Travel Management Project

Non-Native Invasive Species Report

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for:
Chequamegon-Nicolet National Forest

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Introduction

The purpose of the Chequamegon-Nicolet Forest (CNNF) Travel Management Project is to identify a system of roads for public motor vehicle use. Road corridors that are available for public motorized use are at high risk for introduction and spread of Non-native Invasive Species (NNIS) because vehicles can easily carry seeds, spores, eggs, and cocoons long distances. About half of the cars examined in one study were carrying seeds (NCHRP 2006 p3). Generally, the more improved a road is the more often it is traveled, which increases the frequency of NNIS introductions (Gelbard and Belnap 2003 p 429). Over ninety percent of the NNIS plant infestations on the Chequamegon-Nicolet are associated with roads and motorized trails. Because of this, roads across the forest are considered high risk areas for infestation and are targeted for survey. Other high risk areas for NNIS are campgrounds, hiking trails, picnic areas, and other areas frequented by people.

The following paragraphs describe the types of NNIS species present on the CNNF and the potential effects to the surrounding ecosystem:

NNIS Plants

Invasive plants threaten ecosystems by their ability to inhibit the establishment of tree seedlings, reduce available forage for wildlife, out-compete native plants, and change the composition and function of native plant communities. The effect of roads and trails on weed invasion depends on the character of the surrounding vegetation (Banks et al 2004). Weeds such as spotted knapweed and leafy spurge prefer full sunlight and typically invade more open areas such as wildlife openings, log landings and gravel pits but are unlikely to survive in a shaded forest. The NNIS plants that threaten closed canopy forested ecosystems include garlic mustard, buckthorn, honeysuckle, and other shade-loving species that can quite readily spread into undisturbed forest.

Road openings can provide increased sunlight that allows invasive species such as spotted knapweed, thistles, and leafy spurge to maintain a presence in a plant community, spreading into adjacent wildlife openings, log landings, and native open ecosystems like barrens or prairie (Parendes & Jones 2000 p70).

NNIS species can also impede recreation opportunities. For example, exotic shrubs can make walking difficult through the forest or a leafy spurge-infested wildlife opening will not benefit whitetail deer, which can reduce hunting opportunities.

The complete list of NNIS plants and the general habitat affected by each species for the Chequamegon-Nicolet appears in Appendix A.

Other Non-native Invasive Species

Other invasive species of concern include non-native earthworms, non-native insects, and non-native forest pathogens. The forest ecosystems of the Great Lakes region of North America did not evolve with earthworms and their feeding and burrowing activity results in a dramatic alteration of forest plants, soil, and nutrients (Hale 2007 p4). Earthworms are not specifically mentioned in the Forest Plan but recent science indicates this analysis should consider them because of their potential negative effects on forest ecosystems. NNIS insects like Gypsy moth defoliate large expanses of forest. Some of the pathogenic diseases that affect forest trees and plants may be of exotic origin. The cocoons, eggs, and spores of all these organisms can be

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picked up and transported by many of the same means as plant seeds. They can be carried in mud clinging to vehicles and moved by humans and animals.

The risk of spread and new introduction of NNIS

New introductions and spreading of NNIS can be caused by an increase of both vectors and pathways. Natural vectors of NNIS spread include wind, animals, and birds while anthropogenic sources are highway legal vehicles, ATVs, equipment, and clothing. The risk of spread is based on the likelihood of transportation corridors to facilitate spread via seed, spores, and eggs that cling to vehicles, people, and animals. The more pathways through an area there are, the greater the risk of spreading NNIS from primary colonization points into native plant communities. Likewise, the more a road is traveled, the greater the risk of spread (Banks et al. 2004 p2). All of the CNNF is considered at some level of risk for becoming infested.

The risk of NNIS spread and introduction is higher for ATVs because they typically travel softer surfaces and can pick up soil more readily (trail vs. surfaced road). ATVs occasionally travel illegally off trail which can increase the risk of NNIS spread, new introductions, and resource damage. Corridors that are opened to ATV use run a higher risk of spreading NNIS than those open only to highway legal vehicles. Figure 1 below conceptualizes the thought process of level of risk based on decreasing vectors and perturbations.

