to regenerate jack pine on poorer sites. Rubicon is the dominant soil series in the Raco Plains area. Most of the poor results from direct seeding of jack pine in the past have been on Rubicon soil. Good results with direct seeding of jack pine have occurred on other soils within the Raco Plains area, as well as within the transition zone between Rubicon soil and other soils. These transitions zones are usually typed as Rubicon soil on soil maps, and past seeding failures and successes identify where direct seeding could be achieved. Past successes often exceed the stocking levels described in the Forest Plan standards and guidelines level of 800 trees per acre.

DIRECT AND INDIRECT EFFECTS

Alternative 1 (No Action)

Vegetation Management and Kirtland's Warbler Habitat. This alternative does not propose any silvicultural management activities. Selecting Alternative 1 would allow nature to take its course in the jack pine stands in the project area and no Kirtland's warbler habitat would be created at this time unless the area burned. The possibility of high intensity wildfire would be increased as trees died and dead/down jack pine accumulated on the ground. If a fire occurred, the jack pine stands would be regenerated to jack pine, which could be potential Kirtland's warbler habitat. Without fire, stands could proceed with successional patterns. Red pine, white pine, balsam fir, and red maple could develop to varying degrees in the understory and gradually replace jack pine on better sites.

Vegetation Management and Amount of Jack Pine Harvest. This alternative does not propose any silvicultural management activities. Selecting Alternative 1 would allow nature to take its course in the jack pine stands in the project area. The average percent of mortality in the stands not treated is approximately 30%. Up to approximately 6,350 acres of mature jack pine stands not harvested during this entry would be expected to lose 15-20% of the stand volume over the next 10-15 years. The amount of dead and down trees would increase. The jack pine would remain at risk from insect and disease attack, and subsequent wildfire. Natural succession would occur and over time the jack pine would die out and be replaced by more tolerant species, such as spruce, balsam fir, and red maple. Over a long period of time, the spruce and balsam fir would also die out and white pine, red pine, and possibly mixed hardwoods would become established. The fire hazard would continue to increase as trees continued to die.

This alternative would not meet the objectives of providing forest products to mills. It also would not reduce the impacts of the jack pine budworm and create a more evenly distributed age-class. The potential impacts of wildfire in specific areas to residents, visitors, and facilities would not be reduced. There would be no increase in aesthetic values in recreation areas.

Vegetation Management and Timber Harvest Near the North Country Trail. This alternative does not propose any silvicultural management activities. Selecting Alternative 1 would allow nature to take its course in the jack pine stands in the project area. Natural succession would occur and over time the jack pine would die out and be replaced by more tolerant species, such as spruce, balsam fir, and red maple. Over a long period of time, the spruce and balsam fir would also die out and white pine, red pine, and possibly mixed hardwoods would become established.

This alternative would not salvage jack pine trees near the North Country Trail, reduce fuel accumulation and flammability, nor increase aesthetics or recreational values.

Vegetation Management and Amount of Red Pine to Manage. There would be no management activities in the red pine stands. In the stands that are ready to be thinned, the annual growth of the stand would decrease in the short term (5-10 years). In the long run, growth would be offset by mortality. With the reduction of growth, it would take longer for the trees to grow larger, both in diameter and height.

This alternative would not provide forest products to mills.

Effects Common to All Action Alternatives

Three stands would be managed for visual quality within a 1/8 mile corridor along the North Country Trail. In general, the jack pine would be salvaged and all other species would be retained. Most of these trees would be retained unless they need to be harvested to construct roads, skid trails, and landings. The action alternatives would salvage jack pine trees near the North Country Trail, reducing fuel accumulation and flammability, and increasing aesthetics or recreational values.

Compartment 34, Stand 21 is composed of jack pine, aspen, paper birch, and red pine. The jack pine and some of the aspen would be removed. The red pine, paper birch, and clumps of aspen clones would be left.

Compartment 78, Stand 15 is composed of jack pine, red pine, and white pine. The jack pine would be removed and white pine and/or hemlock would be underplanted.

Compartment 78, Stand 18 is composed of jack pine and red pine. The jack pine would be removed and hemlock and/or white pine would be underplanted.

The impact of the jack pine budworm would be reduced by salvaging these jack pine stands, and converting them to other forest types. Over time the harvest of these stands would provide wood products to the local markets.

Thinning would be implemented on approximately 797 acres in 25 red pine stands to improve stand health and vigor. These stands are presently overstocked exhibiting reduced growth and are silviculturally ready for treatment. The species to be harvested would primarily be red pine.

Shelterwood regeneration cuts would be implemented on approximately 89 acres in three stands to naturally regenerate the areas to red pine. Approximately two-thirds of the overstory trees would be cut leaving large, evenly spaced red pine trees to serve as a seed source to naturally regenerate the area. A seedtree regeneration cut would be implemented on approximately 39 acres in one stand to naturally regenerate the area to red pine. Most of the overstory would be cut leaving 1-2 trees per acre that are widely spaced to serve as a seed source to naturally regenerate the area. The dominant species to be harvested for both methods would be red pine. Prescribed fire would be used to

reduce problems associated with the red pine cone beetle (*Conophthorus resinosae* Hopkins) and to prepare the seed bed for natural regeneration of red pine.

The second prescribed burn would be for site preparation for natural regeneration and would be implemented in late summer to prepare a seedbed for the red pine seed. This second burn would probably be implemented 2-3 years after the first burn.

Some regeneration would be destroyed by felling and skidding. However, most red pine regeneration would be protected if the mitigation measures were followed.

Two diseases (Sirococcus shoot blight *Siroccus strobilinus* and Sphaeropsis shoot blight *Spraeropsis sapinea)* can be spread from resin droplets of infected trees dripping onto lower branches of overstory trees and understory trees. For that reason, once red pine natural regeneration is established in these stands, the overstory seed trees would be harvested to reduce any possible chance of these diseases affecting the red pine stands.

The prescribed burning would destroy parts of the existing vegetation after the initial harvest. Most plant species other than the red pine seed trees would be temporarily eliminated until they sprout back or re-seed into the area. Red pine seed trees could be charred on the boles and could have some needles scorched. The bark of older trees is corky, thicker, and more resistant to fire so most trees would not die from prescribed fire.

All action alternatives construct new system roads that are needed to access stands to be harvested. This construction of new system roads would reduce the acres of forested lands (see alternative discussion in the Irreversible and Irretrievable section). However, all action alternatives would also decommission unneeded roads and would add acres back to forested lands.

Forest Plan IV-27 describes a guideline that states "In general, jack pine on sites with site index 55 or better should be converted to red pine, except that jack pine should be retained as needed to obtain composition objectives for the management area or spatial arrangement within the management area." All action alternatives would harvest 1,610 acres of jack pine with site index of 55 or better. Alternatives 2 and 4 regenerate 302 acres to red pine, and Alternative 3 regenerates 211 acres to red pine. The other acres would be regenerated to jack pine to meet compositional and spatial objectives as described in the DFC and purpose and need.

Alternative 2 (Proposed Action)

Vegetation Management and Kirtland's Warbler Habitat. Approximately 3,100 acres of jack pine would be regenerated for Kirtland's warbler habitat. Jack pine regeneration on these sites would be increased to about 1,089 trees per acre.

Increasing stocking levels could reduce the future availability of wood products. The recommended upper limit of stocking for managed stands averaging 5 inches in diameter is 800 trees per acre (Benzie 1976). Stocking levels greater than this upper limit could

result in slower growth, thereby lengthening the rotation, and decreasing yield. This would be due to competition for resources such as sunlight, water, growing space, or nutrients. There could be a possibility of stunted growth of trees or stagnation resulting from this competition. In the long term or at the time of rotation age (40-70 years), the volume available to harvest could be less than that resulting from following the recommended upper limit of stocking (appendix F, Biological Evaluation, table F - 7).

Vegetation Management and Amount of Jack Pine Harvest. Approximately 5,789 acres of jack pine would be salvaged and regenerated back to jack pine. All species would be removed except oak, white pine, hemlock, and black cherry. Most of these trees would be retained unless they need to be harvested for construction of roads, skid trails, and landings. Approximately 2,725 acres would be regenerated back to jack pine by seeding and about 3,064 acres would be regenerated back to jack pine by planting. The method of reforestation for individual stands was determined by using the soils map and past regeneration success on various sites. The Forest Plan states that on droughty soils where the water table is deeper than 7 feet, planting has proven to be more reliable for jack pine regeneration (Forest Plan IV-27). Jack pine stands scheduled to be harvested would be mechanically site prepared. The jack pine stands would be salvaged as soon as possible and where mechanical site preparation is needed, the sites would be chopped as soon after harvest as possible. Chopping the slash as soon as possible after harvest would encourage natural regeneration of jack pine in these stands.

Approximately 302 acres of jack pine would be salvaged and converted to red pine by planting with mechanical site preparation. About 166 acres of jack pine would be salvaged and converted to red pine by prescribed burning.

Approximately 366 acres of jack pine would be salvaged and converted to savanna. This conversion from forested stands to savannas would reduce the amount of timber production acres, thereby reducing future availability of wood products. However, the establishment of savannas would result in a reduction in the acres of over-mature jack pine that are susceptible to future infestations by the jack pine budworm.

Jack pine removal would occur on approximately 94 acres near the Soldiers Lake Campground. This would reduce the impact of potential wildfire in this area by removing over-mature jack pine impacted by the jack pine budworm.

A seedtree regeneration cut would be implemented to naturally regenerate jack pine on approximately 145 acres. This method involves leaving a few selected trees per acre following cutting to serve as a seed source for new regeneration. Once this new regeneration is established, the seed trees are removed. Due to the serotinous nature of many jack pine cones, fire must be used to release seed from the standing seed trees, as well as prepare the seedbed (Hacker et al.). This method attempts to mimic the fire regime of jack pine, while allowing most of the trees to be utilized.

Approximately 1,633 acres of mature jack pine would be deferred from treatment. The average percentage of mortality in the untreated stands is approximately 22%. Mature

jack pine stands not harvested during this entry would be expected to lose 15-20% of the stand volume over the next 10-15 years.

Alternative 3

Vegetation Management and Kirtland's Warbler Habitat. This alternative differs from Alternative 2 in that less acres would be managed for Kirtland's warbler habitat. Approximately 1,184 acres of jack pine would be regenerated for Kirtland's warbler habitat. Jack pine regeneration on these sites would be increased to about 1,089 trees per acre.

Increasing stocking levels could reduce the future availability of wood products as described under Alternative 2.

Vegetation Management and Amount of Jack Pine Harvest. The primary difference between Alternatives 2 and 3 is that Alternative 3 is based on the Forest Plan guidelines pertaining to temporary openings. The size of the new temporary openings (clearcut-salvage units) would be less than 300 acres, therefore, there would be less jack pine acres harvested. This alternative would also increase the amount of edge or fragmentation in the area.

Approximately 2,180 acres of jack pine would be salvaged and regenerated back to jack pine. All species would be removed except oak, white pine, hemlock, and black cherry. Most of these trees would be retained unless they need to be harvested to construct roads, skid trails, and landings. Approximately 895 acres would be regenerated back to jack pine by seeding and about 1,285 acres would be regenerated back to jack pine by planting.

Approximately 211 acres of jack pine would be salvaged and converted to red pine by planting with mechanical site preparation. About 93 acres of jack pine would be salvaged and converted to red pine by prescribed burning.

Approximately 528 acres of jack pine would be salvaged and converted to savanna. This conversion from forested stands to savannas would reduce the amount of timber production acres, thereby reducing future availability of wood products. The establishment of savannas would result in a reduction in the acres of over-mature jack pine that are susceptible to future infestations by the jack pine budworm.

A seedtree regeneration cut would be implemented to naturally regenerate jack pine on approximately 115 acres. This method involves leaving a few selected trees per acre following cutting to serve as a seed source for new regeneration.

The average percent of mortality in the jack pine stands to be treated is approximately 30%. By harvesting and regenerating these mature and over-mature stands to jack pine, the timber would be utilized and the regeneration would be healthy, vigorous, and resistant to jack pine budworm for several decades.

Approximately 3,872 acres of mature jack pine would be deferred from treatment. The average percentage of mortality in the untreated stands is approximately 30%. Mature jack pine stands not harvested during this entry would be expected to lose 15-20% of the stand volume over the next 10-15 years.

This alternative would reduce the impacts of wildfire since dead and dying jack pine trees would be salvaged and regenerated to young, vigorous jack and red pine stands. This alternative would also reduce the impacts of future jack pine budworm (JPBW) infestations, improve health and vigor, increase growth rates, create a more balanced age-class of jack pine, and provide wood products.

Alternative 4

Vegetation Management and Kirtland's Warbler Habitat. This alternative differs from Alternative 2 in that there would be more acres managed for Kirtland's warbler habitat. Approximately 4,246 acres of jack pine would be regenerated for Kirtland's warbler habitat. Jack pine regeneration on these sites would be increased to about 1,089 trees per acre.

Increasing stocking levels could reduce the future availability of wood products as described under Alternative 2.

Vegetation Management and Amount of Jack Pine Harvest. The type of treatment on approximately 122 acres of jack pine has changed. Approximately 101 acres of jack pine would be salvaged and underplanted with white pine. Approximately 21 acres of jack pine would be salvaged and underplanted with red pine. Jack pine salvage retaining approximately 20-30 overstory trees per acre would be implemented on approximately 101 acres to address visual quality concerns from an adjacent landowner. Overstory trees to be retained would be species other than jack pine, and jack pine trees that appear to be healthy. Following harvest activities, white pine would be underplanted with the remaining overstory trees left to nurture the future white pine stand. This treatment would add diversity to a jack pine dominated landscape and was proposed to address comment #30-1 (appendix C, Response to Scoping Comments)

Approximately 5,789 acres of jack pine would be salvaged and regenerated back to jack pine. All species would be removed except oak, white pine, hemlock, and black cherry. Most of these trees would be retained unless they need to be harvested to construct roads, skid trails, and landings. Approximately 2,725 acres would be regenerated back to jack pine by seeding and about 3,064 acres would be regenerated back to jack pine by planting.

Approximately 302 acres of jack pine would be salvaged and converted to red pine by planting with mechanical site preparation. About 166 acres of jack pine would be salvaged and converted to red pine by prescribed burning.

Approximately 366 acres of jack pine would be salvaged and converted to savanna.

Jack pine removal would occur on approximately 73 acres near the Soldiers Lake Campground. All other species would be retained in this stand. In this same area, jack pine removal would be implemented on about 21 acres in one stand. This stand would retain all other species with about 100 trees/acre of red pine underplanted. This would reduce the impact of potential wildfire in this area by removing over-mature jack pine impacted by the jack pine budworm. It would also visually enhance the area by adding some diversity in a jack pine dominated landscape.

A seedtree regeneration cut would be implemented naturally regenerating jack pine on approximately 145 acres.

The average percent of mortality in the jack pine stands to be treated is approximately 30%. By harvesting and regenerating these mature and over-mature stands to jack pine, the timber would be utilized and the regeneration would be healthy, vigorous, and resistant to jack pine budworm for several decades. Therefore, salvaging mature and over-mature jack pine and regenerating a new age-class would reduce the susceptibility of the forest to jack pine budworm outbreaks (USDA Forest Service 1997). A new, young age-class of jack pine would be started. Current stand growth would grow rapidly to produce more useable wood fiber for the future. Also, this would reduce the impact of potential wildfire in this area by removing over-mature jack pine impacted by the jack pine budworm.

Approximately 1,633 acres of mature jack pine would be deferred from treatment. The average percent of mortality in the untreated stands is approximately 22%. Mature jack pine stands not harvested during this entry would be expected to lose 15-20% of the stand volume over the next 10-15 years.

This alternative would reduce the impacts of wildfire since dead and dying jack pine trees would be salvaged, and regenerated to young, vigorous jack and red pine stands. This alternative would also reduce the impacts of future JPBW infestations, improve health and vigor, increase growth rates, create a more balanced age-class of jack pine, and provide wood products.

Effects Common to Alternatives 2 and 4

These alternatives would create temporary openings that exceed the 300-acre harvest size limit as described on Forest Plan pages IV-21 and 33. Larger harvest units provide net public benefits by allowing more jack pine to be salvaged before it loses economic value, make site preparation using prescribed fire easier and safer, reduce the amount of permanent roads needed for harvest, and reduce the amount of edge created by harvesting activities which may reduce impacts of future JPBW outbreaks. The budworm feeds on male cone flowers, which are more numerous on trees grown along edges because they receive more sunlight and have larger crowns.

CUMULATIVE EFFECTS

Please see the *Thunderbird EA* (USDA Forest Service 2004) for a discussion of cumulative effects relative to jack pine harvest levels on the HNF, 1986-present.

The defined area for the vegetation cumulative effects analysis is the land within the Raco Plains LTA. Three large scale projects have been implemented in this LTA in the past. These past projects are the *Raco Plains Jack Pine Budworm Ecosystem Project*, the *Betchler Marsh Project Set*, and the *Brimley Grade Project Set*. These projects have decreased the amount of the jack pine forest type through conversion to other forest types and openings. The Raco Plains project would continue this trend. In both the short term and long term, this would reduce the magnitude of future jack pine budworm outbreaks, and therefore have a positive effect on forest health. It would be expected that in 10-15 years a comparable amount of over-mature jack pine would be salvaged in this LTA.

Mead-Westvaco currently owns 50 acres within the Raco Plains LTA. This land is managed predominately for red pine for pulpwood production. This management direction would most likely continue in the future.

Harvests in mature and over-mature jack pine stands would continue to address forest health concerns. Thinning would maintain or improve stand vigor making red pine stands more resistant to insect and disease outbreaks, and fire. The overall cumulative trend would be a continued improvement in forest health conditions as management moves toward desired future conditions.

The conversion of jack pine sites to savannas and the proposed stocking levels of 1,089 trees per acre on some jack pine sites would reduce the amount of timber volume available in the future. The conversion from forested lands to savannas would reduce the number of timber producing acres for the future. The proposed higher stocking levels would produce less volume than that resulting from following the recommended upper limit of stocking (see Socio-economic section for growth and yield model runs at various stocking levels).

OLD GROWTH

AFFECTED ENVIRONMENT

A total of 963 acres of designated old growth and 9,422 acres of unsuited forestland is contained within the boundary of the Raco Plains LTA. Of the 963 acres of old growth, 206 acres lie adjacent to stands that have timber harvest activities proposed. The old growth system was analyzed with the *Brimley Grade Project Set EA* (USDA Forest Service 1997). No changes to the system were recommended with the *Brimley Grade Project Set EA* (project file). The predominate forest type within these 206 acres is either white pine, red pine, or jack pine, all of which meet the criteria for designation as old growth according to the Forest Plan of 1986. No ground disturbing activities are being

proposed within any stands designated as old growth; so there would be no direct effects to designated old growth from any alternative.