Figure 1. Risk of Spread and new Introductions Continuum

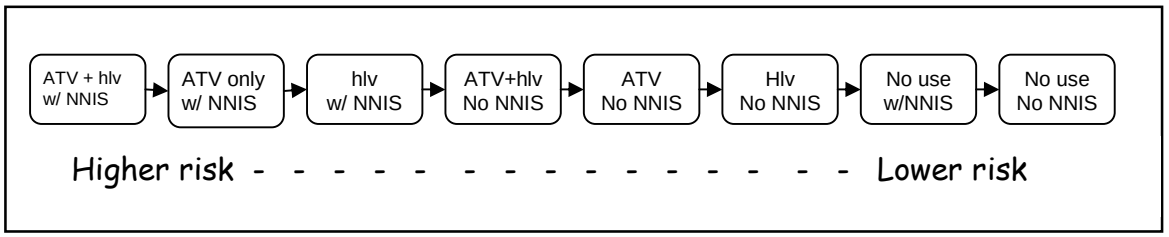

Figure 1. Weed risk (spread and new introduction) continuum as it relates to roads and motorized vehicles (hlv = highway legal vehicle; no use = no public motorized vehicle use) Note: At no point is there "no risk". Model assumes control actions on NNIS are taking place.

Methodology for Analysis

The Chequamegon-Nicolet Forest Plan, CNNF Invasive Species Strategy, Wisconsin State Statute 66.0407 and Executive Order 13112 provide the fundamental plans and laws which guide the following analysis. The analysis focuses on analyzing the risk of NNIS spread and the risk of introducing new populations of NNIS into the forest.

The routes available for public motorized use are considered the highest risk for the spread and introduction of NNIS and are the resource indicators for this report. The factors include:

1. The miles of road open within 100 feet of existing inventoried NNIS sites
2. Miles of road newly opened to ATV use forest-wide

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NNIS Analysis Data & Assumptions

Invasive plant locations are inventoried and recorded in the Forest Service's *Natural Resource Information System* database. The most current data (November 2007) was used to analyze proximity of infestations to road segments under consideration in this project. Using Arc-GIS, existing NNIS sites were overlaid on the location of road corridors being analyzed. A distance of 100 feet or less was selected to indicate presence of NNIS on a road segment. This distance will account for patch size estimation and GPS/mapping accuracy. While any soil-disturbing activity provides a certain amount of risk of spread of NNIS, the risk is increased significantly by the proximity of NNIS infestations.

The following assumptions are made in this NNIS Resource report:

- Vehicles can carry invasive species, ATVs more so due to where they can travel
- Roads provide corridors that facilitate movement of NNIS through the landscape
- Closing a road to motorized use is a form of prevention of NNIS

Although the CNNF conducts annual monitoring, the number of new introductions of non-native plants, earthworms, insects or pathogens by vehicles each year is unknown; this report relies on data collected on the presence of NNIS plants associated with roads as an indicator of new introductions of NNIS with the qualification that not all NNIS sites on roads are due to vehicles.

Existing Condition

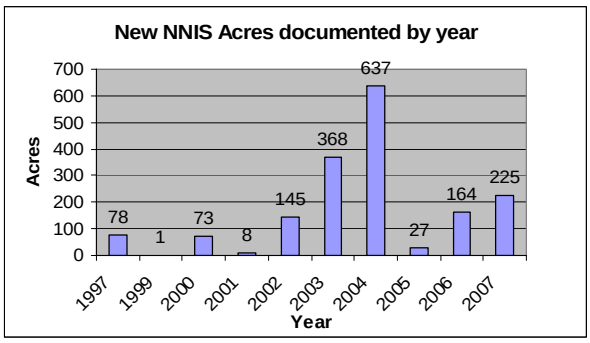
Current Forest-wide NNIS Inventory

NNIS Plants: Locations along Roads

The CNNF lists 20 high priority non-native invasive plants occurring on the forest (Appendix A) that are currently being controlled throughout the forest through the CNNF NNIS Strategy (NNIS Control Project USDA Forest Service 2004b & 2005). Current inventory and GIS maps show 2,724 sites covering 1,565 acres. These NNIS plants occur across the Forest in patches ranging in size from .001 acres to about 200 acres in size and 90 percent are less than one acre. Most (91 percent) of these sites are along roads. The rest occur at recreation sites or are found in the forest away from roads and structures (CNNF data 9/2007).

The number of infestations and size of infestations has increased dramatically in the past 15-20 years.