See appendix G, figure G – 7, Old Growth and Unsuited Lands Map, showing the spatial arrangement of old growth, in relation to lands not suited for harvest. Juxtiposition of old growth and unsuited stands is an important consideration for the system. The old growth/unsuited map provides a perspective on how these stands are spatially arranged across the landscape throughout the LTA. In addition, table 3-6 summarizes total acres of old growth and unsuited lands by forest type.

DIRECT AND INDIRECT EFFECTS

No additional stands would be added to the total old growth system and no stands would be removed from old growth designation as a result of any of the alternatives.

Table 3-5 shows total acres of activities in stands that border designated old growth. This table gives an indication of the possible indirect effects to old growth resulting from proposed harvest activities in bordering stands.

Table 3 - 5. Stands Proposed for Treatment Adjacent to Stands Designated as Old Growth.

Designated Old Growth Stand*			Adjacent Proposed Treatment Stand(s)			Proposed Treatment Alt. 2 & Alt. 4	Proposed Treatment Alt. 3
Comp	Stand	Acres	Comp	Stand	Acres		
27	39	31	50	31	36	Jack pine (JP) salvage all adjacent stands	JP salvage
31	24	64	31	62	34		JP salvage
31	33	28	30	5	14		No entry to Stnd 5
57	6	25	57	27	195		No entry to Stnd 14 JP salv. Stnd 27
57	9	9	57	14			
77	73	10	77	18,26	107,26		JP salv. Stnd 26
78	5	22	78	47	22	Red pine (RP) thinning	RP thinning
79	45	9	79	16,19	24,48	JP salvage	No entry Stnds 16,19
95	106	8	95	55,100	40,30	Stnd 55 final RP harvest, Stnd 100 JP salvage	Stnd 55 final RP harvest, Stnd 100 JP salvage

*The designated old growth stand in the left column is next to the proposed treatment stands in the right columns.

Alternative 1 (No Action)

Under Alternative 1 no activities are proposed. Since there are no changes to the designated old growth system there would be no effects.

Effects Common to All Action Alternatives

None of the action alternatives would modify the existing designated old growth/unsuited lands system. The harvest activities adjacent to old growth in all alternatives are either jack pine salvage or final harvest of red pine.

The action alternatives contain activities that would indirectly affect vegetation, soil, or other parts of the environment. Therefore, there may be indirect effects to adjacent designated old growth stands resulting from these activities. These effects may occur 100 ft. to 300 ft. into the old growth stand and decrease as distance from the edge increases. Possible indirect effects include increase in sunlight penetration, air movement, seed dispersal, indirect human disturbance, decreased solitude, and decreased humidity. The amount of impact to old growth is dependant upon the type, amount, and location of the neighboring activity. Whether jack pine salvage or final red pine harvest activities are proposed, the neighboring old growth stands would be affected in the same way.

Thus there would be no direct impact to designated old growth from any of these alternatives. Indirectly, Alternative 3 is similar to Alternatives 2 and 4 with less acres of harvest involved.

CUMULATIVE EFFECTS

The following table shows the acres of the major forest type working groups for the Raco Plains area in comparison to the rest of the HNF.

Table 3 - 6. Summary of Forest Types in Unsuited Lands and Designated Old Growth in Raco and Across the Hiawatha National Forest.

Forest Type	Raco Unsuited Land (ac)	Raco Suited Old Growth (ac)	HNF Unsuited Land (ac)	HNF Suited Old Growth (ac)
Jack pine	304	247	11,642	1,314
Red/white pine	210	425	9,316	8,020
Aspen	76	66	27,674	8,090
Cedar	80	0	47,839	10,921
Hardwoods	155	161	57,286	19,404
Spruce/fir/swamp conifers	911	64	100,940	11,762
Open	7,686	0	127,597	0
Total	**9,422**	**963**	**382,267**	**59,511**

TES PLANTS

Summary of effects

Measure	Alternative 1 (No Action)	Alternatives 2 (Proposed Action), 3, and 4
Effects to Region 9 listed sensitive species	No impact (25 species)	No impact (3 species) or may impact individuals but not likely to cause a trend toward Federal listing (22 species)

(See appendix F, Biological Evaluation, plant section, for additional information.)

NON-NATIVE INVASIVE SPECIES

Non-native invasive plants (weeds) can displace natives and alter habitat conditions to reduce capacity to support native plants, animals, and communities (see appendix H for rationale).

- Once introduced, weeds can spread, sometimes into undisturbed habitat.
- Effects may not be evident until decades after weeds are introduced.
- Weed control options are limited on the HNF, but prevention is the cheapest.

Summary of effects

	Alt. 1 (No Action)	Alts. 2 and 4	Alt. 3
Summary of relative risk of weeds becoming established (1=least risk, 3= most risk)	1	3	2

Mitigation Measures

1. Mitigation measure. Gravel and sand borrow for roadwork shall come from pits where a non-native invasive plant (NNIP or weed) eradication program is in place. If gravel or sand is proposed from sources other than the HNF pits, a qualified botanist would be consulted to determine if an adequate weed eradication program is in place. The botanist may conduct an on-site weed inspection. A recommendation would be made to approve or disapprove the proposed material source based on the results. .
Purpose of mitigation. To reduce the spread of weeds in transported pit materials.
How we know the mitigation measures will be effective. Controlling weeds in pit materials is a recommended practice, USDA Forest Service Guide to noxious weed prevention practices (2001b). Weeds were pulled on stockpiled gravel in some HNF gravel pits in the summer of 2003 and pulling is planned to be repeated in 2004. However, fewer than half the active pits on the Eastside of the HNF were covered. Weed pulling would reduce the amount of weed seed contained in the gravel from those piles, and provide an incremental reduction of potential for weed transport. The reduction would be greater each year the program is continuously in place. See discussion in weed section under ground-disturbing activities, road construction. The principal benefit of weed inspections, particularly of off-forest sources, is that if new

invader weed species (from the Raco Plains priority list) are found, an alternate source can be specified for use, and introduction of new weed species can be avoided.
2. Mitigation measure. If new populations of weed species on the priority list for Raco Plains are found in the project area, eradication efforts would be initiated before they have a chance to spread.
Purpose of mitigation. To eliminate new weed populations before they grow too large to control.
How we know the mitigation measures will be effective. "The most effective method for managing noxious weeds is to prevent their invasion…Methods…include…Detecting and eradicating weed introductions early…" (Sheley et al. 1999)
3. Mitigation measure. For revegetation, use appropriate locally native seed and/or annual cover crops such as oats in seed mixes approved by the HNF Botanist. Any mulch used should be non-seed bearing such as straw. Hay mulch would not be used.
Purpose of mitigation. To avoid introducing invasive plants deliberately for revegetation or as unintended mixtures in mulch.
How we know the mitigation measures will be effective. Recommended practice, USDA Forest Service Guide to noxious weed prevention practices (2001b). Annual cover crops such as oats are not invasive. Locally native species are adapted to local plant communities and are not invasive. Non-seed bearing mulches cannot introduce invasive species.

AFFECTED ENVIRONMENT

Many plants and animals have been introduced to the Upper Peninsula and the HNF from other countries or regions. Some of these are beneficial, such as agricultural crops, livestock, and ornamentals. Some have become naturalized and reproduce on their own in wild or disturbed landscapes. A few species have proved to be highly competitive in native communities and have demonstrated the ability to displace or harm native species. These are designated non-native invasive species (NNIS), and may also be called exotics or aliens. They may be classified in three broad categories:

- Weeds – non-native invasive plants
- Aquatics – fish and aquatic invertebrates
- Forest pests – insects, fungi, and other organisms that cause disease, and non-native earthworms

For information about aquatics and invertebrates, see appendix H, Non-native Invasive Species section.

Weeds. Non-native invasive plants found on the HNF are listed in the draft Non-native Plants of Concern for the Hiawatha National Forest (Schultz 2001). Information used for this analysis comes from the three volumes of Michigan Flora (Voss) published from 1972 to 1996, which gives county distribution maps for each species. These maps are based on the recorded locations of herbarium specimens, and some plants, such as Canada thistle, which are known to be widely distributed, are not represented by collections from all counties (Voss 1996). Another source is TES plant surveys by HNF ecology and botany employees and contract botanists. Surveyors make lists of plant species seen in activity units in project areas, concentrating on natural communities and rare species. In general, areas in the interior of previously undisturbed units are weed

free (Swartz 2002). The HNF has not collected detailed plant information for areas not scheduled for activities. Survey information for weeds can never be complete, because it is not practical to cover 100% of the ground, and because weeds spread, sometimes quite quickly making information out of date. Repeated monitoring is necessary to document weed spread. The complete list and a list of the weeds ranked "I" (most immediate ecological concern) may be found in appendix H, Non-native Invasive Species section.

Efforts to control weeds would be most effective if directed first at new invaders with high potential for impacts, while their populations are small. These are species that could have the widest ecological effects if introduced into the project area. Five species fall in this category for Raco Plains. These species have not yet been documented in the Raco Plains project area, although there may be small undetected populations, but suitable habitat exists for them there. This is the Raco Plains project area priority list (for more information about these species, see appendix H).

- Garlic mustard (*Alliaria petiolata*)
- Leafy spurge (*Euphorbia esula*)
- Purple loosestrife (*Lythrum salicaria*)
- Non-native buckthorns: common buckthorn, (*Rhamnus cathartica*), and glossy buckthorn, (*R. frangula,* synonym *Frangula alnus*)

The HNF has taken some steps to begin combating the spread of weeds on National Forest lands. The HNF has developed a draft list of NNIS and compiled records of weed locations from some past survey data. The HNF participates in the Michigan Invasive Plants Council, a statewide cooperating group of individuals and organizations interested in preventing the introduction and spread of invasive plants. The Council includes members representing the nursery industry, beekeepers, conservation organizations, and the Michigan Department of Agriculture among others. The HNF has constructed greenhouse and seed processing facilities to support a program of plant production used in revegetation of pipeline, fisheries, and road projects with locally native plant materials. The HNF sent crews to pull weeds from stockpiled materials in some of the HNF gravel pits in 2003 (see weed effects, ground disturbing activities, for more information). The HNF M&E Report 2000 (USDA Forest Service 2001a, pp. 25-27) cites the effects of exotic species on natural habitats as an emerging issue, and recommends monitoring the threats and locations of noxious weeds, and their relationship to fire.

DIRECT AND INDIRECT EFFECTS

Factors affecting invasive species. Establishment and expansion of populations of invasive species depend on complex environmental interactions. Climate, topography, soil, and particularly interactions with other organisms such as competitors, prey, predators, and soil organisms can all limit the establishment of new species. Not enough is known about most species that enter the USA to predict what the result of these interactions will be. Even species that have been studied relatively intensively, such as spotted knapweed, have not been studied in the context of the particular ecosystem of the Raco Plains LTA. For this analysis, alternatives will be compared where there is a factor or factors that are known or suspected to affect spread or establishment of invaders,

which differ(s) among alternatives. Information is incomplete for all invaders discussed. The best information available was used for this analysis.

All of the Raco Plains project area could be affected by the potential spread of NNIS, which could reduce the capacity of the project area to support native species and communities (see appendix H for more information about weed effects). However, those areas where timber harvesting, road building and other ground-disturbing activities are proposed have a higher risk of NNIS establishment, and populations established there could spread to other areas.

The following table displays the major proposed activities that may affect the establishment of weeds in the project area. For a full listing of activities, see chapter 2.

Table 3 - 7. Major Proposed Activities that May Affect the Establishment of Weeds in the Raco Plains Project Area. Acres and miles are approximate.

Activity	Alt. 1 (No Action)	Alt. 2 (Proposed Action)	Alt. 3	Alt. 4
Harvest jack pine	0 ac.	6,358 ac.	2,484 ac.	6,257 ac.
Site prep for jack pine and red pine reforestation	0 ac.	6,000 ac.	2,300 ac.	5,900 ac.
Opening and savanna creation	0 ac.	390 ac.	530 ac.	390 ac.
Roads				
New construction, classified roads	0 mi.	1.0 mi.	1.0 mi.	1.0 mi.
New construction, temporary roads	0 mi.	13.0 mi	7.0 mi.	13.0 mi.
Road maintenance and reconstruction	0 mi.	26.0 mi.	25.0 mi.	27.0 mi.
Road decommissioning	0 mi.	14.0 mi.	23.0 mi.	22.0 mi.
Weed control	0 ac.	20 ac.	20 ac.	20 ac.

Canopy removal. Most weeds grow best in full sun. There are three major canopy-removal activities planned in the project area:

- Jack pine harvest removes all the tree cover from stands except for oak, white pine, hemlock, and black cherry (retained for wildlife).

- Road building and maintenance remove tree canopy over the road. In jack pine stands roads generally remain unshaded. In red pine stands, because the trees are taller and rotations are longer, some shade returns to the roadsides when the stand is mature. Most of the proposed activities are in jack pine stands.

- Opening/savanna creation makes permanent openings. Savannas have scattered trees.

Some planned treatments do not appear in the table because their potential to facilitate weed establishment is low. Thinning in red pine disturbs the ground very little. In a thinned stand the remaining trees are tall and provide some shade continuously, and shade increases again over a few years. Jack pine removal by Soldiers Lake, and jack

pine thinning and underplanting with white pine, would increase canopy opening only partially and temporarily.

Ground-disturbing activities. Removal of competition by soil disturbance provides an opportunity for weeds to establish. There are three major ground-disturbing activities planned in the project area:

- Harvest and site preparation for reforestation. Site preparation techniques are designed to turn up at least 60% exposed mineral soil for best establishment of jack pine. Mechanical site prep for red pine also disturbs the soil.

- Road construction and maintenance. Road construction that requires addition of gravel or other pit materials to the roadbed carries the highest risk of weed introduction. In 2002 the HNF conducted a weed survey of a sample of eight sand/gravel/clay pits on the HNF (Marr 2002). All had invasive weed populations. Species found from category I of the HNF draft weed list include spotted knapweed (all pits), white sweet clover (6 pits), St. John's wort (5 pits), bull thistle (3 pits), bird's foot trefoil (2 pits) and Canada thistle (1 pit). Seeds of weeds can be transported with the extracted materials to new sites. One species from the Raco priority list (leafy spurge) is known to be present in one HNF eastside pit (Ackrigg) (Jaunzems 2002). This site was covered with two layers of black plastic in 2003, in an effort to smother the population and prevent access to the infested area. The cover would be monitored regularly to see that it remains intact. In 2003 crews weeded the gravel piles in some HNF gravel pits, making 1-3 visits to each pit, and completely removing the large weeds from most of the piles. Active pits included from the Eastside were Red Creek, Ackrigg, East Lake, and Supe. Active pits not weeded were Cad Soo, Worth Road, Dollar Settlement, M28, Trout Brook, H-40 clay, and H-40 (Big Spring). Weeding would reduce but not eliminate the seed bank of noxious weeds established at the pits. Thirty percent of the seed of spotted knapweed, the most constant and abundant weed in the pits, may be viable after eight years of burial (Mauer et al. 2001). A 70% reduction in seed numbers may not prevent effective dispersal of this plant in pit materials, because production of up to 146,000 seeds per square meter has been reported (Mauer et al. 2001). Continuous, consistent control effort would be required to eliminate transport of weed seeds in pit materials. The pit weeding program is planned to be continued in 2004.

- Opening /savanna creation. Openings are created for wildlife habitat, and may also function as rare plant habitat. Tree canopy would be removed permanently except for scattered trees in savannas. Slash would be roller chopped, burned, or distributed by heavy machinery. The combination of full sun conditions and soil disturbance could aid weed establishment.

Scale. Weed introduction can occur on two different scales. On the scale of individual stands, the interior of most stands that have not been entered before, or were entered before many weed species became established in the Upper Peninsula, are generally weed free (Swartz 2002). When roads are built to these stands weeds commonly found on roadsides in the project area would probably be introduced either immediately or later, as

weeds use the road as a corridor for establishment. The risk of establishment continues as long as the road is open. Temporary roads would be closed when the sale is completed, and the risk of weed introduction then decreases in proportion to the reduction in disturbance from traffic.

On the scale of the project area, there would be a continuing risk that weed species new to the area would be introduced, such as the five species on the priority list above. This risk would increase in proportion to the use of recreational, road building, or logging equipment in the area that may carry soil, plant parts, or seeds from an infested area. Consequences of introduction of these five weeds could include loss of habitat for native plant species and other species dependant on these plants. The chance of introduction is low, because the priority weed species have not been found in the project area. However some, such as purple loosestrife, are known to occur within about five and one-half miles of the project area border. Once a colony is established by long-distance transport, it could spread along road corridors and into adjacent stands.

Table 3 - 8. Schematic Illustration of Weed Risk by Activity. Alternatives are ordered by the amount of each activity proposed. Note that for the preventive activities (road decommissioning and weed removal) weed risk is reduced by the activity.

	lower		**higher**
Relative Risk of Weed Establishment: ←----------→			
New classified road	Alt. 1	Alts. 3, 4	Alt. 2
New temporary road	Alt. 1	Alt. 3	Alts. 2, 4
Road maintenance	Alt. 1	Alt. 3	Alts. 2, 4
Opening and savanna creation	Alt. 1	Alts. 2, 4	Alt. 3
Harvesting and site prep	Alt. 1	Alt. 3	Alt. 2, 4
Road decommissioning	Alts. 3, 4	Alt. 2	Alt. 1
Weed removal and monitoring		Alts. 2, 3, 4	Alt. 1

Table 3 - 9. Weighting of Activities for Assessment of Weed Risk by Alternative.

Activity	Weight
New classified roads	High, because conditions for weed establishment and transport of seeds would continue into indefinite future, and weeds may become established in areas that were previously weed-free.
New temp. roads	Medium, because conditions for weed establishment would be temporary, but weed populations that do become established would probably not be eradicated.
Road maintenance and reconstruction	Medium, because many weeds are probably already established on existing roads, but ground disturbance would create fresh opportunities for new invaders, and equipment and fill materials may carry seeds or plant parts in from other locations.
Opening and savanna creation	Medium, because soil would probably be disturbed over at least 50% of the ground, and most shade would be removed permanently. However openings would not function as pipelines or corridors for new weed establishment.
Harvest and site preparation for reforestation	Medium, because site preparation requires soil disturbance of at least 60%, but the disturbance interval is usually just once in 50 years. Shade from the new stands would probably return to reforested jack pine sites in 15 years, and bracken fern may provide substantial shade after the first season.
Road decommissioning	Low, because although effective road decommissioning would prevent traffic on the road, weed populations already established would most likely persist. The main effect would be to reduce risk of introducing new invaders.
Weed removal and monitoring	Low, because one year of weed removal is a start, but weed removal must occur consistently and continuously to effectively lower weed populations.