Figure 2. CNNF NNIS Inventory



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NNIS Plants: Locations Related to ATV Use

In a study on the CNNF, Rooney (2005) surveyed two ATV trail systems for NNIS and the ATVs themselves were examined for NNIS seeds or plant parts. Of the trail segments surveyed, 88 percent had NNIS present. Plant species most likely to be transported by motor vehicle are those with traits common to most invasive species: small seed size, gravity, or wind dispersed, high seed production, and persistent seed banks. About one third of the ATVs examined had seed in the mud samples adhering to the vehicle. Most of the seed was of a native sedge species but the seed size is similar to many invasive species of concern. This study shows that ATVs are capable of picking up NNIS seed. Forest monitoring indicates that all of the ATV trail systems on the CNNF have weeds somewhere along their length (CNNF GIS data).

Other Non-native Invasive species

The CNNF has not monitored vehicles as vectors of non-plant, non-native invasive species.

Forest-wide CNNF NNIS Strategy

In compliance with Forest Service regulatory direction and State law, there are currently two separate CNNF forest-wide decisions to control non-native invasive plants (USDA 2004b and 2005). Combined, the two decisions accomplish the action items described in the comprehensive, forest-wide Chequamegon-Nicolet NNIS Strategy to manage non-native invasive plants. The strategy is based on the national and regional frameworks and contains six major emphasis areas or goals:

- Prevention
- Early detection: Inventory and Monitoring
- Rapid Response: Control and Management
- Information and Education
- Restoration
- Leadership, Coordination, & Cooperation

The CNNF NNIS Strategy involves annual surveys, monitoring, and treatment of known sites. It is the goal of the CNNF NNIS Strategy to contain or control all of the "A-list" (Appendix A) infestations, and any new sites found. High risk areas are targeted and include roads, trails, recreation areas, and projects such as timber and road construction/maintenance. Rapid response that includes control and management efforts has increased over the past few years.

NNIS Plants

Currently, most plant infestations occur along roadsides within the CNNF and are eligible for treatment under the Forest NNIS Strategy. NNIS infestations require repeat treatments on some sites, monitoring of effectiveness, and annual surveys. In 2007, 637 acres were treated which represents 40 % of the total Forest acres (Figure 3).

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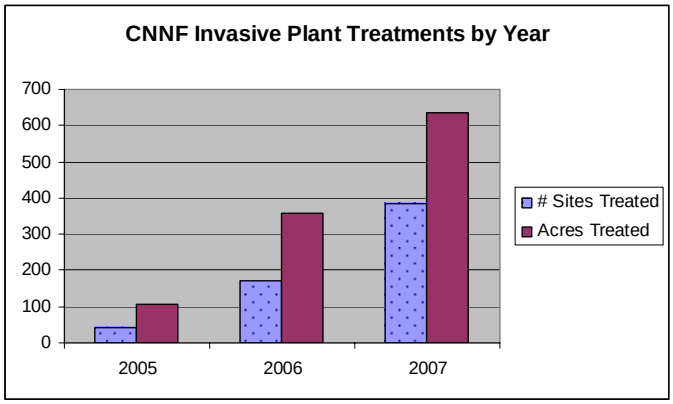
Figure3. CNNF Invasive Plant Treatments by Year.



Other Non-native Invasive Species

Non-native earthworms, insect pests, and forest pathogens also occur on the forest and can be spread by vehicles along transportation routes as cocoons, eggs, and spores (Gundale et al 2005 p1075; NTWC p2). The forest monitors and controls these organisms at varying intensities of data collection and treatment. For example, Gypsy moth outbreaks have been treated since 1995 with pheromone mating disrupters and/or BTk, a naturally occurring bacterium that kills moth larvae (Theisen 2007).

There is no known way to actively control exotic earthworm spread (Hale 2007). Researchers and forest personnel are collecting earthworm inventory and investigating measures to slow their spread through prevention measure at the Forest level and national levels (Holdsworth et al 2007; Gundale et al 2005 p 1075; Lawrence et al 2003 p 145). Pathogen outbreaks have occurred (oak wilt, spruce decline) and while silviculturists have not determined whether they are native or not, these diseases are treated and monitored.

Monitoring

There is no NNIS monitoring required for the CNNF Travel Management Project to meet regulatory requirements since it is already being done forest-wide through the Forest NNIS Strategy. Specifically Forest NNIS monitoring for the Forest Plan (USDA Forest Service 2004a 4-6; 4-8) includes:

- How many NNIS sites occur on the Forest? (4-8)
- How many were treated annually? (4-8)
- Has a treatment strategy been developed and implemented? (4-8)
- What is the effect of OHV use on the spread of NNIS?
- Control of destructive insects and disease (4-6)

Recommendation

Monitoring un-gated road corridors that are not available for public motorized travel would provide information on high risk areas for the introduction and spread of NNIS. Monitoring

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should continue every 2-3 years until corridors become overgrown or are analyzed in a district project for permanent closure, decommissioning and rehabilitation.

Travel Management Project Indicators

Miles open within 100 feet on NNIS

The existing condition includes 4,657 miles of unauthorized and low-maintenance roads open for public motorized use. Of these, 674 miles have NNIS plants within 100 feet somewhere on their length.

Miles newly open to ATV use

This indicator is applicable to alternatives 2 and 3 where ATVs will be allowed on corridors that did not allow them before.

Table 1. Existing Condition for Travel Management Indicators

	Alt 1
Miles open to all motorized use	4,657
High Risk -Miles open w/in 100 ft of NNIS	674
Lower Risk - Miles open with no NNIS	3982
High Risk - Miles **newly** open to ATVs	N.A.

Desired Condition

The Chequamegon-Nicolet National Forest Land and Resource Management Plan (USDA Forest Service 2004a) contains the following desired conditions for non-native invasive species that are applicable to the Travel Management Project:

"Use permissible mechanical, biological, and chemical controls to reduce the spread of non-native invasive species" (p. 2-25) and "Annually treat non-roadside and roadside NNIS acres. Develop an NNIS strategy to guide amounts and locations of treatments." (p 1-3).

"*Pest management will tier to latest revision of "Gypsy Moth Management in the U.S.: a cooperative approach" Final Environmental Impact Statement and Record of Decision."* (p2-26)

The CNNF Non-native Invasive Species Strategy includes an integrated pest management plan that guides the desired future condition for managing NNIS on the forest (USDA Forest Service 2004b & 2005). The Strategy goal is, "to contain, control, and reduce populations of invasive species forest-wide."

Overview of the Forest Proposal

The forest proposal (Alternative 2) presents the interdisciplinary, public involvement-based, outcome of the 1,052 roads put through the CNNF roads analysis process (RAP). The RAP included ranking criteria for resource risks (water quality, soils, heritage resources, resource protection-based management areas, Threatened, Endangered, and Sensitive species habitats,

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other wildlife needs, the potential to spread of non-native invasive species, and a road value to the public (access for hunting, bough and firewood gathering, recreation, access to private in holdings, and administrative access). The majority of the roads under consideration typically do not get much motorized use since they are not "through-ways" as are higher maintenance-level system roads on the Forest. This action will not physically close or decommission any roads.

Mitigation Applicable to All Alternatives

The environmental consequences of the CNNF Travel Management project do not trigger any specific mitigation measures since there will be no action taken on the ground that could directly spread NNIS or cause new introductions. Independent of the TMR project, the Forest NNIS Strategy guides control and containment efforts on current and future sites of NNIS.

Environmental Consequences

The Chequamegon-Nicolet NNIS Strategy will be implemented under all alternatives to treat and control all currently known and newly discovered NNIS plant sites.

Alternative 1 - No Action

The CNNF Travel Management Project baseline condition (No Action Alternative) is outlined in the most current Forest Order (R913-06-01) and the CNNF forest plan as summarized:

- Currently, no designated roads are open to ATV use on the Nicolet side of the forest;
- Street legal vehicles are allowed on any route that is not physically closed to use;
- Cross-country travel by any vehicle is prohibited;
- Forest roads are closed to ATV use unless posted open with a sign. The open roads are identified on ATV maps available at CNNF Ranger District Offices. The MVUM will replace these maps

Direct Effects

Alternative 1 does not reduce the miles of routes open to motorized use. The risk of spread and new introductions of NNIS (including plants, earthworms, and forest pathogens) by vehicles will therefore remain at the current level under this alternative. There would be no direct effects that would increase or decrease the populations of non-native invasive species. New introductions of NNIS would continue at their present rate and may increase their individual numbers and number of sites through natural means of spread (wind, water, animals) or by man-caused spread (motorized vehicle use, routine road maintenance, previously scheduled management, etc.). The CNNF NNIS Strategy will offset much of the increase over several years.