Alternative 1 (No Action)

Under the no-action alternative, road maintenance on major roads would continue at about its present level. No new roads would be constructed. Weed infestations would likely remain at approximately their current levels, or slowly expand, since no new areas would be disturbed. There is a small chance that new invaders named above could be introduced to the project area carried on equipment such as off-road vehicles, or road maintenance equipment, which had previously been operating in infested areas. The buckthorn species could be carried in by birds. This alternative presents the least risk of weed spread in the project area. Although it proposes no road decommissioning or weed removal, those activities are given low weight for the reasons described in table 3 - 9.

Alternatives 2 (Proposed Action) and 4

These alternatives carry the highest weed establishment risk of the alternatives. New road construction is weighted most heavily in the risk analysis, and Alternative 2 proposes the greatest mileage of new roads, 1 mile; and Alternative 4 slightly less, 0.7

miles. These two alternatives also propose about twice as much temporary road construction as Alternative 3. Proposed site preparation for jack pine reforestation (~6,000acres) is about twice as much as Alternative 3 (~2,300 acres). Opening and savanna creation for these alternatives (390 acres) is less than Alternative 3 (530 acres) but the acreage for this activity is much less than that for site preparation, and both have medium weight. Amount of road maintenance proposed is about the same for all action alternatives. Proposed weed control is the same.

Alternative 3

This alternative carries less weed risk than Alternatives 2 and 4 because proposed site preparation is about 3,600 acres less, and temporary road construction is about six miles less, as described above. Proposed new road construction is slightly less than Alternative 2 and the same as Alternative 4 (0.7 mi.). This alternative proposes the most road decommissioning, but that activity is given lower weight than site preparation and road maintenance for the reasons listed in table 3-9.

CUMULATIVE EFFECTS

The area considered for cumulative effects for weeds is Chippewa, Mackinac, and Luce Counties, approximately the eastern end of the Upper Peninsula. This area was chosen as the area most likely to contribute to weed establishment or spread in the project area because of proximity. The Great Lakes form natural barriers on three sides. The time considered for future cumulative effects is the next 15 years, which is approximately the time in which all project activities are expected to be completed. The process of invasion of new areas by weeds would not stop at 15 years, but predictions about effects become increasingly speculative in longer time frames. Weed control options and practices both on and off the HNF may change in that time.

Prior to European settlement in the seventeenth century, there were no NNIS in the Upper Peninsula. Weeds were introduced with trade and settlement. Recorded dates of first collection in the three counties for weeds on the HNF Draft Invasive Plant List range from 1838 (the first survey) to the present. Some weeds are still expanding their ranges into the cumulative effects area. The predominant land use in the project area has been forestry and wildland recreation rather than more intensive development. This factor may have delayed introduction of some weed species and also reduces the potential of the project area to act as a source of new invader weed species to other areas.

The US Census 2000 shows the population in the area of consideration has increased between 1990 and 2000 (Chippewa County +11%; Mackinac County +12%; Luce County +22%) (U.S. Census Bureau 2000). On State and private lands in the area considered, new roads, ground disturbance, and increased recreational use of natural areas may be expected to accompany population growth. Therefore, conditions favorable for the establishment of weeds have probably increased in the cumulative effects area and probably would continue to increase in the next 15 years.

The main cumulative effect that may be anticipated in the next two decades is expansion of weed species known in other areas of the Upper Peninsula into the project area, either by long distance transport by equipment of all kinds or by gradual expansion of established populations by natural means. The proposed alternatives would contribute to this cumulative effect in proportion to their ranking above.

WILDLIFE

Summary of Effects

The animal or wildlife species covered in this analysis include those likely to be affected by the proposed activities based on habitat types impacted and that could occur within the project area based upon both habitat conditions and/or known occurrences. These species are from the following wildlife lists: Federal endangered (FE), Federal threatened (FT), Regional Forester sensitive (RS), State endangered (SE), State threatened (ST), State special concern (SC), and Hiawatha management indicator species (MIS).

This section of the EA will discuss the effects of the alternatives on wildlife emphasizing the issues from the EA dealing with roads, openland habitat, and amount of jack pine harvested. The issue dealing with Kirtland's warbler is addressed in the BE (appendix F). Effects portrayed in this EA will focus on the Management Indicator Species (MIS) and wildlife species associated with them. The effects are summarized below.

Measure	Alt. 1 (No Action)	Alt. 2 (Proposed Action)	Alt. 3	Alt. 4
Early successional habitat (permanent and temporary openings)	None	Most	Less than 2; more perm open but less temp open and small size.	Same as 2
Late successional habitat and coarse woody debris	Most	Least; but mitigated by design criteria	More than 2 due to less harvest this entry	Same as 2
Potential road impacts to wildlife	Least; but future entries would likely add roads	Most	Less; more decommission and fewer roads this entry	Less; more decommission
Kirtlands warbler habitat	Depends on natural disturbance or future entry	3,100 acres possible	1,184 acres possible and smaller units	4,246 acres possible
MIS	Benefit late successional species	Benefit early successional species	Same as 2 but to lesser degree	Same as 2

Potential impacts to Threatened, Endangered, and Region 9 Sensitive species (TES) such as wolf, lynx, Kirtland's warbler, and sharp-tailed grouse are summarized in this section of the EA (see TES summary below) with a more detailed discussion of TES in the BE (appendix F).

Summary of TES Animal Effects Determination.

Species	Status	Habitat (H) or Species Present (S)	Alt. 1 No Action	Alt. 2 Proposed Action	Alt. 3	Alt. 4
ANIMALS						
Kirtland's warbler	E	H	NE	NLAE	NLAE	NLAE
Wolf	T	S	NE	NLAE	NLAE	NLAE
Eagle	T	H	NE	NE	NE	NE
Lynx	T	H	NE	NLAE	NLAE	NLAE
Short-eared owl	R9	H	NI	BI	BI	BI
Connecticut warbler	R9	H	NI	MINLTL	MINLTL	MINLTL
Prairie warbler	R9	H	NI	BI	BI	BI
Sharp-tailed grouse	R9	S	NI	BI	BI	BI
Black-backed woodpecker	R9	S	NI	MINLTL	MINLTL	MINLTL
Northern Goshawk	R9	S	NI	MINLTL	MINLTL	MINLTL
Red-shouldered hawk	R9	S	NI	MINLTL	MINLTL	MINLTL

NLAE: Not Likely to Adversely Affect
NE: No Effect
NI: No Impact
BI: Beneficial Impact
MINLTF: May Impact individuals but Not Likely to cause a Trend to Federal Listing or loss of viability

Summary of Design Criteria and Mitigation Measures

Design criteria and mitigation measures were established to protect wildlife resources. They are described in chapter 2 of the EA and include provisions for:

- Reserving green islands in clearcuts.
- Reserving some large pine trees in clearcuts.
- Reserving most dead trees in harvest units.
- Creating large pine snag trees in red pine thinning.
- Retaining almost all oak, white pine, hemlock, and black cherry in all harvest units.
- Treatments that create new savannas would have only the jack pine removed.
- Treatments that increase jack pine stocking levels conducive to KW nesting.
- Treatments that create openings.

These criteria would be effective in protecting wildlife resources because they would provide habitat diversity in the form of biological legacies, mature forest patches, nesting habitat, den and snag trees, and coarse woody debris (CWD) in all harvest units. These habitat features are important to species of disturbance ecosystems like the Raco Plains LTA. Design criteria that maintain habitat diversity within a highly managed matrix of early successional habitat would better mimic the natural processes that the species of Raco Plains have evolved with.

AFFECTED ENVIRONMENT

Virtually every plant in a forest provides food or shelter for a diverse wildlife community (Hunter 1990). Forest practices that decrease habitat for one species will frequently increase habitat for another. At a larger scale, forest type and age-class composition across a landscape also influence wildlife distribution and abundance. These changes in

habitat structure at the stand or landscape scale are usually caused by natural disturbance, plant succession, or forest management.

A management indicator species is one whose presence in a certain location or situation, at a given population, indicates a given environmental condition. Their population changes are believed to indicate effects of management activities on a number of other wildlife species. The list of wildlife MIS for the Hiawatha National Forest (Forest Plan IV-42) was evaluated for species with habitat potentially affected by the Raco Plains project. Bald eagle, timber wolf, and sharp-tailed grouse are MIS but they will be addressed in the attached BE as they are also Federally threatened, endangered, or sensitive (TES) species. Recent trends for MIS likely to occupy the Raco Plains LTA are shown in table 3 -10.

Table 3 - 10. Population Trend Summary for Management Indicator Species.
(Information provided for the State of Michigan unless otherwise noted.)

Species	Population Trend
Osprey	State Threatened. Encouraging recovery (Brewer 1992).
Beaver	Stable to slight increase (MDNR harvest information).
Black bear	Populations in both peninsulas are stable to increasing (MDNR status report 2003).
Black-throated green warbler	Increasing population trend based on breeding bird survey data (1966-2001); Breeding bird surveys on West Unit of HNF show stable to slightly increasing population for time period of 1989-1999.
Bobcat	Stable to slight increase based on limited harvest information (MDNR harvest information).
Eastern timber wolf	Increasing population 1989-2003 (MDNR).
Great blue heron	Increasing population trend based on breeding bird survey data (1966-2001).
Gray squirrel	Unknown population trend on the Hiawatha National Forest.
Pileated woodpecker	Increasing population trend based on breeding bird survey data (1966-2001).
Pine marten	Population continues to grow and disperse across the UP (MDNR data).
Ruffed grouse	Population likely on downward slope of 10-year cycle (MDNR data).
Sandhill crane	Increasing population trend based on breeding bird survey data (1966-2001).
Sharptailed grouse	Stable to declining population on the HNF (HNF monitoring).
Whitetailed deer	As of 2002, deer are above desired population levels for Chippewa County (2002 MDNR Hunting Prospectus).
Wood duck	Increasing population trend based on breeding bird survey data (1966-2001).

The Raco Plains project area provides a variety of habitat types. An existing wildlife-habitat database for the HNF; Wildlife in the Upper Great Lakes Region: A Community Profile or Northwoods Database (Benyus et al. 1992), was used to quantify existing habitat (table 3-11). Spruce grouse was included as it is a species of special concern in Michigan that inhabits the mature jack pine stands of the Raco Plains LTA.

Table 3 - 11. Acres of Existing Habitat in Raco Plains Project Area for Management Indicator Species and Spruce Grouse Using Northwoods Database Habitat Types.

Habitat Type	Total Acres	Beaver	Black Bear	Black-throated green warbler	Bobcat	Osprey	Great Blue Heron	Gray Squirrel	Pileated Woodpecker	Pine Marten	Ruffed Grouse	Sand hill Crane	Sharptail Grouse	White tailed deer	Wood duck	Spruce Grouse
Lake	**109**	109				109	109								109	
Pond	**76**	76				76	76								76	
River & stream	**324**	324				324	324								324	
Marsh	**65**	65					65					65			65	
Sedge meadow	**299**						299					299	299	299		
Shrub swamp	**335**	335			335						335			335	335	
Bog	**52**											52	52			52
Small grass opening	**249**		249								249	249		249		
Large field	**5,106**											5,106	5,106			
Shrub-sapling opening	**12,632**	12,632	12,632		12,632						12,632		12,632	12,632		
Young upland deciduous	**1,122**	1,122	1,122		1,122						1,122			1,122		
Mature upland deciduous	**2,829**	2,829	2,829		2,829	2,829	2,829	2,829	2,829		2,829			2,829	2,829	
Young upland coniferous	**6,326**		6,326		6,326					6,326				6,326		
Mature upland coniferous	**28,648**		28,648	28,648	28,648	28,648	28,648		28,648	28,648				28,648		28,648
Young upland mixed	**140**	140	140	140						140	140			140		
Mature upland mixed	**2,035**	2,035	2,035	2,035	2,035			2,035	2,035	2,035	2,035			2,035	2,035	
Semi-open lowland conifer	**433**				433									433		433
Closed-canopy lowland conifer	**1,146**		1,146		1,146	1,146				1,146				1,146		1,146
Mature Lowland Decid.	**350**		350		350		350	350	350					350	350	
Unvegetated Lands	**895**															
Total Acres	**63,171**	**19,667**	**55,477**	**30,823**	**55,856**	**33,132**	**32,700**	**5,214**	**33,862**	**38,295**	**19,342**	**5,771**	**18,089**	**56,544**	**6,123**	**30,279**

The Raco Plains project is important sharp-tailed grouse habitat, a key MIS for this system, as identified in the Forest Plan (appendix P). Table 3-12 lists some MIS associated with common wildlife species found in the Raco Plains project area and the general habitat types in which they occur.

Table 3 - 12. Common Wildlife Species Found in the Raco Plains by General Habitat Type.

OPENINGS	YOUNG FOREST	MATURE FOREST
American kestrel	Brown thrasher	Black backed woodpecker
American robin	Dark eyed junco	Black burnian warbler
Chipping sparrow	Hermit thrush	Black capped chickadee
Eastern bluebird	Magnolia warbler	**Black throated green warbler (MIS)**
Eastern meadowlark	Nashville warbler	Eastern chipmunk
Killdeer	Red eyed vireo	Eastern wood pewee
Northern flicker	**Ruffed grouse (MIS)**	Evening grosbeak
Sandhill crane (MIS)	Snowshoe hare	Golden crowned kinglet
Savannah sparrow	Whip-poor-will	Northern flying squirrel
Sharp-tailed grouse (MIS)	**Whitetailed deer (MIS)**	**Pileated woodpecker (MIS)**
Tree sparrow	White throated sparrow	Pine warbler
Upland sandpiper		Porcupine
Northern harrier		Red squirrel
Woodchuck		Spruce grouse

The combination of dry outwash soils and jack pine communities of the Raco Plains provides an ecological condition conducive to frequent wildfire. Jack pine are highly adapted to fire and have serotinous cones which are opened under high temperatures such as those occurring during a fire. Periodic disturbance from fire has been an important natural component of this ecosystem. Plant and animal species associated with dry jack pine communities have adapted to natural disturbance by fire. Several species of birds including the eastern bluebird, Kirtland's warbler, upland sandpiper, sharp-tailed grouse, and red-tailed hawk are found in openlands and pine barrens, the result of fire in the U.P. Fire provides snags used by cavity nesters, perches used by raptors, openings used as dancing grounds, and an increase in spatial complexity. The quantity and quality of plant materials increase following fire and new growth and mast production is vigorously sought after by snowshoe hare, whitetailed deer, black bear, and other wildlife species.

Wildfire, windthrow, and insect population cycles are the primary naturally occurring disturbance factors for the Raco Plains LTA. Wildfires have been actively suppressed during the past century reducing the impacts of this naturally occurring disturbance agent. Timber harvest is often viewed as a disturbance mechanism that can replace wildfire. A primary difference between naturally occurring disturbances and the disturbance resulting from timber harvest activities is the amount of residual CWD. Large dead wood is one of the more obvious structural legacies of a natural disturbance, and a major reason why clearcuts are not the ecological equivalent of natural disturbance (Kohm and Franklin 1997).

Jack pine and red pine comprise a vast majority of the cover type. Past management activities resulted in a mosaic of relatively small stands (less than 40 acres) of various size classes throughout much of the area. As a result, the project area does not generally provide for larger continuous forested blocks of either a given forest type or size class. Aspen, white pine, paper birch, northern pin oak, and red maple are found throughout the area in mixed stands, as a component of the red and jack pine stands, and to a lesser extent as stands. As a result of recent project implementation (i.e. *Brimley Grade Project Set* and *Betchler Marsh Project Set*), some large areas of open land habitat, including savannas, are found in the central portion of the project area. Blueberry, juneberry, and beaked hazelnut are common shrub species found throughout much of the area. The well-drained sand soils of the Raco Plains do not support a diverse, highly productive ground cover. The nutrient-poor ecosystem produces relatively low amounts of forage for herbivores. Consequently, the area supports relatively low numbers of carnivores.

Jack pine regeneration cuts comprise the major activity in the jack pine type. When residual trees including snags, dead trees, and cavities are present, the diversity of wildlife species that can utilize the area increases to include species such as tree swallow, eastern bluebird, American kestrel, and black-backed woodpecker.

All age-classes of the jack pine forest type provide wildlife habitat. Management for jack pine generally involves regenerating the stand every 40 to 60 years. The cut-over and young regenerating stands provide openland habitat for species including American woodcock, northern harrier, and short-eared owl. When the cut area is larger, in the order of 100s of acres, species such as sharp-tailed grouse can also benefit. Young jack pine stands provide habitat favorable for the prairie warbler and Kirtland's warbler. Older jack pine stands provide habitat for species such as spruce grouse and black-throated green warbler.

Roads can impact wildlife by resulting in increased disturbance from human related activities. The Forest Plan identifies several MIS whose principal habitat characteristics include seclusion, isolation from human disturbance, or areas with low road densities. These species include osprey, sandhill crane, great blue heron, bald eagle, common loon, timber wolf, bobcat, and black bear (USDA Forest Service 1986). Road density is a useful index of the effect of roads on wildlife populations. It is likely that a few large areas of low road density, even in a landscape of high average road density, may be the best indicator of suitable habitat, especially for large vertebrates.

DIRECT AND INDIRECT EFFECTS

Effects common to all alternatives.

There is little difference between all action alternatives in the amount of habitat created for generalist species, or those that occupy a wide range of habitat types such as black bear, bobcat, and white-tailed deer (figure 3-4). There is no change in the amount of habitat created for wood duck and gray squirrel since no activities are proposed in those

habitat types. Black throated green warbler, great blue heron, osprey, pileated woodpecker, pine marten, and spruce grouse would benefit the most by the no action alternative as they rely on mature forest conditions. These species would also have more habitat created under Alternative 3 compared to Alternatives 2 and 4, since just under half the amount of jack pine would be harvested under Alternative 3. Early successional species like sharp-tailed grouse, Kirtland's warbler, and sandhill crane would have more habitat created under Alternatives 2 and 4 since much more jack pine would be harvested with subsequent temporary openings established. At a coarse scale, the following chart (figure 3-4) shows the acres of suitable habitat (Northwoods database habitat types) for the MIS that would result from implementation of each of the four alternatives. There are other more subtle differences between the alternatives that are discussed below.