Indirect Effects

Open roads within 100 feet of existing NNIS site:

Indirectly, taking no action would leave all 4,657 miles of unauthorized road corridors open to motorized traffic and therefore maintain the current level of risk for the spread or new introduction of NNIS. Currently, 674 of the 4,657 forest road miles have NNIS present. Indirect risks are higher on these roads than roads with no NNIS currently present. The risk that NNIS would continue to be spread or be introduced by vehicles remains as long as the roads are open. NNIS plant sites will be treated under the Forest NNIS Strategy so this indirect effect will be offset somewhat.

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The spread of earthworms and pathogens by vehicles will remain at the current level. Leaving roads open for public motorized use does not change the current condition for the potential spread of worms; prevention is the only known method to control worm spread (Hale 2007 p 3).

Miles newly open to ATVs

Since no new miles will be opened, ATVs as a vector of NNIS would remain at current levels.

Table 2. NNIS data Alternative 1

	total miles	miles with NNIS
Miles available for all motorized use	4,657	674

Alternative 2 - Forest Proposal

Direct Effects

The forest proposal does not include physically closing or decommissioning any roads. Since the corridors will not be physically blocked, illegal use may occur. The risk of NNIS spread on the corridors remaining open for public motorized use (2,080 miles) will be the same existing conditions; however the continued risk will be lower on 80 % of the roads without current NNIS sites. There are no direct effects of selecting this alternative on NNIS spread and introduction.

Indirect Effects

Open roads within 100 feet of existing NNIS site

Alternative 2 reduces the total roads available for public motorized use by 2,577 miles (Table 3), reducing the risk of spread and introduction of NNIS on closed roads. Reducing the risk for the spread and new introductions of NNIS is consistent with CNNF forest plan guidelines and the NNIS Strategy. The risk of spreading NNIS will remain highest on 415 miles of roads with NNIS plants within 100 feet of the roadway that would remain available for continued public motorized use. This alternative also has the indirect effect of concentrating motor vehicle use to a smaller number of roads hence, concentrating and increasing the risk on the roads.

Implementation of the CNNF NNIS Strategy is expected to mitigate potential risk of the spread and introduction of NNIS associated with implementing this alternative.

Alternative 2 provides for the lowest risk of infestation and introduction of NNIS of the three alternatives indirectly by discontinuing motorized use on 2,577 miles of road and would best contribute to moving the Forest toward the NNIS Strategy goals.

Miles newly open to ATVs

Alternative 2 provides 58 new miles of routes open to ATVs that were not open before. Risk of spread will be higher for 10 miles of these routes that are within 100 feet of know NNIS infestations. Risk of spread will be at a slightly lower level on 48 miles of ATV routes where there currently are no known NNIS populations.

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Table 3. NNIS data Alternative 2

	total miles	miles with NNIS	*% Infested*
Miles available for all motorized use	2,080	415	20%
Miles unavailable for motorized use	2,577	231	9%
Miles newly open to ATVs	58	10	17%

Alternative 3

Alternative 3 considers an alternative way to meet the purpose and need of the project by emphasizing more motorized access through:

- Increased seasonal motorized access (specific roads opened seasonally from September 15th to December 31st for hunting and bough and firewood gathering);
- Designating ATV routes and connections on the Nicolet side of the forest, specifically on the Lakewood-Laona District; Opening new ATV routes on the Nicolet side of the forest
- Increased designated routes for motorized recreation experiences

Direct Effects

There are no direct effects of selecting this alternative on NNIS spread and introduction. There will be no barriers to road corridors constructed, hence no ground disturbance to increase NNIS risk.

Indirect Effects

Open roads within 100 feet of existing NNIS sites

Implementing Alternative 3 lowers the risk of spread and introduction of NNIS on some road corridors but not as many as Alternative 2. Therefore, this Alternative provides the "middle level" of the three alternatives in terms of the risk of NNIS spread (Table 4). The risk will be reduced indirectly by not allowing motorized travel on 2,499 miles of road; however the risk will remain high on 2,158 miles of road where motorized travel will continue. Movement toward Forest strategy goals will occur, but at a slower rate than Alternative 2.

Miles newly open to ATVs

Implementing Alternative 3 would increase the risk of new infestations of NNIS on by providing 84 new miles of routes open to ATVs that did not allow them before. Risk of spread will be high for 16 miles of these routes that are within 100 feet of known NNIS infestations. The level of risk would be the same regardless of the season of year because seeds can be spread even in winter if ATVs run through standing dried plants. The risk of spread will be lower on 68 miles of ATV routes with no known NNIS populations. The risk will still be lower than the No Action Alternative because 2,499 miles of roads will be unavailable for public motorized access.