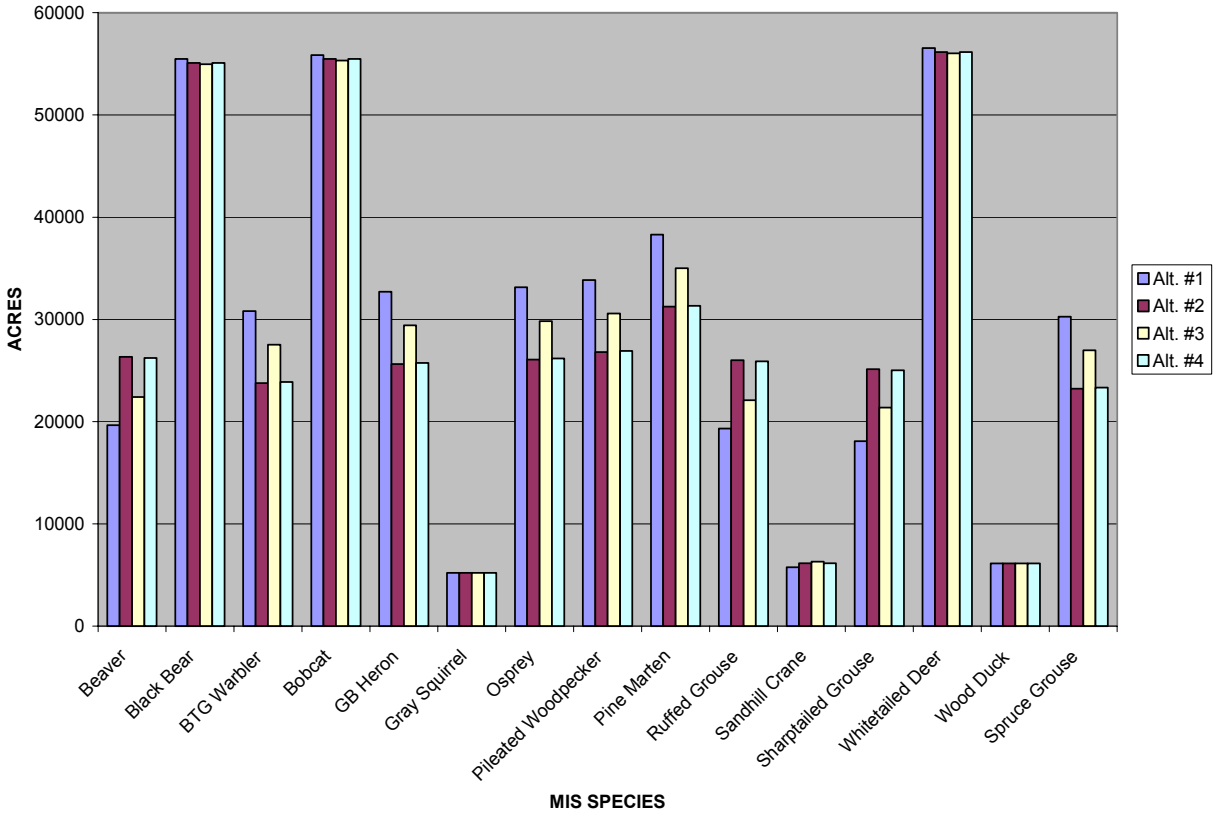

Figure 3 - 4. Acres of Habitat Available by Alternative for MIS and Spruce Grouse.

The design criteria and mitigation measures provide important key habitat components under all action alternatives. Within the stands proposed for timber harvest, varying amounts of residual trees would remain, and contribute to the diversity of the regenerating stand. Mitigation would provide for retention of small groups of residual trees in those stands where the residual basal area is very low to zero. This mitigation, to meet Forest Plan standards for potential snags and cavity trees, would contribute to the diversity of the regenerating stand and provide CWD.

All action alternatives would have 2,500 acres of existing permanent wildlife openings maintained. This would provide important habitat for sharp-tail grouse and associated early successional species. The grasses, fruit shrubs, and CWD found in permanent openings are valuable to these species and when augmented by rotating temporary openings provide an optimal multiple-use management scenario for wildlife and timber outputs.

In general, clearcuts would have the least amount of residual living trees. Scattered individual trees or groups of trees would remain in many clearcuts because in all proposed clearcuts either certain species are designated for cutting, or certain species are reserved from cutting. As a result, all clearcuts would contain pockets of residual trees or scattered individual trees, but overall the majority of the area would look open. These clearcuts would provide temporary shrub/sapling openland habitat for several years before the regeneration of the new stand becomes established. This would provide an immediate increase in available openland habitat to those species that require it; such as sharp-tailed grouse, woodcock, and northern harrier. However, it would also create an immediate decrease in mature forest habitat. Over time, as these stands are regenerated and mature, they become unavailable to openland species and available to species which favor a young, dense, coniferous forest type such as dark eyed junco and Kirtland's warbler. As these stands further mature, they would benefit species such as spruce grouse, and pileated woodpeckers that rely on a mature coniferous forest type.

Management of succession that simulates a natural system benefits the entire suite of species adapted to that ecosystems. For the Raco Plains fire ecosystem, some of the important habitat elements are large stand size, relatively high jack pine stocking, natural distribution of trees within a stand (patchy mosaic not in rows), den and snags trees, and down woody material. When these elements are provided, either through natural disturbance or management of succession, the species linked to the various stages of the forest would have habitat provided. The design criteria compliment the alternatives and attempt to maintain these elements while harvesting the majority.

Potential impacts of roads include loss of wildlife habitat from the road corridor, the introduction of edge habitat into forest areas, and road avoidance behavior by larger mammals. The degree of impact on wildlife depends on several factors including the amount of use, road clearing width, and road maintenance level. Temporary roads would have the least potential for impacts, followed by winter use only roads. Roads with lower maintenance levels and roads with narrow corridors would also have less impact than roads with wider corridors and higher maintenance levels. Roads closed to motorized use would have less impact than roads that remain open to motorized use.

It is likely that most disturbance impacts to wildlife resulting from proposed road activities would be short lived. No alternative proposes more than 1.0 miles of new classified road construction over the project area. All new classified roads would be closed to traffic and all new temporary roads would be obliterated following proposed management activities. Furthermore, a decrease in road density, following road

decommissioning proposed in all three action alternatives, would result in less wildlife disturbance by human related activities throughout the project area.

Alternative 1 (No Action)

The impacts of this alternative on wildlife are primarily:

- Early successional habitat creation would depend on natural disturbance events such as wildfire, which have been effectively suppressed.
- More CWD.
- No new roads and associated disturbance to wildlife.

Under Alternative 1 no new vegetative management actions would occur. Any disturbance that resulted in changed habitat conditions would be naturally occurring events such as fire or windstorm. However, recent wildfires have been effectively suppressed. The average fire size over the last 80 years was 3.3 acres per fire with an average of only 10 acres burned by wildfire per year (Fire Ecology section).

A primary difference between naturally occurring disturbances and the disturbance resulting from timber harvest activities is the amount of residual CWD. Large dead wood is one of the more obvious structural legacies of a natural disturbance, and a major reason why clearcuts are not the ecological equivalent of natural disturbance (Kohm and Franklin 1997). Those wildlife species that utilize CWD and tree cavities for nesting as part of their special habitat requirements would benefit from this alterative. Alternative 1 would provide the most opportunity for restoration (wildfire) given the current jack pine budworm outbreak and the potential for wildfire. However, the Forest Service would still have a mandate to suppress wildfires and restoration by wildfire would be determined by chance events.

As shown in figure 3-4, Alternative 1 would provide the most habitat for wildlife species that utilize a mature forested condition or rely on snags and tree cavities. This alternative would provide less habitat for species associated with openland or young forest conditions.

Under Alternative 1, no roadwork, permanent opening work, timber harvest, or prescribed burning would take place. Therefore, no impacts or disturbances to wildlife or habitat would be expected.

Alternative 2 (Proposed Action)

The impacts of this alternative on wildlife are primarily:

- To provide new quality habitat for sharp-tailed grouse (MIS) and associated early successional species that utilize large openlands or large patches of jack pine.
- Less early successional habitat for Kirtland's warbler than Alternative 4 (see BE for details).
- More road miles and subsequent wildlife disturbance opportunities compared to Alternatives 3 and 4.

Management for jack pine in larger patches reduces the amount of edge between jack pine age-classes, reduces road needs, and reduces fragmentation. Alternative 2 would provide clearcuts that better reflect the size of historical wildfires; however, the amounts of residual CWD would be less than that found in a natural disturbance. Sharp-tailed grouse and associated species benefit from the increased habitat these larger temporary openings and regenerating jack pine stands provide. Indirectly, spruce grouse and Kirtland's warbler would also benefit over time by maintaining large blocks of jack pine in a balanced age-class structure.

The creation of new savannas and new permanent openings would occur within or adjacent to, existing large permanent openings. This would increase the effectiveness of permanent openland habitat within the project area, and benefit those species that use temporary upland openings created through salvage clearcutting. This conversion of jack pine would decrease the habitat available for species of mature forest, such as spruce grouse since these acres would not be regenerated or maintained in the jack pine forest type.

Temporary openings have a much different habitat structure than permanent openings. Temporary openings have a lot of slash, stumps, and bare-ground and will receive several reforestation treatments designed to convert the opening into a young forest. Permanent openings generally would have more large woody debris left on the site (i.e. jack pine removals to create red pine savannas). Permanent openings contain high amounts of den and snag habitat (which decay over time), extensive blueberry patches, quality grassland, and plenty of berry-producing shrubs. Proposed prescribed burns on permanent openings would maintain a high quality barrens habitat. Temporary openings augment the fine-scale quality habitat maintained in permanent opening habitat, and add a landscape scale element of size that enhances nearby permanent openings.

Alternative 2 also provides for about 1,514 acres of improvement cuts such as thinnings, shelterwood, removal, and seed tree cuts in jack pine and red pine forest types. These cuts would generally provide wildlife habitat by the establishment of understory vegetation, which leads to increased structural diversity. Loss of CWD to harvest in these stands is partially mitigated by the design criteria for retention of snag and cavity trees within these treatment areas.

There would be disturbance to wildlife resulting from harvest activities. Some animals would be forced to move and nesting birds would have nests and fledglings destroyed by harvesting equipment, especially in spring and early summer.

Of the action alternatives, Alternative 2 proposes slightly more new classified and temporary road construction and much less road decommissioning; thus, having the most potential to affect wildlife. Road impacts are lessened by the large block size since repeated entries into the same general area usually require permanent and higher standard roads.

Alternative 3

The impacts of this alternative on wildlife are primarily:

- Smaller jack pine harvest block size fragments habitat and provides lower quality early successional habitat.
- More permanent opening habitat but less temporary opening habitat.
- Less road construction this entry. May require more roads over time as repeated entries may be scheduled to salvage the jack pine.
- Less KW habitat than Alternatives 2 and 4.

Two key differences between the action alternatives are the amount of jack pine proposed for harvest and regeneration, and the size of the units being harvested. In Alternative 3, emphasis is placed on creation of temporary harvest-created openings that are less than 300 acres to meet current Forest Plan guidelines. Though these temporary openings would meet Forest Plan size limits, their creation would increase the amount of edge, and would not emulate historical stand replacing disturbances, which likely produced temporary wildfire openings that were much larger. Due to the size limitation, much less jack pine would be harvested this entry.

Alternative 3 proposes harvesting about 40% as much jack pine as Alternatives 2 and 4. Less jack pine salvage results in less temporary open land habitat. Those species that rely on open land habitat such as sharp-tailed grouse, sandhill crane, and upland sandpiper would benefit least from the silvicultural activities proposed in Alternative 3. In the short term, spruce grouse, pine marten, and pileated woodpecker would have more mature habitat retained in Alternative 3 than Alternatives 2 and 4, with over half the amount of mature jack pine not proposed for harvest. However, over time, the smaller stand size and fragmentation would possibly impact species of mature jack pine since small blocks are not a natural condition for jack pine on the Raco Plains.

Alternative 3 proposes creation of 528 acres of upland savanna versus 366 acres of savanna and 23 acres permanent opening creation proposed in Alternatives 2 and 4. Alternative 3 would create slightly more permanent openings but much less temporary openings compared to Alternatives 2 or 4. More permanent openings would move the project closer to the Forest Plan goal of 20% upland opening in MA 4.4.

Alternative 3 also provides for about 1,147 acres of improvement cuts such as thinnings, shelterwood, removal, and seed tree cuts in jack pine and red pine forest types. These cuts would generally benefit wildlife by the establishment of understory vegetation, which leads to increased structural diversity. Forest Plan guidelines for the retention of snag and cavity trees within these treatment areas reduce the potential for adverse impacts to wildlife habitat.

There would be disturbance to wildlife resulting from harvest activities as described under Alternative 2, but since less area would be harvested there would be fewer acres of this impact.

Of the action alternatives, Alternative 3 proposes the most road decommissioning; the same amount of new classified road as Alternative 4, and the least amount of temporary road construction. This proposed road work has the least potential to negatively impact wildlife this entry. However, additional roads would likely be needed as jack pine not salvaged with this entry would likely be scheduled for harvest soon that would require additional roads.

Alternative 4

The impacts of this alternative on wildlife are primarily:

- Similar to Alternative 2 with same acres of jack pine harvested, but with more acres dedicated to the higher stocking suitable for Kirtland's warbler (see BE for details).
- Fewer roads and fewer impacts to wildlife from road disturbances.

Alternative 4 is similar to Alternative 2 regarding the proposed amount of jack pine harvest and the size of the harvest units. In general, impacts to wildlife would be similar for both alternatives. One difference is that 101 acres of jack pine would be salvaged and underplanted with white pine. Residual jack pine would eventually die and decay while young white pine would mature and become established. Over time, this process would benefit pileated and black backed woodpeckers with the provision of cavity trees and snags, and pine marten and other species dependant upon CWD.

Another key difference is in the proposed amount of heavily stocked jack pine regeneration following salvage clearcutting. Alternative 2 proposes 3,100 acres of heavily stocked jack pine; whereas, Alternative 4 proposes 4,246 acres. Kirtland's warbler is the primary beneficiary of the heavily stocked jack pine stands; however, spruce grouse and other species associated with dense conifer stands would also benefit.

Alternative 4 also provides for about 1,615 acres of improvement cuts such as thinnings, shelterwood, removal, and seed tree cuts in jack pine and red pine forest types. Impacts to wildlife would be similar to those described for Alternatives 2 and 3.

There would be disturbance to wildlife resulting from harvest activities as described under Alternative 2.

Proposed roadwork is very similar to Alternative 3; a key difference is in the amount of proposed temporary road construction. Since temporary roads are obliterated after use, impacts to wildlife would be minimal and short-lived. Alternatives 3 and 4 propose the most road decommissioning. This has long term benefits to wildlife by decreasing motorized use and other human disturbance in the area, and returning the corridor to a vegetative condition. Overall, the road actions in Alternative 3 would have the least potential to negatively impact wildlife compared to Alternatives 2 and 4.

CUMULATIVE EFFECTS

Wildlife cumulative effects will generally address actions over the timeframe of the current Forest Plan, signed in 1986. The reasonably foreseeable future would cover actions that would be likely to occur over the next 10 years. At this time, future actions are more difficult to predict, since the current Forest Plan is undergoing revision. The cumulative effects area for wildlife is the HNF and Eastern U.P. Please see the *Thunderbird EA* (USDA Forest Service 2004) for a discussion of cumulative effects relative to jack pine harvest levels on the HNF, 1986-present.

The principal cumulative effects to wildlife resources are project effects that could contribute to broad-scale effects at a larger temporal or spatial scale. Raco Plains wildlife cumulative effects include:

- The gradual loss of the jack pine habitat type through harvest and conversion to red pine and non-forest.
- The fragmentation of the jack pine habitat type caused by roads and small harvest blocks, especially early in the period.
- The reduction in CWD through extensive salvage of budworm trees and effective fire suppression.
- The increase in barrens and savanna habitat due to expanding temporary and permanent openings combined with an effective prescribed burn barrens restoration program on the permanent openings.

The conversion of jack pine to red pine results in a loss of habitat for jack pine and openland species, in terms of altered species composition, habitat quality, and extended rotations (changed from 40-60 years for jack pine to 120 years or more for red pine). The annual rate of conversion of acreages from jack pine to red pine has averaged about 475 acres per year from 1986 to the present. Approximately 20% of the jack pine on the HNF has been converted to other types since 1983 (88,400 acres down to 70,100 acres). This represents a cumulative decline in opportunities to manage habitat for species of early successional and jack pine ecosystems (table 3 - 13). Conversions within the Raco Plains LTA have been relatively substantial, at 3,877 acres since 1986.

Table 3 - 13. Outwash Plain Landtype Associations of the HNF and Acres of Conversion from Jack Pine to Red Pine 1986-2003.

	Total LTA Acres	Total Jack Pine to Red Pine Conversions (acres)	Percent of LTA
Raco Plains (north half)	46,668	3,877	8.3%
Wetmore Outwash	32,915	317	1.0%
Whitefish Delta	13,571	784	5.8%
Indian River Uplands	9,260	163	1.8%
Steuben Outwash	24,133	954	4.0%

Forest inventory data provided by the North Central Forest Experiment Station indicate a similar trend towards decreasing acreage of jack pine in the Eastern Upper Peninsula. Since 1980, jack pine has decreased from 227,000 acres to 197,000 acres. A number of species rely on the jack pine community, and some (i.e. spruce grouse) demonstrate little tendency to successfully disperse over large distances, so it is important that this community type is maintained across the landscape (Soule 1992). Further conversions warrant continued close scrutiny to ensure sufficient habitat is maintained on the HNF, to maintain species viability and meet Endangered Species Act obligations.

The following charts illustrate the vegetative composition of the project area and compare that to guidelines established in the Forest Plan. These charts specifically show the Forest Plan standards and guidelines for the minimum percentage of a given cover type by MA. On the same chart is displayed the existing Forest-wide cover type by MA (since Forest Plan goals were written to address Forest-wide conditions). Jack pine and red pine composition are highlighted in these charts. Since both the HNF and the Raco Plains area have met and exceeded the minimum vegetative compositional objectives for red pine and jack pine, there is no Forest Plan need to convert more acres from jack pine to red pine.

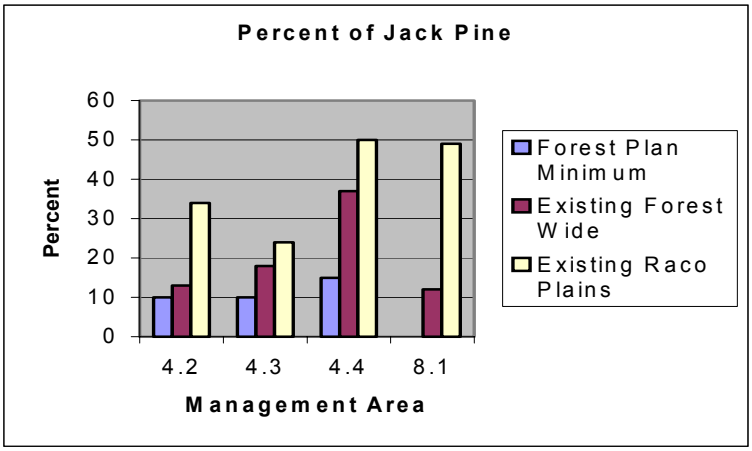

Figure 3 - 5. Percent of Jack Pine by Management Area.