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Table 4. NNIS data Alternative 3

	total miles	miles with NNIS
Miles available for all motorized use	2,158	428
Miles unavailable for motorized use	2,499	
Miles newly open to ATVs (including Lakewood-Laona District)	84	16

Cumulative Effects for all Alternatives

There are no direct effects from the Travel Management Project because the project does not include ground disturbing activities which could effect new introductions or the spread of NNIS. Therefore, there are no potential cumulative direct effects.

Potential environmental consequences of the Travel Management Project to NNIS come from indirect effects of making roads unavailable for motorized use, for leaving roads open to use when they could be made unavailable through this decision, and from opening routes to ATV use that currently do not allow ATV use.

The spatial boundary for indirect cumulative effects is the CNNF Boundary based on information available and motorized recreation use patterns. The temporal boundary begins with the Forest NNIS Control Project EA (Strategy) extending to projects listed in the current forest SOPA which provides a reasonable list of expected future projects.

The decision to make roads unavailable to continued public motorized use could result in a beneficial effect of reducing the risk for new introductions and spread of NNIS by motor vehicles. Cumulative beneficial effects would be in conjunction with other projects on the CNNF and surrounding land owners that include road closures, and control efforts. While these beneficial effects can not be scientifically quantified at this time, it is reasonable to assume that removing a source of spread and introduction will contribute to the reduction of NNIS. Actions such as ground disturbance that contribute toward increasing spread and introduction of NNIS will combine with the negative increased risk of leaving roads open. Relative risk is a qualitative measure and is expected to increase with increased miles of open road (see figures 1 and 4). The Forest NNIS Strategy includes annual monitoring and the forest will continue to assess and treat the spread and new introductions of NNIS.

The decision to allow ATV use on routes that are currently closed will indirectly increase the risk of new introductions and spread of NNIS along the corridors. The risk of spread is increased where there are other soil-disturbing actions that overlap in time and space. As above, this risk is measured qualitatively and is expected to increase with increased miles of open road. The Forest NNIS Strategy includes annual monitoring and the forest will continue to assess and treat the spread and new introductions of NNIS, including those on ATV routes and trails.

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Summary

Table 5. Summary of Alternatives for NNIS resource Indicators

	Alt 1 No Action	Alt 2 Proposed	Alt 3
Miles open to all motorized use	4,657	2,080	2,138
High Risk -Miles open w/in 100 ft of NNIS	674	415	428
High Risk - Miles **newly** open to ATVs	N.A.	58	84

No Action Alternative

Leaving 4,657 miles of corridors open to public motorized use maintains the risk of spread and introduction of NNIS at the current high level on these corridors. Combined with actions to control NNIS, the risk is lowered, but reaching Forest Plan goals will take longer.

Alternative 2

Reducing the miles of roads available for public motorized use will work toward the Forest Plan goal of reducing and controlling NNIS populations on the Forest. It will help prevent new infestations over time and allow treatment to be more efficacious, thereby moving the forest toward its goal sooner. Other actions that would reduce risk are decisions that physically close roads; past NNIS treatment; on-going NNIS treatment and monitoring; prevention measures such as equipment cleaning and public outreach, and control efforts on lands of other ownership.

Choosing to leave 2,080 miles of roads open to public vehicular traffic will maintain the current risk of NNIS spread in these areas. However, these open roads will still be monitored and treated for NNIS plants. Other projects on the forest that may contribute to increasing NNIS risk near these roads are unknown.

Alternative 3

Choosing to leave 2,138 miles of roads open to public vehicular traffic will maintain the current risk of NNIS spread in these areas. In addition, there is a higher risk of NNIS spread on 84 miles of routes newly open to ATVs. Combining the effects possible from other risk actions listed in Alternative 2 above, increases the timeframe for reaching Forest goals for NNIS control.