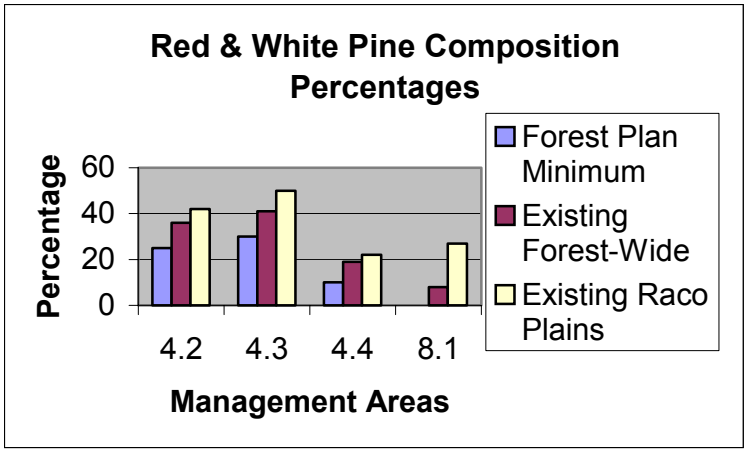

Figure 3 - 6. Percent of Red and White Pine by Management Area.

In general, the short and long-term effects of jack pine harvest, and ensuing temporary openings (new clearcuts) or openings resulted in net gains of suitable habitat for open-land species. While the Forest Plan did not quantitatively or spatially identify acreages for conversion to permanent openings, the vegetation composition objectives for most management areas included the provision for a minimum percentage in permanent openings. For most management areas, this minimum ranged from three to seven percent. However, for MA 4.4, characterized by dry, sandy outwash soils, where wildlife habitat management for sharp-tailed grouse and other open-land species is and has been an important objective, a minimum of twenty percent in permanent upland openings was prescribed. Since the inception of the Forest Plan, approximately 6,000 acres across the HNF within the jack pine type have been converted to permanent openings.

The following chart highlights the fact that both the HNF and the Raco Plains area have not yet met the minimum vegetative composition objectives for upland non-forested, open land habitat in MAs 4.3 and 4.4.

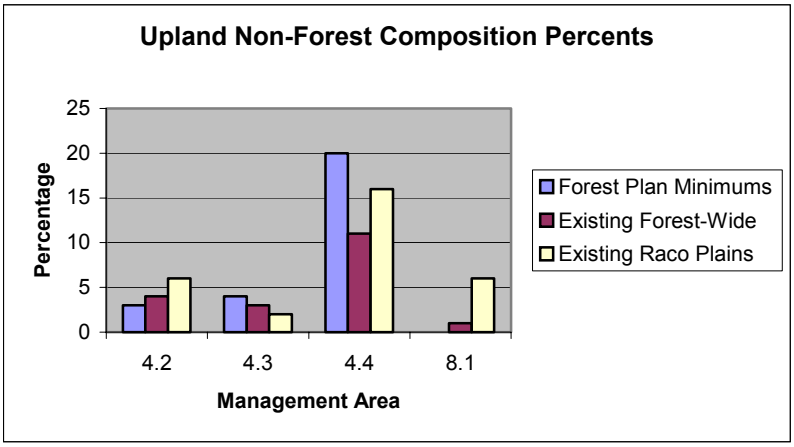

Figure 3 - 7. Percent of Upland Non-forest Area by Management Area.

Several wildlife species are associated with either the jack pine forest type or the openings associated with the regeneration of this type. The sharp-tailed grouse is a MIS whose habitat requirements include large (200+ acres) openings. Extensive logging and subsequent wildfires during the early 1900s created an abundance of this habitat type. Natural regeneration and 1930s reforestation activities gradually reduced the amount of this habitat type. As these stands matured and were harvested during the 1970s, the size of regeneration unit was generally less than 100 acres. During the 1980s to early 1990s, the size of regeneration units was 40 acres or less. These harvest activities did little to benefit species associated with larger openings such as sharp-tailed grouse. Within the project area, sharp-tailed grouse habitat is provided within MA 4.4. Since the mid 1990s, patch size of jack pine regeneration units increased, with many jack pine regeneration units in the 100s of acres up to 500 acres. Past projects include the *Raco Plains Jack Pine Ecosystem Project*, the *Betchler Marsh Project Set*, and the *Brimley Grade Project Set EAs*. As a result of these projects, the amount of opening habitat increased. The distribution and abundance of sharp-tailed grouse also increased in response to the increased habitat availability. Alternatives 2 and 4 propose jack pine regeneration in patches large enough to continue to improve sharp-tailed grouse habitat.

As a result of the increase in openland habitat, species associated with openland conditions (i.e. sharp-tailed grouse) have expanded across the Raco Plains LTA. Prior to the mid 1990s sharptails were confined to one or two small areas in the central portion of the Raco Plains LTA. Within the past few years, sharp-tailed grouse have expanded into the larger newly created openings. This expansion for the sharp-tailed grouse and other species associated with openland habitat would be expected to continue as these projects continue to be implemented. In contrast, those wildlife species associated with forest cover have reduced habitat due to the conversion to early successional habitat. The effects of these large temporary openings on individual species vary based on specific habitat requirements for these species, and are temporary based on the amount of time it takes for a stand to move through the age classes.

Developments such as roads have become a feature on the landscape and are wide-spread over the planning area. Impacts from roads can gradually reduce wildlife habitat suitability by increasing the following:

1. Access for pets that transmit disease and kill wildlife.
2. Poaching mortality.
3. Accident mortality.
4. Human disturbance that makes habitat unsuitable.
5. Physical barriers to movements.
6. Edge habitat and travel corridors for predators and parasites (Hunter 1990).
7. Fragmentation and isolation of habitat (Hunter 1990).

FISHERIES

Summary of Effects

Alternatives 3 and 4 would harden or stabilize the Sullivan Creek crossing on FR3132 directly upstream from the fish hatchery thus reducing the potential for sediments to enter Sullivan Creek at that crossing.

Mitigation Measures

Design criteria and mitigation measures are established to include the Forest wide standards and guidelines (Forest Plan 1986), the BMP guidelines as described in Water Quality Management Practices on Forest Land (MDNR 1994), and mitigation measure for Sullivan Creek (see chapter 2, Design Criteria and Mitigation Measures Common to All Action Alternatives). All activities would adhere to mitigating measures to provide effective control of erosion and minimize impacts on the quality of surface and ground water, thereby limiting impacts to the fisheries resources.

AFFECTED ENVIRONMENT

There are several small lakes within the Raco Plains project boundary. Most are shallow, small, surface runoff lakes with low natural productive capability, and little potential for fisheries management. Two lakes within the project area are managed for fisheries. Highbanks Lake is managed for coldwater species while Soldiers Lake is managed for warm water species. Though the action alternatives propose various activities around these lakes, none are in close enough proximity to affect them in any way.

Likewise, several small tributaries and creeks are located within the project boundary, most of which do not support productive fisheries. Sullivan Creek, Sweiger Creek, North Branch Pine River, and Black Creek are all within the project area boundary and support coldwater fisheries including native brook trout. Sullivan Creek is a high quality coldwater stream that is the source of water for the U.S. Fish and Wildlife Service fish hatchery located immediately upstream from FR3134. The action alternatives propose decommissioning roadwork in the vicinity of this stream course.

DIRECT AND INDIRECT EFFECTS

Alternative 1 (No Action)

No proposed vegetative activity or ground disturbance of any kind would be carried out under this alternative; therefore, no effects (direct or indirect) would be expected or measured.

Effects Common to All Action Alternatives

Each of these three actions alternatives propose road decommissioning near Sullivan Creek, timber harvest activity near a tributary to upper Sweiger Creek, and Alternatives 2 and 4 propose timber harvest near the extreme upper reaches of the North Branch Pine River. Alternatives 3 and 4 would stabilize the Sullivan Creek crossing on FR3132 directly upstream from the fish hatchery thus increasing water quality and reducing the potential for sediments to enter Sullivan Creek at that crossing.

Proposed timber harvest activity is not expected to impact the fisheries within these streams for the following reasons:

- Regenerated stands would be coniferous species which would not attract beaver.
- Retention of buffer strips (per BMPs) would preserve water temperature.
- No blockage of fish movement within system (per BMPs).
- No sediment input to streams (per BMPs).
- No interruption of flow or water input to system (per BMPs).

Likewise, adherence to the BMPs would also mitigate potential effects of proposed road decommissioning and road maintenance along Sullivan Creek. No timber harvest activity is proposed along or adjacent to Sullivan Creek in any of the alternatives.

CUMULATIVE EFFECTS

No direct or indirect effects are expected to impact any of the mentioned fisheries resources as a result of proposed activities of any action alternative. Therefore, no cumulative effects can be expected or measured.

RECREATION AND VISUAL RESOURCES

Summary of Effects

The view of the landscape within the project area is the most likely impact to the visitor's recreation experience that would result from the implementation of this analysis, regardless of the alternative that is chosen. The most concentrated recreation use areas within this project area are the North Country National Scenic Trail (NCT), Soldier Lake Campground, and Three Lakes Campground.

Visitors to the campgrounds are less likely to have their recreation experience impacted by the change in the visual resource than are visitors to the NCT. This is due to the fact that tree removal is an ongoing activity within national forest campgrounds. Trees are constantly being evaluated for their hazard potential within developed recreation areas, and trees deemed to have a high hazard potential are removed. This has included trees in and around Soldiers Lake and Three Lakes Campgrounds, which are within this project area and experience a high percentage of jack pine loss.

Visitors to the NCT are more likely to have their recreation experience impacted by the change in the visual resource, since the NCT typically winds through areas of healthy forest. The concentration of dead and dying jack pine is a natural occurrence, but is not necessarily nice to look at. This concentration along the NCT also creates a safety hazard that the Forest Service is required to review and act upon; removal is only one manner of addressing this safety problem. Any type of timber harvest along the NCT, whether simply to remove a hazard along the NCT or for more widespread reasons, would result in a change in the visual resource. Whether that change would result in an impact to the visitor's recreation experience would depend on each individual's preferences.

The summary below displays, by alternative, the miles of North Country Trail that would be affected by adjacent timber harvest activities.

Proposed Harvest and Reforestation Activity	Approximate Miles of NCT Affected			
	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Jack pine removal	0.0	3.0	1.51	3.0

Design Criteria and Mitigation Measures

Design criteria and mitigation measures were established to protect the recreation resource, specifically the visual experience. These criteria are described in chapter 2 of this document and include provisions for:

- Reserving trees along M-28 for visual screening.
- Prohibiting harvest between May 15 and September 15, within 1/8 mile of campgrounds, campground entrance roads, and the North Country Trail.
- Harvesting only jack pine within 1/8 mile of the NCT, and retaining all other tree species.
- Planting hemlock and white pine in certain locations along the NCT to provide a longer-lived forest type and species (visual) diversity.
- Placement of educational signing in Soldier Lake Campground along the NCT, near harvest activities, to inform the visitor of the reason for the harvest activities (salvage operations) and the expected outcomes of those activities (improved forest health).
- Harvest activities, primarily jack pine salvage, that would take place adjacent to portions of the North Country Trail, Soldiers Lake Campground, and Three Lakes Campground. Harvest activities would be prohibited within 1/8 mile of these sites from May 15 through September 15, which is when the highest recreation visitation occurs, to reduce the number of visitors impacted by the harvest activities.
- During times of harvest activities, visitors to the NCT may have their experience impacted by the sights and sounds of logging activities. Safety signing and informational signing would be placed near these recreation areas, providing the visitor with information regarding the activities and affording the visitor an opportunity to go elsewhere on the NCT if they desire a different experience. The informational signing would also allow the traveler to enjoy and appreciate the particular land and resource uses within the project area, thus contributing to the mission of the NCT.

- Harvest activities would cross the NCT in as few locations as possible to protect the trail surface and visitor experience while accommodating harvest activities. At no time would harvest activities be allowed to block the NCT, or to obliterate the trail tread. Skidding would not be allowed on the NCT, unless the trail is also a system road.

These criteria would be effective in protecting and possibly enhancing the visitor's visual experience by providing vegetation diversity in terms of species and ages, by providing some screening of harvest activities and post-harvest debris, and by prohibiting harvest activities during the highest (summer) visitation timeframe. Long-term effectiveness would be measured by the continued vegetation diversity and improved forest health, which would rapidly become more visually evident than the evidence of harvest activities.

AFFECTED ENVIRONMENT

Visuals. Forest-wide standards and guidelines for Visual Quality Objective (VQO) are identified in the Forest Plan (Amendment 5, pg 17-26), and on the Forest Plan VQO map (project file). The majority of the planning area has a VQO of Modification. The VQO of Modification, in general, allows for the full range of forest management activities with the general guidance that these management activities should have a natural appearance.

Areas within the project area that have a VQO of Partial Retention are found in the project file and include the NCT corridor, Betchler Marsh, Sullivan Creek, and Biscuit Creek. A VQO of Partial Retention allows for the full range of forest management activities with the general guidance that these activities should have a natural appearance. In general, Partial Retention provides greater protection of the visual resource than Modification, but specifically excludes salvage operations from many of the more restrictive criteria.

Areas within the project area that have a VQO of Retention include Three Lakes Campground, Soldiers Lake Campground, and the Pine River primitive camp area. A VQO of Retention is more restrictive than Partial Retention, while still allowing for management activities and providing exemptions for some activities including salvage operations.

Recreation Opportunity Spectrum. The Recreation Opportunity Spectrum (ROS) is a system of classifying the range of recreation opportunities and experiences that can typically be found and/or managed for in a particular area, landscape, or environment. The Raco Plains project area has an ROS class of Roaded Natural. This means the visitor can typically expect a predominantly natural environment with evidence of resource utilization and alteration. Evidence of the sights and sounds of humans is moderate but in harmony with the natural environment. Opportunities exist for both social interaction and moderate isolation from sights and sounds of humans.

North Country Trail. In addition to the ROS and VQO guidelines, the Forest Plan provides specific guidance for management of the North Country Trail. These guidelines are located on page IV-19 of the Forest Plan. In general, *"management of the North Country Trail will conform with the National Trails System Act and the 'North Country National Scenic Trail Comprehensive Plan for Management and Use' (USDI-NPS, 9/1982)."*

Specific direction regarding timber harvest is as follows: *"Timber activities may be seen along portions of the trail in Retention and Partial Retention; however, any temporary opening will generally not be greater than ... 10 acres in Partial Retention, as seen from any point along the trail. An exception to this may be salvage operation of overmature jack pine or aspen type."*

Page 26 of the "North Country National Scenic Trail Comprehensive Plan for Management and Use" (USDI-NPS, 9/1982) provides the following general direction for trail management: *"It is not the intent of this plan to completely isolate the user from land use practices surrounding the trail, but rather to allow the traveler to enjoy the mosaic of resources and land uses through which the trail passes while taking special advantage of the natural and scenic elements along the way. Thus, resource management activities such as timber cutting, even occasional clearcutting, are not out of harmony with management of the NCT."*

DIRECT AND INDIRECT EFFECTS

Alternative 1 (No Action)

In this alternative, the recreation opportunities within the project area as a whole would remain largely unchanged.

Decline of the jack pine stands would be expected to continue. The increase in dead and dying trees, particularly adjacent to the NCT and developed recreation sites, would be expected to impact the visual experience. Appropriated recreation funds would be used to eliminate those trees causing a health and safety hazard within these recreation use corridors, reducing the amount of funding available for other recreation maintenance and improvement projects. Lack of funding or available personnel to remove these hazard trees could lead to increased fuel loading and increased fire hazard, and the increased safety danger could potentially lead to the closing of the NCT and developed recreation sites.

Effects Common to All Action Alternatives

Harvest activities would likely affect the visual experience of recreation visitors. During harvest activities, visitors may see and hear logging equipment, and would likely see evidence of logging for a few years after the harvest operation. Visible evidence would include stumps and slash. The forested environment would appear much more open in

the harvested stands, providing greater viewing distances into the forest and possibly improving the visitor's chances of viewing wildlife.

Large openings (greater than 10 acres) would result from salvage operations in those stands primarily consisting of dead and dying jack pine. Large openings are typical of the jack pine barrens land type, so new openings should not present a stark visual contrast to the surrounding landscape. The combination of topography and tree retention along the North Country Trail should provide enough visual screening so that, while created openings along the North Country Trail may appear greater than 10 acres from any one point along the trail, they will be natural in appearance. In addition, reforestation of these sites would quickly reduce or eliminate the visual impact of these openings.

The forested environment is currently dominated by dead and dying jack pine. During harvest, all tree species other than jack pine would be retained within 1/8 mile of the NCT, in an effort to encourage and improve vegetation diversity. This diversity would contribute to greater habitat diversity, which once again has the potential to provide a wider variety of wildlife viewing opportunities. A variety of regeneration strategies are proposed for these harvested stands that would further increase vegetation diversity, which would improve the visual diversity from the current jack pine monoculture appearance.

The quality and type of access currently available to forest recreationists is directly related to timber harvest activities and their associated road maintenance. The forest road system ranges from one-lane dirt paths through the forest to two-lane paved forest highways. Any and all forest roads used for timber harvest activities, including sale preparation and reforestation, are developed and maintained primarily through timber sale receipts. Recreation receipts, while certainly included in the annual appropriations used for road maintenance, could not maintain the road system expected by the public to access their recreation destinations.

CUMULATIVE EFFECTS

During the 10-year period of 1986 through 1995, 15% (140,000 acres) of the HNF was impacted by some type of timber harvest activity. Of that, approximately 1/3 occurred on the Eastside of the HNF (the combined St. Ignace and Sault Ste. Marie Ranger Districts), or an estimated 47,000 acres total. Thus, an estimated 4,700 acres of the Eastside are impact annually by timber harvest activities, or approximately 1.2 percent of the estimated 396,000 acres that encompass the Eastside.

Approximately ¾ of the estimated 66 miles of NCT on the Eastside of the HNF are located adjacent to stands identified in the Forest Plan as suitable for timber harvest. Using the comparison above, with the understanding that the timber harvest percentage is based on the spatial arrangement of forested stands while the NCT is more of a linear representation, timber harvest would tend to impact an average of ¾ of ½ percent, or 0.9 percent of the NCT each year. Using this analysis, an average of less than 1 mile of the NCT would be impacted by timber harvest activities annually.

This analysis is understandably flawed, because practical application shows us that some project areas may not impact the NCT at all while others, as in the case of the Raco Plains project, may impact more than the average simply due to their location. However, in reviewing cumulative effects, it is helpful to look at an average over a period of time.

In addition, while stumps may be visible for several years after the completion of harvest activities, law requires that timber stands that have received their final commercial harvest by fully stocked within five years. This full stocking is generally accomplished through direct seeding or planting. This requirement, in addition to the implementation of the mitigation measures which include reserve and retention areas along travel corridors, help to return the harvest area to a natural appearance in a much shorter timeframe.

Cumulatively then, the visitor may experience a change in vegetation composition, age-class distribution, opening size, and location. However, the overall expectation is that the visual and recreation experience across the Eastside would be enhanced by these changes, while the forest continues to meet the consumptive needs of the public as well.

TRANSPORTATION

This section will address the design criteria & mitigation measures related to roads and will address Key Issue #1, Roads and Accessibility.

Summary of Effects

Description of Roadwork			**Estimated Cost**	
			Construction	**Survey/Design, Administration**
New Road Construction	System Road: single lane, local, ML=1, TSL=D		$8,000/mi	$2,000/mi
	Temporary Road		$1,500/mi	$100
Road Maintenance	Swieger Creek Road, FR3132 Stream Crossings (not related to Timber Harvest)	Road with stream crossing and asphalt surface	$168,000/mi	$8,000/mi
		Road with stream crossing, no asphalt surface	$80,000/mi	$8,000/mi
	Maintenance required prior to timber haul ML 2 and 3 roads		$2,600/mi	$400/mi
Road Reconstruction			$9,200/mi	$2,000/mi
Road Decommissioning			$800/mi	$150/mi
Road Closures	Gate (each)		$2,000 each	$500 each
	Rock closure (per road)		$500 each	n/a
Add Unclassified Road to System			No cost	n/a

Design Criteria and Mitigation Measures

Chapter 2 describes the following design criteria and mitigation measures for roads:
1. New system roads would be closed.
2. Temporary roads would be obliterated upon completion of management.
3. Road maintenance would be done to meet road management objectives.
4. Road decommissioning would restore roadways and discourage motor vehicle use.
5. Existing corridors would be used if possible.

These measures would be effective because the Forest Service has used them for several years on several different projects. When used with proper design, implementation, and monitoring, these methods have proven to minimize maintenance costs, minimize resource impacts, minimize unauthorized motor vehicle use, and provide non-motorized corridors for recreation use. See the Direct and Indirect Effects section for more details.

AFFECTED ENVIRONMENT

There is a map of the existing transportation system for the project area in appendix G.

The primary transportation arterial through the Raco Plains area is Michigan Highway M-28. It is a paved all-weather road in good condition. Other primary arterials are Michigan Highway M-123 on the western side of the project and Ranger Road (FR3154) on the eastern side of the area. Both of these are paved all-weather highways in good condition.

The Strongs Road South (FR3142) is an arterial road that passes through the western portion of the area. This road has an asphalt surface and is in good condition.

The Dick Road (FR3139) is an arterial road with crushed aggregate surface that crosses the western side of the area. This road is in good condition.

The Old Brimley Grade (FR3153) is a collector road in the northeast portion of the area. This road has an asphalt surface through the county maintained southern portion and a crushed aggregate surface through the Forest Service maintained northern portion. It is in good condition. Another collector road in the northeast portion of the Raco Plains area is the Pendills Lake Road (also known as the Dump Road or the Plantation Road). This road, under the maintenance jurisdiction of Chippewa County is in fair condition. The gravel surface is somewhat thin or nonexistent on portions of this road. There are plans in the works by the Bay Mills Indian Community to improve the eastern part of the Pendills Lake Road.

The Cad-Soo Road (FR3156) and the Rexford North Road (FR3157) are crushed aggregate surface collector roads in the north central part of the area. These roads are in good condition.

Another collector road in the north central portion of the Raco Plains is the Avery Road (FR3366). This road is in fair condition; the surface is a combination of native material and pit-run aggregate and is prone to rutting in some areas during timber haul.

The Flatfoot Road (FR3161) is a collector road that passes through the north central portion of the area. This road is in fair condition. The surface is a combination of pit-run aggregate and native sandy material. Portions of this road are likely to loosen and rut under timber haul. There are sight distance and roadway width issues on this road, portions do not meet the current Road Management Objectives and are in need of maintenance.

Gravel surface collector roads along the southern portion of the area include the Sullivan Creek Road (FR3131), the Waiska Road (FR3352), the Hayward School Road (FR3339), and the Sweiger Creek Road (FR3132). These roads are in good condition except the Sweiger Creek Road, which has sections where the aggregate surface is thin and prone to breaking up under heavy traffic. This road also has stream crossings where improvements could prevent sedimentation.

The Lone Pine Road (FR3141) and the Bobbygay Lake Road (FR3343) are collector roads on the southwestern portion of the area. The Lone Pine Road is an aggregate/native surface road in fair condition. The Bobbygay Lake Road has a crushed aggregate surface and is in good condition.

Several roads in the Raco Plains area are part of the designated snowmobile trail system in the winter. These roads include: FR3343, FR3137, FR3352, FR3153, FR3366, FR3156, FR3369, FR3021, FR3566, FR3634, and FR3158.

The local transportation system is comprised largely of native surface roads constructed primarily to access stands for timber harvest. These roads are seasonal in nature; many are passable only with high clearance vehicles. Sand blowholes and ruts are common on these roads and many are grown in with brush and trees.

The existing road density in MA 8.1 near Raco Plains is approximately 0.7 miles per square mile, the Forest Plan allows up to 1.0 miles per square mile. The existing road density in MA 4.3 included in Raco Plains is approximately 3.9 miles per square mile, the Forest Plan allows up to 4.5 miles per square mile, with up to 4.0 miles per square mile open. No road activities are being proposed in these areas under this document.

The existing road densities for the Raco Plains, MAs 4.2 and 4.4 are shown in table 3-14, Road Densities in Raco Plains Project Area. Existing road densities are lower than the maximum densities allowed by the Forest Plan.

The primary objectives for roadwork in this area would be to make improvements necessary to accomplish vegetative management in a safe, economically effective, and environmentally sound manner. Access for vegetative management activities would use the existing roads to the extent feasible. New road construction or road reconstruction is

proposed for local roads only. An adequate arterial and collector road system is in place throughout the Raco Plains project area.

Where new road construction is proposed, whether permanent or temporary, the use of existing corridors, if available, would be given first consideration. These corridors could be old logging roads, skid trails, railroad grades, or fuel breaks, which do not meet the Forest Service Manual definition of a road. They are generally not drivable. Use of existing corridors can minimize costs somewhat because fill and/or clearing & grubbing may be partially completed. Where an existing corridor is in a location not conducive to economical forest management or where drainage or erosion problems exist, it may not be used for new road construction, and may need rehabilitation work.

Permanent roads are designed to Forest Service standards as described in *Forest Service Handbook* 7709.56. These roads would provide the needed access for vegetative management while minimizing effects on other resources. When new, permanent, system roads are constructed they are added to the inventory of system roads.

All new permanent system roads constructed would be closed to general traffic. Closing roads would reduce maintenance costs by allowing the Forest Service to control the use and assure the user is responsible for maintaining the road during and upon completion of the use. Resource impacts would be reduced for the same reason; Forest Service personnel would directly control and monitor the use.

Various road closure devices may be used in this project area. Where frequent access would be required for administrative or vegetative management activities, a gate type closure device would typically be used. For most closures, however, frequent access would not be required and a boulder type closure would be used. While earth berm type closures have been used in the past, these have not always proven to be effective in preventing off road vehicle/all terrain vehicle) (ORV/ATV) use unless the road is also blocked by scattering slash for several hundred feet behind the berm. Signs would be placed at the closures stating that the road is closed to all motorized vehicle use and that foot traffic is welcome. Location, design, monitoring, and law enforcement would make road closures effective.

Where National Forest roads have access onto paved county or State roads, gravel approaches would be provided to minimize tracking of mud onto the pavement. Culverts would also, generally, be required to maintain drainage in the ditches along the paved roads. These approaches are required by State and county road agencies; the Forest Service would obtain permits for this work.

Aggregate and/or sand borrow used for road construction and maintenance would come from various pits. These include the Big Spring Pit, Cad Soo Pit, Supe Pit, Raco Sand Pit, and the Dollar Settlement Pit, or from private sources. The determination as to which pit would be used to provide material for a particular road would be made by the designer based on location and availability of required material in the pit, or during contracting depending on proposals made by the contractor.

Reconstruction would occur in the Raco Plains area where existing roads need to be realigned or upgraded to meet road management objectives.

Road decommissioning would occur as shown on alternative maps. The cost of road decommissioning varies depending on the site conditions specific to the road to be decommissioned.

Temporary roads would be located by Forest Service timber sale administration personnel with consideration of input from the timber sale purchaser. Consultation with HNF resource specialists would be made if necessary. Locations and miles shown on the alternative maps are approximate, with final locations made on the ground. Temporary roads are not intended to be a part of the HNF transportation system and are not necessary for long term resource management. Temporary road construction typically includes clearing of trees, brush, and ground cover; grubbing of larger stumps; shaping; placement of fill, slash, mats, or rock drains across wet areas; and placement of temporary culverts to maintain drainage. Temporary roads would be decommissioned after use is complete.

Road decommissioning of temporary, system, and unclassified roads, may include removing culverts, eliminating ditches, out sloping the roadbed, removing ruts and berms, seeding, tree planting, stabilizing the roadbed and slopes, and signing. Road decommissioning may also include piling slash and stumps on the abandoned roadbed to further discourage motor vehicle use. Decommissioning would be accomplished through timber sale work, during site preparation and treatment, by Forest Service maintenance crews, or through contracts. The work would be made effective through proper site evaluation, design, monitoring, and law enforcement.

The average costs of all proposed work associated with roads is shown in the table at the beginning of this section under Summary of Effects.

Road maintenance is a mission of the Forest Service and would occur in the Raco Plains area regardless of this project. These road maintenance miles displayed are related to the specific needs and proposals of this project.

DIRECT AND INDIRECT EFFECTS

Alternative 1 (No Action)

This alternative would have no effect on overall road densities in the Raco Plains project area. No roads would be decommissioned. There would be no direct roadwork costs associated with this alternative. Routine road maintenance would continue to occur.

No road closures would be constructed. Several miles of system road in the Raco Plains area are currently not being driven and are in the process of naturally reverting to forest. Many of these roads have been identified, through the road analysis process, as not being

needed for management of the National Forest. Under this alternative these roads would be open to use by ORVs and 4-wheel drive vehicles, a result that would be desirable to forest users who are in favor of motorized access. But the result would also be that miles of currently unused road, which have been determined not needed for forest management, would be vulnerable to having the self-obliteration process ended, vegetation destroyed, topsoil displaced, and mineral soil exposed. The effect of not decommissioning unneeded roads now could be increased cost to accomplishing the work in the future. The effect could also be, if resource damage were to occur, negative impacts on the environment, and an increased burden on the Forest Service maintenance budget.

This alternative does not propose road maintenance on FR3132 at the stream crossings. Routine maintenance on these areas could still take place. If funding became available for maintaining the crossings to meet current standards (aquatic species passage, Best Management Practices, road management objectives) a NEPA process would need to be initiated and a decision made to proceed with this work.

Alternative 2 (Proposed Action)

The approximate location of all proposed roadwork is shown on the Alternative 2 map. Total miles are indicated in the table at the beginning of this section under Summary of Effects. The effect of this alternative on road densities is shown in table 3-14, Road Densities in Raco Plains Project Area.

Under Alternative 2 there would be some decommissioning of unneeded roads but other roads determined to be unneeded would remain open or left to self obliterate if they get no use. Effects could be similar to that described above under Alternative 1.

This alternative does not propose road maintenance on FR3132 at the stream crossings. Routine maintenance on these areas could still take place. If funding became available for maintaining the crossings to meet current standards (aquatic species passage, Best Management Practices, road management objectives) the NEPA process would need to be initiated.

This alternative proposed to decommission the heavily used, unauthorized, ORV trail/road south of Strongs and east of the Three Lakes Campground. The decommissioning of this route would likely require law enforcement monitoring to be effective. This ORV use is well established, decommissioning this route would likely result in users finding other routes to get to the area south of Three Lakes Campground. There could be an increase in ORV traffic on the Three Lakes Road (FR3142), which would be an increased safety and law enforcement concern.

Aggregate and borrow materials, according to design criteria and mitigation measures described in chapter 2 under Non-native Invasive Species, shall come from pits where a non-native invasive plant eradication program is in place. This would reduce the spread of non-native plants. The decision to approve or disapprove material sources would be

based on the inspections and recommendation of a qualified botanist to reduce transport and spread of non-native weeds. The effect of this would be:

1. Possibility that some National Forest pits and private materials sources would be disapproved for use.
2. Increase in funds spent by the National Forest to maintain weed eradication programs.
3. Increased haul distances and, therefore, increased cost of roadwork.
4. Increase in deferred maintenance on roads.
5. Increased cost for all projects requiring sand and gravel to be brought from off site including administrative sites, campgrounds, and recreation sites.

Alternative 3

The approximate location of all proposed roadwork is shown on the Alternative 3 map. Total miles are indicated in the table at the beginning of this section under Summary of Effects. The effect of this alternative on road densities is shown in table 3-14, Road Densities in Raco Plains Project Area.

This alternative proposes maintenance on the FR3132 stream crossings. Work to maintain these crossings to meet current Best Management Practices, aquatic species passage guidelines, and road management objectives could occur on these stream crossings, which are part of the critical Pine River watershed.

Alternative 3 proposes decommissioning on all the roads that were identified to be unneeded for forest management in the Roads Analysis Process. The effects of this could be costly in areas where there is no proposed forest management to help decommission roads. In areas where there are roads currently being used, with little or no resource damage concerns, and with an absence of natural barriers and vegetation to help in decommissioning the work would be costly and time consuming to accomplish. There would be an impact on law enforcement and other personnel to monitor the decommissioning.

Aggregate and borrow materials shall come from pits where a non-native invasive plant eradication program is in place. The effects of this measure are the same as alternative 2 and are described under Alternative 2.

This alternative proposed to decommission the heavily used, unauthorized, ORV trail/road south of Strongs and east of the Three Lakes Campground. The decommissioning of this route would have the same impacts described under Alternative 2.

Alternative 4

The approximate location of all proposed roadwork is shown on the Alternative 4 map. Total miles are indicated in the table at the beginning of this section under Summary of

Effects. The effect of this alternative on road densities is shown in table 3-14, Road Densities in Raco Plains Project Area.

This alternative proposes maintenance on the FR3132 stream crossings. Work to maintain these crossings to meet current Best Management Practices, aquatic species passage guidelines, and road management objectives could occur on these stream crossings, which are part of the critical Pine River watershed.

Alternative 4 proposes more miles of decommissioning than Alternative 2 and fewer miles than Alternative 3. The miles of road decommissioning that would be difficult and costly to achieve, and present no resource damage concerns are not included in this alternative. The effect would be to accomplish the higher priority road decommissioning and still leave some roads open for forest users.

Aggregate and borrow materials shall come from pits where a non-native invasive plant eradication program is in place. The effects of this measure are the same as Alternative 2 and are described under Alternative 2.

This alternative proposes to decommission the heavily used, unauthorized, ORV trail/road south of Strongs and east of the Three Lakes Campground. The decommissioning of this route would have the same impacts described under Alternative 2.

CUMULATIVE EFFECTS

Cumulative effects for transportation activities were considered as part of this EA. The area considered for cumulative effects was the Eastside of the HNF and included Federal, State, local government, and private land. Effects related to other proposed or reasonably foreseen activities were also considered as appropriate. The time period used to evaluate future cumulative effects was 10 years because that is a reasonable time period considering the political, social, and scientific nature of National Forest management.

Table 3 - 14. Road Densities in Raco Plains Project Area.

Management Area	Forest Plan Road Density	Existing Road Density Alt. 1 (No Action)	Alt. 2 (Proposed Action)	Alt. 3	Alt. 4
4.2	4 mi./sq.mi., 3.6 mi./sq.mi. open	3.3 mi./sq.mi.	3.2 mi./sq.mi	3.1 mi./sq.mi.	3.1 mi./sq.mi.
4.4	4 mi./sq.mi., 2.8 mi./sq.mi. open	3.7 mi./sq.mi.	3.5 mi./sq.mi.	3.4 mi./sq.mi.	3.4 mi./sq.mi.

Notes:

1) Existing road density for all 4.4 Management Areas on the Eastside of the HNF is 2.7 mi./sq.mi. with 2.6 mi./sq.mi open. Effects of the alternatives on road density considering all 4.4 MAs on the Eastside of the HNF would be as follows:
Alt 2 – 2.6 mi./sq.mi. with 2.5 mi./sq.mi. open
Alt 3 – 2.5 mi./sq.mi. with 2.4 mi./sq.mi. open
Alt 4 – 2.6 mi./sq.mi. with 2.5 mi./sq.mi. open

2) The existing road density, forest wide, for MA 4.2 is approximately 3.7 miles per square mile, and MA 4.4 is also approximately 3.7 miles per square mile.

Past Activities

Many of the roads on the Sault Ste. Marie District and in the Raco Plains area were established in the late 1800s and early 1900s. The primary need for roads was to provide access for logging. Many of the roads around the Raco Airbase and the old rifle range were developed to support the needs of the military. Throughout the last 40 years the majority of the collector and arterial roads have been reconstructed. Construction, reconstruction, and maintenance of local roads have taken place to meet the needs of forest management.

In the past 40 years the amount of recreational use by 4-wheel drive vehicles, motorcycles, snowmobiles, and other off-road vehicles has increased on National Forest roads. This use varies by road, some get little or no use, and others get used heavily.

Present Activities

The collector and arterial roads in the area are maintained by the responsible agency, usually Federal, State, or local government. The Forest Service maintains its maintenance levels 3, 4, and 5 roads to meet the standard of the Highway Safety Act and to meet the Road Management Objectives of each road.

Maintenance of National Forest local roads is usually accomplished during timber harvest. Otherwise the local roads with maintenance levels of 1 or 2 would receive little or no maintenance unless work is needed to correct or prevent resource damage, or to meet recreation needs. Roads do get some maintenance by users, for example hunters often keep roadways clear of downed trees, limbs, and brush.

Temporary roads on the National Forest are decommissioned after the use for which they are established is completed. Current Forest Service policy is to do a complete job of decommissioning temporary roads and to monitor the effectiveness of the decommissioning.

New local roads on the National Forest are usually established for administrative and management use, they are usually closed to general public traffic. Foot traffic is welcome on all National Forest roads.

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

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

A recently completed road inventory on the HNF has identified corridors that meet the current Forest Service manual definition of a road but are not necessarily needed for management of the forest. These roads present opportunities for decommissioning unneeded miles of road.

Future Activities

Roadwork, in the form of maintenance, construction, reconstruction, and decommissioning, will occur on the Sault Ste. Marie District of the HNF in the next 10 years to meet the needs of National Forest management activities, to meet the needs of the forest users, and to meet environmental guidelines. There are currently forest management activities in the implementation stages on the Sault Ste. Marie District; there are other management activities in the planning stages. It is likely that some unneeded roads would be decommissioned and some new local roads would be established. Roadwork decisions would be supported by science based road analysis. The overall road density and amount of open/closed roads would be within the guidelines identified in the Forest Plan.

There is little information available for future activities on State and private land. There would likely continue to be private land developed, for example around the Bay Mills Indian Community or on the land near Sullivan Creek currently owned by Mead-Westvaco. Roads will be constructed and reconstructed in the populated areas around Strongs and Raco.

There are no new collector or arterial roads foreseen to be constructed by either the Forest Service, State, county, or private landowners other than possibly in the Bay Mills Indian Community.

The road use demand by the public for recreational purposes would likely stay the same or increase. The Forest Service would continue to work toward a road system that meets the needs of these users within the guidelines set by the Forest Plan and by other controlling regulations and laws

SOCIO-ECONOMICS

Summary of effects

This summary table provides a picture of the broad economic situation resulting from a wide variety of activities under the alternatives. Not all costs and revenues are directly associated with the timber sale program. Please see table 3-18 for a detailed cost breakdown of specific activities.

	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Volume (timber)	0 mmbf	50.6 mmbf	25.2 mmbf	50.4 mmbf
Volume (03/04 monetary value)	$0	$4,412,300.00	$2,355,549.00	$4,404,051.00
Net economic outcome	$0	$179,731	-$118,223	-$101,120
Amount of cost incurred due to need to plant to ensure successful jack pine regeneration	$0	-$520,880	-$218,450	-$520,880
Amount of cost incurred due to need to create KW habitat	$0	-$129,398	-$41,882	-$166,170
Reduction in future value associated with KW stocking level	$0	-$215,743	-$67,397	-$270,435

Mitigation Measures: None

INTRODUCTION

This section assesses the social and economic impacts of the four alternatives in the Raco Plains project, including the potential impacts on the local economy. To identify the potential impacts of each of the alternatives, this section incorporates the results of several of the analyses in this chapter, including harvest species and volume estimates and estimates of necessary road construction.[1]

The only issue related to socio-economics is Key Issue #3 which relates to the cost of Kirtland's warbler habitat.

[1] Note that this assessment does not attempt to value any environmental damage (i.e., erosion impacts) that might be caused by harvest activities; evaluation of environmental impacts has concluded that environmental damage is likely to be very limited, and will therefore have minimal economic impacts.

AFFECTED ENVIRONMENT

Social benefits in the Raco Plains project area are primarily related to leisure time activities such as snowmobiling, fishing, camping, hunting, and ORV riding. Economic benefits come from tourism, the sale of forest products, and jobs related to logging and post-harvesting activities such as reforestation/timber stand improvement (TSI) projects.

The Raco Plains project would affect the northern portion of the Eastside of the HNF near the communities of Eckerman, Strongs, and Raco. Current patterns of forest visitation (which emphasize use by local residents) in the Upper Peninsula suggest that the economic impacts of the proposed Raco Plains project would likely be limited primarily to Chippewa and Mackinac Counties, and possibly some residents of Luce County. The combined population of both Mackinac and Chippewa Counties represent approximately 0.5 percent of Michigan's total population. Both counties have experienced growth in populations over the last decade. Median household income in the counties is lower than the State average, and unemployment is considerably higher, reflecting to some extent the seasonal nature of the tourist and natural resource industries. The largest industries in the two counties include State and local government and services (i.e., hotels, restaurants, health care, education).[2] The percent earnings by the service sector in both counties have risen substantially over the last decade. According to the U.S. Census County Business Patterns Economic Profile for 1998, service industries (including hotels, restaurants, and all other services), retail trade, and public administration account for roughly 85 percent of jobs in the Chippewa and Mackinac Counties. In the State of Michigan as a whole, service, retail, and public administration jobs account for roughly 63 percent of employment.[3] Table 3-15 contains a summary of key social and economic data for Chippewa and Mackinac Counties, and for the State of Michigan as a whole.

[2] BearFacts Michigan 1988-98, Bureau of Economic Analysis: (http://www.bea.doc.gov/bea/regional/ bearfacts/bf10/26/index.htm).

[3] See U.S. Census County Business Patterns Economic Profile for 1998; estimates are adjusted to eliminate double-counting.

Table 3 - 15. Socio-economic Characteristics of the Raco Plains Project Area (Mackinac and Chippewa Counties, Michigan).

Socio-economic Indicator	Mackinac County	Chippewa County	State of Michigan
Population[a] (2000)	11,943	38,543	9,938,444
Percent change in population (1990-2000)[a]	11.9%	11.4%	6.9%
Median household income[b] (1997)	$28,637	$30,477	$38,883
Civilian labor force, 1999[c]	7,572	18,187	5,458,174
Unemployment rate, 1999[c]	9.6%	7.2%	3.7%

Sources and Notes:
[a] County Population 2000 (http://www.quickfacts.census.gov)
[b] Michigan Information Center (MIC) website (http://www.state.mi.us/dmb/mic/census/econ.htm)
[c] FedStats.gov (http://www.fedstats.gov/qf/states/26000.html)

The service and retail economy in the Eastern Upper Peninsula is consistent with the local emphasis on tourism. Tourism data for the Eastern Upper Peninsula indicates that Mackinac and Chippewa Counties ranked 4th and 5th, respectively, out of 83 counties in the State of Michigan for trips received in 1997.[4] In addition, Michigan State University estimates that total 1997 tourism expenditures in Mackinac County ($178 million) and Chippewa County ($102 million) rank 9th and 15th, respectively, among counties in the State.[5] Hotel and lodging establishments in the two counties provided over 22,000 full and part-time positions in 1998. The 1998 U.S. Economic Census data estimates employment in the "forestry and logging" sector for both Chippewa and Mackinac Counties at between 62 and 141 employees.[6] This represents approximately 1 and 1.5 percent respectively, of the counties total employees, and collectively represents between 3 and 6.5 percent of Michigan's total employment in "forestry and logging."

Forest Service information suggests that Chippewa and Mackinac Counties contain as many as five sawmills. However, because most timber harvested in the Raco Plains

[4] Stynes, Daniel J. "Economic Impacts of Tourism in the Eastern Upper Peninsula," unpublished study, Michigan State University, 1997.

[5] Table 1. "Tourism Spending Estimates by County and Lodging Segment, Michigan 1997 ($Millions)" at http://www.msu.edu/course/prr/840/econimpact/index.htm (Visited 2/27/01). Estimates for total tourist-related expenditures include spending on groceries, gas, entertainment, restaurants, sporting goods, and fuel. Expenditures for overnight visitors also include lodging at motels, campgrounds, and seasonal homes.

[6] This estimate is consistent with the U.S. Census County Business Patterns Economic Profile for 1998, which identifies approximately 100 employees in both counties, representing between one and two percent of the industry employees in the counties. See U.S. Census County Business Patterns Economic Profile, 1998. (http://www.cache.census.gov/cgi-bin/datamap/cnty?26=097). See also Forest Service web site at http://www.ncrs.fs.fed.us/ gla/social/images/mill.gif).

project alternatives would be pulpwood, area sawmills would unlikely be affected by the Raco Plains project. Similarly, because likely destination mills for pulp from the Raco Plains project are outside the counties, the Raco Plains project would not likely have any local impact related to pulping or papermaking.[7]

Most of the jack and red pine pulpwood harvesting on the Eastside of the HNF within the last two years has gone to mills in Marquette and Escanaba. There is also a mill in Sault Ste. Marie, Ontario that may use jack pine pulpwood. Jack and red pine sawtimber harvested on the Eastside of the HNF within the last two years has most likely gone as sawtimber or utility poles to mills in Marquette and McBain. There is also a pine sawmill in Shingleton.

A few recent Forest Service timber sales have taken place in the immediate area of Raco and less recent timber harvests are still evident in the project area. The sale and harvest of timber in the Raco Plains project area would therefore represent an expansion of current economic activity in the existing, well-established forestry and logging industry.

Recreational use within the HNF has increased in recent years, consistent with general trends in tourism. The Raco Plains project area has some developed recreation, including Soldiers Lake Campground and the North Country Trail. Developed snowmobile trails also cross the area. The Raco Plains area also supports dispersed recreational use by county residents and nearby landowners play a primary role in overall forest use patterns. Tourism is a major part of the economy in Chippewa County. Several businesses exist within the project area that likely capture some of the tourist dollars including gas station/convenience stores, restaurants, bars, small motels, and other service providers in the communities of Raco and Strongs within the project area and to a lesser extent the nearby communities of Brimley, Trout Lake, and Eckerman.

The Forest Service makes three kinds of payments to states in which National Forests reside based on the receipts generated and lands in Federal ownership.

Payment in Lieu of Taxes (PILT) funds are paid by the Department of the Interior to the State of Michigan which distributes them to the counties in which the HNF is located. Since PILT funds are distributed by the Department of Interior and none of the alternatives would affect that funding, they are not considered in this analysis.

Chippewa County has elected to receive annual payments under "The Secure Rural Schools and Community Self-determination Act of 1999" rather than receiving twenty-five percent of the gross receipts from the HNF which are predominantly from the sale of timber products, minerals, and fees paid for land, recreation, and special uses. These funds are distributed by the US Department of Agriculture. In 2003, this payment to Chippewa County was $245,939. Since the payment from this Act is not tied directly to

[7] Because pulp mills generally have several potential supply sources for pulp, the Raco project is not likely to have a measurable impact on pulp mill operations or local economies near mills.

the annual gross receipts from HNF, this amount would not change, regardless of alternative selected.

Chippewa County does continue to receive 10% of gross receipts for roads and trails. The analysis below will reflect this payment to the county since it does vary by alternative.

DIRECT AND INDIRECT EFFECTS

Economic Factors. Table 3-16 presents the summary costs and returns associated with the timber sale, roadwork, reforestation, timber stand improvement, noxious weeds, wildlife, fisheries, and other projects called for in the various alternatives. These are the relevant costs of the alternatives. The values presented are estimates based on the most recent stumpage and unit cost estimates of activities. Values were not compounded to the future nor depreciated, but simply represent estimates as if they occurred at the present.

Table 3 - 16. Net Economic Outcome.

PROJECT TOTALS	Alt. 1 (No Action)	Alt. 2 (Proposed Action)	Alt. 3	Alt. 4
Total Revenues	$0	$4,406,730	$2,355,549	$4,398,481
10% Roads & Trails (payment to county)		-$440,673	-$235,555	-$439,848
Total All Costs	$0	-$3,786,326	-$2,238,217	-$4,059,753
Net Economic Outcome	$0	$179,731	-$118,223	-$101,120

Table 3 - 17. Estimated Tangible Revenues.

PROJECT REVENUES	Alt. 1 (No Action)	Alt. 2 (Proposed Action)	Alt. 3	Alt. 4
JP salvage	$0	$3,336,296	$1,303,454	$3,283,298
JP seedtree	$0	$76,087	$60,345	$76,087
JP partial salvage and underplant	$0	$0	$0	$44,845
JP removal	$0	$41,736	$0	$41,736
Create savanna	$0	$88,641	$127,876	$88,641
Clearcut red pine	$0	$254,718	$254,718	$254,718
Red pine seedtree & shelterwood	$0	$271,699	$271,699	$271,699
Thin red pine	$0	$337,553	$337,457	$337,457
Sub-total revenues	$0	$4,406,730	$2,355,549	$4,398,481

Table 3 - 18. Estimated Tangible Costs. (Within this table, items in gray could be paid for using timber sale receipts, if they are available. If timber sale receipts are not available, these projects could be accomplished using appropriate program dollars.)

PROJECT COSTS	Alt. 1 (No Action)	Alt. 2 (Proposed Action)	Alt. 3	Alt. 4
Opening maintenance	$0	-$375,000	-$375,000	-$375,000
Create savanna	$0	-$54,900	-$79,200	-$54,900
Rx burn salvaged JP to RP	$0	-$16,600	-$9,300	-$16,600
Salvage JP site prep and plant RP	$0	-$114,760	-$80,180	-$114,760
Create upland opening	$0	-$3,450	$0	-$3,450
Timber sale prep	$0	-$759,315	-$377,250	-$757,785
Timber sale admin	$0	-$430,278	-$213,775	-$429,411
JP seeding	$0	-$327,492	-$75,834	-$170,082
KW JP seeding	$0	-$243,776	-$106,496	-$388,128
JP planting	$0	-$471,408	-$267,904	-$305,072
KW JP planting	$0	-$773,822	-$241,738	-$969,990
JP seedtree burn	$0	-$14,500	-$11,500	-$14,500
JP seedtree create openings	$0	-$1,450	-$1,150	-$1,450
Red pine seedtree & shelter burn twice	$0	-$25,600	-$25,600	-$25,600
JP partial salvage and underplant	$0	$0	$0	-$38,380
Plant 100 RP/ac with hwd regen	$0	$0	$0	-$5,250
Clearcut red pine site prep and plant	$0	-$45,600	-$45,600	-$45,600
New road construction	$0	-$10,000	-$7,000	-$7,000
Road reconstruction	$0	-$4,480	-$4,480	-$4,480
Maintenance stream crossings	$0	-$0	-$211,200	-$211,200
Road maintenance ML 2-3	$0	-$76,500	-$68,100	-$75,900
Temp. road construction	$0	-$20,800	-$10,720	-$20,640
Road decommission	$0	-$9,595	-$19,190	-$17,575
Road closure - rocks	$0	-$2,000	-$2,000	-$2,000
Weed control	$0	-$5,000	-$5,000	-$5,000
Sub-total costs associated with timber sales (including required road and reforestation work)	$0	-$3,314,781	-$1,557,727	-$3,369,628
Sub-total costs NOT associated with the timber sales (additional wildlife habitat, weed control, additional road work)	$0.00	-$471,545	-$680,490	-$690,125
Sub-total: all costs	$0.00	-$3,786,326	-$2,238,217	-$4,059,753

Alternative 1 (No Action)

This alternative would not harvest any wood products. Thus, no jobs or raw materials for local industry would be provided from this project area. This alternative would neither incur any costs nor yield any revenues. There would be no direct benefits to the local community from increased job availability. Selection of this alternative would result in a lost opportunity to supply wood to nearby area mills and to provide revenue for the Federal treasury as well as for local governments (10% Roads and Trails Fund).

No potential Kirtland's warbler habitat would be created so Kirtland's warblers would be unlikely to move into the Raco Plains area. There would be no potential for any tourism related to Kirtland's warbler.

Effects Common to All Action Alternatives

To varying degrees, as evident in the previous two tables, these alternatives would have the following effects:

Harvest of wood products would provide raw materials to local industry and create jobs related to harvesting and processing timber. Growth and value of products from residual stands would continue to increase as a result of improved vigor with this harvest entry.

Timber harvest in the past, and anticipated timber harvest in the future has and would continue to be a stable employment and revenue source for local communities and governments. Local industries have had and would continue to have access to purchase raw timber products for processing.

Through the duration of the timber sale contracts, these alternatives would help to maintain current employment levels, current pulpwood and sawtimber supplies to nearby area mills, and revenues to both Federal and local governments.

By creating potential Kirtland's warbler habitat, these alternatives might have some impact on tourism related to bird watching in the long term if Kirtland's warblers become established. The main KW populations occur in the Mio/Grayling area of Michigan. Since 1974, the USFWS and USFS have been conducting daily tours for about 1,200 people each year in the Mio/Grayling area to allow the public to view this rare songbird. The town of Mio, in coordination with the Kirtland's Community College also holds a "Kirtland's Warbler Festival" each year for the last few years with participation of approximately 2,500 people. No formal analysis of the economic impact of these events is currently available but some are planned and may be available in the future. The general impression of some of the organizers of these events is that they are having an economic impact as a result of participants staying in motels and eating in restaurants (Enger and Mensing, pers. comm. 2004).

Any economic impact as a result of creating potential Kirtland's warbler habitat through these alternatives is speculative. The Mio/Grayling area has established programs which draw participants and the established, large KW population makes the likelihood of seeing the rare bird high, which is attractive to bird watchers coming to the area.

Key Issue #3 raises a concern about the cost of management for creating potential Kirtland's warbler habitat. The cost of regeneration varies by type of activity required to obtain regeneration and the desired resulting stocking level (table 3-19).

Table 3 - 19. Per Acre Cost of Various Jack Pine Regeneration Techniques.

Type of Jack Pine Reforestation	Activities Required to Obtain Desired Reforestation	Total Cost Per Acre
Natural regeneration – traditional timber stocking levels (875 trees/ac)	Rollerchop (twice) Chain Collect or purchase seed Broadcast seed	$198
Artificial regeneration – plant at traditional timber stocking levels (875 trees/ac)	Rollerchop (twice) Bracke (make planting site) Purchase seedlings Plant	$368
Natural regeneration – KW stocking levels with openings (1,089 trees/ac)	Rollerchop (twice) Chain Collect or purchase seed Broadcast seed Create 20% small openings	$208
Artificial regeneration – KW stocking levels (openings incorporated into planting design) (1,089 trees/ac)	Rollerchop (twice) Bracke (make planting site) Purchase seedlings Plant	$434

Costs associated with jack pine regeneration varies by alternative depending upon the number of acres to be regenerated and the type of regeneration technique to be used. Table 3-20 displays the total cost for each alternative for all regeneration techniques and provides a breakdown of costs incurred in order to meet the need for planting or for Kirtland's warbler habitat creation. A summary of these costs by alternative is found in table 3-21.

Table 3 - 20. Cost of Jack Pine Regeneration (total cost, cost incurred due to need to plant, cost incurred due to need to create KW habitat) by Type of Regeneration Treatment.

	Natural Regeneration – Traditional Timber Stocking Levels (875 trees/ac) ($198/ac)	Artificial Regeneration – Plant at Traditional Timber Stocking Levels (875 trees/ac) ($368/ac)	Natural Regeneration – KW Stocking Levels with Openings (1,089 trees/ac) ($208/ac)	Artificial Regeneration – KW Stocking Levels (openings incorporated into planting design) (1,089 trees/ac) ($434/ac)
Alt. 1 – number of acres	0	0	0	0
Alternative 1 – total cost	$0	$0	$0	$0
Alt. 2 – number of acres	1,654	1,281	1,172	1,783
Alt. 2 – Total cost	$327,492	$471,408	$243,776	$773,822
Amount of cost incurred due to need to plant	$0	$217,770	$0	$303,110
Amount of cost incurred due to need to create KW habitat	$0	$0	$11,720	$117,678
Alt. 3 – number of acres	383	728	512	557
Alt. 3 Total cost	$75,834	$267,904	$106,496	$241,738
Amount of cost incurred due to need to plant	$0	$123,760	$0	$94,690
Amount of cost incurred due to need to create KW habitat	$0	$0	$5,120	$36,762
Alt. 4 – number of acres	859	829	1,866	2,235
Alt. 4 Total cost	$170,082	$305,072	$388,128	$969,990
Amount of cost incurred due to need to plant	$0	$140,930	$0	$379,950
Amount of cost incurred due to need to create KW habitat	$0	$0	$18,660	$147,510

Table 3 - 21. Summary of Jack Pine Regeneration Costs by Alternative and by Reason for Incurring the Cost.

	Alt. 1 (No Action)	Alt. 2 (Proposed Action)	Alt. 3	Alt. 4
Total cost	$0	$1,816,498	$691,972	$1,833,272
Amount of cost incurred due to need to plant to ensure successful jack pine regeneration	$0	$520,880	$218,450	$520,880
Amount of cost incurred due to need to create KW habitat	$0	$129,398	$41,882	$166,170

Another concern associated with Key Issue #3 involves the loss of merchantable timber volume as a result of managing jack pine stocking levels higher than optimum timber productions stocking levels in order to create potential Kirtland's warbler habitat.

In order to address this issue, a computer model (Forest Vegetation Simulator) was used to model merchantable volume at time of harvest (see project file). Three different stocking levels were modeled: for optimum timber management, for Kirtland's warbler habitat, and for stocking levels found attainable in stands which have recently been regenerated within the project area (table 3-22).

Table 3 - 22. Modeled Prediction of Merchantable Volume at Time of Final Harvest at Various Stocking Levels.

	Optimum Timber Management Stocking Levels	Kirtland's Warbler Habitat Stocking Levels	Summary of Recent Jack Pine Regeneration within the Project Area During Previous Projects
Number of trees per acre	875	1,400 (over 80% of the area)	2,725
Percent of area with at least 1 tree in 1/750th acre plot	100%	80%	84%
Modeled merchantable volume per acre at time of harvest (ccf per acre)	20.18	15.37	13.13
Modeled merchantable volume per acre at time of harvest (cds per acre)	26	20	17

As can be seen in table 3-23, the modeled prediction of volume per acre at time of final harvest was much higher than the per acre volume found during recent timber sales in the area and much higher than the per acre volume estimated for the harvest of stands in this EA (see Silviculture section). This is likely due to the loss of volume in these stands as a result of the last two budworm outbreaks which is estimated to have reduced volumes by 10-40%. The modeling did not include a factor to account for budworm mortality in the modeled stands.

Since most of the current jack pine stands being harvested were CCC era plantations, stocking levels at time of establishment were most likely closest to optimal timber management stocking levels. Assuming that budworm would affect the stands and that the modeled prediction for optimal timber management stocking levels would most appropriately match the modeled merchantable volume based on optimal timber management stocking levels, the second column sets the other stocking level volumes estimated proportionally from that baseline.

Table 3 - 23. Actual, Estimated, and Modeled Volume per Acre of Jack Pine at Time of Final Harvest Under Variable Conditions.

	Volume Per Acre (cords)	Volume Per Acre (cords) Assuming Modeled Stands Would Experience Mortality Due to Budworm	Value Per Acre (currently $40.37/cord)
Recent (within last 5 years) jack pine sales within the project area	12	N/A	N/A
Estimated volume per acre expected as a result of harvesting the current stands in project area	13	N/A	N/A
Modeled merchantable volume based on traditional timber management stocking levels	26	12	$484
Modeled merchantable volume based on KW stocking levels	20	9	$363
Modeled merchantable volume based on recent (last 10 years) jack pine regeneration units	17	8	$323

Table 3-24 shows a $121/acre reduction in value associated with managing jack pine stands for Kirtland's warbler. It also shows a $161/acre reduction in value associated with current natural jack pine regeneration techniques. Another complicating factor is that some level of "volunteer" jack pine seedlings may become established even in stands that would have artificial regeneration (jack pine planting) that would reduce the final harvest volume as well. No data is available.

Table 3 - 24. Dollar Value of Potential Reduction in Future Value at Time of Harvest Based on Predicted Volume Loss Due to Use of Natural Regeneration Technique and KW Stocking Levels.

	Alt. 1 (No Action)	Alt. 2 (Proposed Action)	Alt. 3	Alt. 4
Reduction in future value associated with using natural regeneration technique	$0	-$454,986	-$144,095	-$438,725
Reduction in future value associated with KW stocking level	$0	-$215,743	-$67,397	-$270,435
Total reduction in future value as a result of using natural regeneration and managing for KW	$0	-$670,729	-$211,492	-$709,160
Addition cost required if ONLY artificial regeneration was used and ALL acres were managed to traditional timber management stocking levels	$0	$1,501,950	$555,900	$1,476,195

CUMULATIVE EFFECTS

The geographic area of consideration for cumulative economic effects is Chippewa County. The time frame considered is the previous 5 to 10 years and next 5 to 10 years since most project activities would be completed during this time and the economic effects would not extend beyond that time.

Table 3 - 25. Type of Jack Pine Regeneration Technique Called for in Recent Decisions on the Eastside of the HNF.

Name of EA	Raco (the original EA)	Betchler Marsh	Brimley Grade	Interior Wetlands
Year of decision	1993	1996	1997	2003
Acres of natural jack pine regeneration	761	728	3,367	2,286
Acres of artificial jack pine regeneration (planting)	255	0	0	0
Acres of jack pine managed at KW stocking levels	0	0	1,520	271

The original *Raco Plains Jack Pine Budworm Ecosystem Management EA* and the *Brimley Grade Project Set EA* covered roughly the same geographic area as this current *Raco Plains Ecosystem Management EA*. Combined, these decisions called for about 6% of the acres to be artificially planted to regenerate jack pine. In this *Raco Plains Ecosystem Management EA*, the alternatives call for the following percentage of acres to be artificially planted to jack pine:

- Alternative 1: no action, 0 acres
- Alternative 2: 52%
- Alternative 3: 59%
- Alternative 4: 53%

All the action alternatives show a higher dependence on artificial regeneration and additional acres of KW stocking levels. If this represents a trend toward artificial regeneration of jack pine and toward creating stocking levels favorable to KW, there may be a trend of increasing cost of jack pine regeneration.

The Raco Plains project area would provide a steady, sustainable flow of tangible and intangible benefits to consumers of forest products, forest visitors, and local governments in terms of wood fiber and recreation opportunities. In a recent analysis of economic impact on the regional economy, the *Rudyard Project Set EA* (USDA Forest Service 2002a) which evaluated similar projects and roughly one-third of management/outputs estimated that management of the area would generate from 30 to 50 thousand dollars in economic activity on an annualized basis and would also return from 200 to 400 thousand dollars to the treasury every 5-6 years (in 2001 dollars). The Raco Plains project would likely have approximately three times that impact.

HERITAGE RESOURCES

Mitigation Measures

Any potentially eligible archaeological sites that are located in or adjacent to proposed activities would be protected through the use of reserve areas (RAs) and/or project boundary adjustment. If these measures are implemented, this project should comply with 36CFR800 and not affect any resources eligible for the National Register of Historic Places.

We have a Memorandum of Agreement with the Michigan State Historic Preservation Office that indicates we may consider projects to have "no effect" and proceed with implementation (pending submittal of our annual survey and evaluation reports) if surveys are completed and all potentially eligible sites are protected from earth disturbing activities.

The potential direct and indirect effects of this project on the nine heritage resources that warrant protection would be mitigated through the layout and enforcement of site-protective buffer zones, the application of the timber sale reserve clause, and the monitoring of harvest activities by the Timber Sale Administrator. The project leader will coordinate with an HNF archaeologist as needed during the timber sale layout in order to ensure protection of sites.

Even the most intensive field surveys may not locate all cultural sites in advance of project implementation. Consequently, timber sale contracts prepared under any action alternative will include the "B6.24# Protecting of Cultural Resources" clause which enables the Forest Service to modify or cancel a timber sale contract to protect heritage resources, regardless of when they are identified. Personnel involved with sale layout and timber marking will be directed to report any previously undocumented sites discovered during sale preparation.

AFFECTED ENVIRONMENT

In accordance with 36CFR800, all public lands involved with actions proposed for the Raco Plains project area have been inventoried for heritage resources through numerous archaeological surveys conducted between 1979 and 2003. A total of 73 heritage sites, representing pre-contact Native American sites (n=6), post-contact era sites (n=66), and one cache pit site of an unknown age, have been documented within the boundaries established for the Raco Plains project area. Two of the post-contact era Euro-American sites have been determined eligible for the National Register of Historic Places (NRHP); the Demond Hill fire tower, which was built in the 1920s, and the Soldiers Lake Campground picnic shelter, which was built by the CCCs in the 1930s. Nine of the sites have been determined ineligible for the NRHP, while the eligibility of the remaining 62 sites has not yet been evaluated.

A wide variety of site types are represented within the general project area, including prehistoric lithic scatters, cache pits, logging camps, CCC camps, railroad related structures, farmsteads, recreation camps, and several structures with unknown functions, to name only a few. Late 19th and early 20th century logging camps are the most frequently encountered site type in the area, followed by 20th century recreational camps and cabin sites. The Raco Rifle Range represents the largest site in the project area. This target range was constructed and used by military personnel associated with the former Camp Lucus/Fort Brady Military Base. The relative paucity of prehistoric sites in the project area is largely due to the distance of proposed timber harvest stands away from culturally significant water features.

DIRECT AND INDIRECT EFFECTS

Timber harvest and road construction activities involving earth disturbance can affect archaeological sites. A maximum number of 13 historic sites would potentially be impacted by the four timber harvest alternatives proposed for the Raco Plains project area without mitigation measures (table 2 - 1). The thirteen site numbers are, 15, 62, 117, 151, 180, 265, 285, 287, 298, 337, 341, 346, and 352. Three of these sites have been determined ineligible for the NRHP, and therefore do not require protection (sites 62, 287, and 298). Likewise, site 15 represents an archival site whose existence has not been verified. Previous archaeological surveys have failed to locate the remains of several structures purported to exist in this area on a 1926 Timber Type map. Consequently, site 15 is considered destroyed and not in need of protection. The nine remaining sites, however, would require protection from timber harvesting activities.

The potential effects of harvesting timber can be mitigated through the designation of buffer zones around individual sites, wherein no earth disturbing activities would be allowed to take place. The HNF has entered into a Memorandum of Agreement with the Michigan State Historic Preservation Officer (SHPO) regarding compliance with 36CFR800 that states:

- When an inventory (or records search of an area already inventoried) reveals that no cultural resources are present in the impact area of a project, or when the Forest Service assures avoidance of direct or indirect effects on any properties present, then the project will be considered to have "no effect" on cultural resources.

Reports on cultural resource surveys covering the Raco Plains project area have been submitted to the SHPO in accordance with this agreement.

Comparison of Alternatives

Alternatives 2 and 4 involve the same nine sites discussed above (table 2 - 1). Alternative 3, on the other hand, involves only eight of the nine sites, with the removal of site 04-352 from the list of potentially impacted sites. Alternative 1 (No Action) poses the least effects. However, with the recommended mitigation measures implemented in Alternatives 2, 3, or 4 would result in only a slightly elevated level of impacts to heritage resources located within the Raco Plains project area.

CUMULATIVE EFFECTS

Improved access after construction of system and temporary roads may increase the possibility of vandalism of archaeological or historical resources that may be in the area. Temporary road obliteration and closing system road would reduce the threat of vandalism. Consequently, no long-term change in vandalism threat is expected due to changes in the road system.

ENVIRONMENTAL JUSTICE

AFFECTED ENVIRONMENT

The US Environmental Protection Agency defines environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socio-economic groups should bear disproportionately high and adverse human health or environmental effects resulting from Federal agency programs, policies, and activities."

The area of consideration for the Raco Plains project consists of Chippewa and Mackinac Counties. United States Census data was gathered from the 2000 Census in order to determine if there is potential for an environmental justice case. This is completed through the use of income data and ethnic data for Chippewa and Mackinac Counties.

The State of Michigan low-income threshold is 29% at or below an annual income of $25,384. If the low-income population percentage is greater than twice the State percentage, the case should be identified and addressed as a potential environmental justice case. If the low-income population percentage is less than twice but greater than the State percentages, and if there are community-identified environmental justice issues, the case should be identified and addressed as a potential environmental justice case. If the low-income population percentage is equal to or less than the State percentage, the case should not be considered an environmental justice case.

Approximately 37% of the population for Chippewa and Mackinac Counties is at or below an annual income of $24,999. This is less than twice, but greater than the State percentages. However, at this time, there are no known community-identified environmental justice issues. Therefore, this project has not been identified as a potential environmental justice case.

The State of Michigan minority threshold is 18%. If the minority population percentage is greater than twice the State percentage, the case should be identified and addressed as a potential environmental justice case. If the minority population percentage is less than twice but greater than the State percentages, and if there are community-identified environmental justice issues, the case should be identified and addressed as a potential

environmental justice case. If the minority population percentage is equal to or less than the State percentage, the case should not be considered an environmental justice case. Approximately 23% of the population for Chippewa and Mackinac Counties is considered minority. This is less than twice, but greater than the State percentages. However, at this time, there are no known community-identified environmental justice issues. Therefore, this project has not been identified as a potential environmental justice case. (Summary tables from the Census Data are available in the project file.)

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

The minority and low-income populations in the two counties are 23.1% and 36.6 % of the total population respectively. These percentages are not equal or greater to twice the statewide minority and low-income percentages but they are between the State and twice the State percentages. However, management of HNF supports people of a variety of backgrounds directly and indirectly through employment in timber and recreation-related industries as well as through the provision of forest products and recreation opportunities. In addition, access to lands in the Raco Plains project area is available to everyone, regardless of race, color, national origin, sex, religion, age, disabilities, political beliefs, sexual orientation, or marital or family status. Therefore, there is no reason to believe that any of the proposed alternatives would involve environmental justice issues. Thus there should be no direct or indirect effects to minority and low-income populations under any of the four alternatives.

CUMULATIVE EFFECTS

Cumulative Effects Common to All Alternatives

There should be no cumulative effects to minority and low-income populations under any of the four alternatives.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

An irreversible commitment of resources refers to resources that are renewable only after a long period of time (such as soil productivity) or non-renewable resources (such as heritage resources and minerals). An irretrievable commitment of resources refers to losses of the productivity or use of renewable resources. This represents opportunities foregone for a period of time that the resource cannot be used.

DIRECT AND INDIRECT EFFECTS

Alternative 1 (No Action)

Alternative 1 would commit forest resources in the project area to ecosystem processes for the time being. The jack pine stands in this project area exhibit poor health and vigor due to age and JPBW. There is evidence of tree mortality in these stands as seen through snags, dead and downed trees, and advanced generation in canopy gaps where trees have already died. The continued decay of mature and infested jack pine stands would represent a loss of timber volume.

Effects Common to All Action Alternatives

Management requirements and mitigation measures reduce effects on long-term productivity by protecting resources like soil, water, wildlife, threatened or endangered plants and animals, and visual quality. Some soil movement would occur from timber harvesting, road construction and reconstruction, mechanical site preparation, and prescribed burning. These would be irreversible losses. However, implementing standards and guidelines described in the Forest Plan and BMPs for stream and riparian protection would avoid and mitigate almost all of these possible impacts.

Conversion of jack pine to openland represents an irretrievable reduction in timber production, while those stands are in an open condition.

Irretrievable commitment of resources associated with these alternatives would be the economic value lost to JPBW in mature jack pine stands not harvested during this entry. The Lake States Jack Pine Budworm Decision Support System estimates that 15-20% of stand volume in these stands would be lost over the next 10-15 years.

Alternative 2

Irretrievable commitment of timber resources associated with this alternative would be the loss of 389 acres from the suitable land base due to the increase in permanent upland openings and savannas.

Approximately 1.0 acres of forested land would be lost due to construction of approximately 1.0 miles of new system roads. This is an irreversible loss. However, the decommissioning of roads on approximately 10.1 miles would add approximately 9.8 acres of road back to forested land.

Alternative 3

Irretrievable commitment of timber resources associated with this alternative would be the loss of approximately 551 acres from the suitable land base due to the increase in permanent upland openings and savannas.

Approximately 0.7 acres of forested land would be lost due to construction of approximately 0.7 miles of new system roads. This is an irreversible loss. However, the decommissioning of roads on approximately 20.2 miles would add approximately 19.6 acres of road back to forested land.

Alternative 4

Irretrievable commitment of timber resources associated with this alternative would be the same as Alternative 2, except approximately 0.7 acres of forested land would be lost due to construction of approximately 0.7 miles of new system roads. This is an irreversible loss. However, the decommissioning of roads on approximately 18.5 miles would add approximately 17.9 acres of road back to forested land.

SHORT-TERM VERSUS LONG-TERM PRODUCTIVITY

Alternative 1 (No Action)

Tree growth rates would decline and susceptibility to insect and disease attack could increase within the stands proposed for harvest in Alternatives 2-4. With this increased susceptibility, tree mortality would increase.

Effects Common to All Action Alternatives

Management requirements and mitigation measures reduce effects on long-term productivity by protecting resources like soil, water, wildlife, threatened or endangered plants and animals, and visual quality.

CUMULATIVE EFFECTS

Implementing Alternatives 2 and 4 would lead to a balanced, area-wide age-class condition over the long-term. Alternative 3 would leave an additional 3,998 acres of jack pine in the 60 plus age-class condition resulting in a less balanced age-class distribution. Sediment from these alternatives is not expected to have any long-term cumulative effect. Short-term increases in sediment are predicted to occur. The quantities of sediment predicted are not expected to have any effect on channel condition of the existing stream courses other than locally at crossings by temporary roads.

SUMMARY OF ADVERSE EFFECTS THAT CANNOT BE AVOIDED

Effects Common to All Alternatives

These alternatives would not likely have an adverse effect on human health and safety when all mitigation measures were followed.

Effects Common to All Action Alternatives

Despite mitigation measures, some adverse effects cannot be avoided. Some non-target plants would be injured or killed by all management activities (timber harvest, harvesting, site preparation, etc.). Wildlife that require mature habitats would be displaced by harvest and road construction activities; while those that require early successional habitats would be displaced as young stands age.

During timber harvest and road construction activities, short-term effects on water quality and stream sediments from soil erosion would occur until the sites become revegetated. Air quality would be temporarily impaired from prescribed burning. Visual quality would be temporarily impaired by all management activities. Existing dispersed recreation in some areas would be temporarily displaced.

Some plant and animal species that require late successional habitat would be displaced.

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