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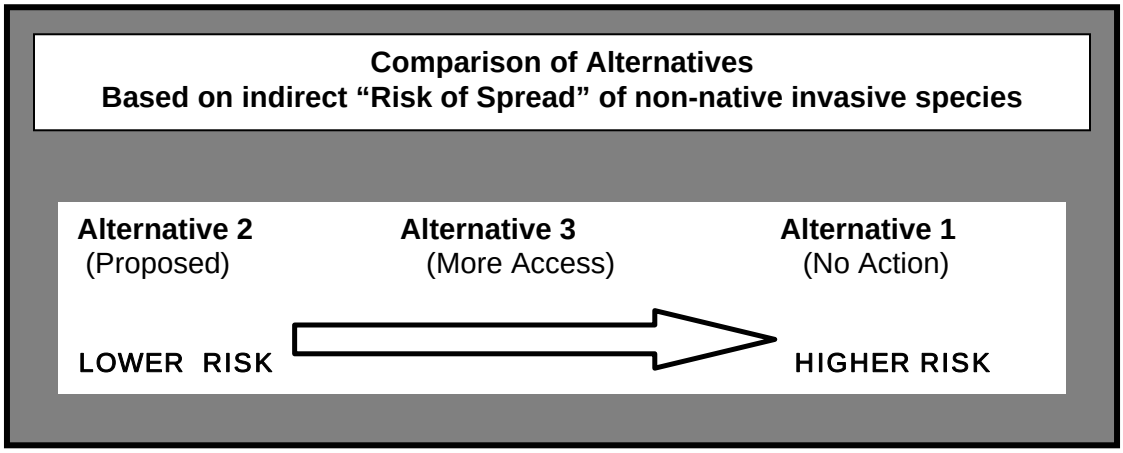
Figure 4. Summary comparison of Alternatives



Compliance with the Forest Plan and Other Regulatory Direction

All alternatives comply with the Chequamegon-Nicolet Forest Plan, State and federal law, and Executive Order 13112 with respect to the issue of non-native invasive species (NNIS).

Forest Plan

NNIS acres have been treated according to the CNNF NNIS Strategy since 2004. None of the alternatives will hinder this effort. Making roads unavailable to motorized use will help prevent the spread and introduction of NNIS in accordance with the CNNF Forest NNIS strategy.

State Guidelines

Wisconsin State statute 66.0407 charges that "the person having immediate charge of any public lands shall destroy all noxious weeds on the lands". Canada thistle and leafy spurge are listed as noxious weeds in Wisconsin and there are currently approximately 490 and 50 sites respectively of these weeds on the forest. Since 2004 many of these sites have been treated using mechanical, chemical and, in the case of leafy spurge, bio-control insects. None of the alternatives will hinder this effort.

EO 13112

Executive Order 13112 was signed in 1999 and established the National Invasive Species Council. This order is designed to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause. It's authority is based on numerous laws including the Federal Plant Pest Act (7 U.S.C. 150aa *et seq*.) and the Federal Noxious Weed Act of 1974, as amended (7 U.S.C. 2801 *et seq*.). The Travel Management Project provides for an opportunity for some prevention by making roads unavailable for motorized use.

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Appendix A

Chequamegon-Nicolet National Forest Invasive Plant List (2007 version)

Category A (High risk)-Species of immediate concern. These species are documented on the Forest and are currently invading native plant communities on the Forest. Control is warranted. (shaded boxes are plants found more often in shade)

Species	Vectors	Habitat	Effect
Leafy Spurge *Euphorbia esula*	Transport of seeds and soil by tires, equipment, shoes, animal fur.	Open habitat – most vigorous in dry sandy soils.	Out competes native species possibly allelopathic
Canada Thistle *Cirsium arvense*	Seeds and soil by tires, equipment; wind	Open and edge habitat, variety of soils	Clonal nature out competes native species, reduce species diversity.
Swamp thistle *Cirsium palustre*	Humans, machinery, wind, birds	Open and semi-open areas; woods roads, edges of forest	Displaces native plants
Bull thistle *Cirsium vulgare*	Wind, birds, equipment & vehicles	Open, disturbed areas, gravel pits, fields	Displaces native plants
Spotted knapweed *Centaurea biebersteinii (other Centaurea species)*	Seeds by equipment, humans, wildlife, fill, gravel, and soil.	Open - grasslands, barrens, gravel pits, roadsides.	Out-competes native plants. Reduces wildlife grazing, increases surface runoff and sedimentation.
Purple Loosestrife *Lythrum salicaria*	Transport of seeds and soil by water flow, equipment, wildlife	Open wetlands, water body edges, and wet disturbed areas like ditches.	Crowds or shades out native species
Autumn olive *Elaeagnus umbellata*	Human - planted; spread by birds as seed	Open areas, road edges.	Displaces native shrubs
Wild parsnip *Pastinaca sativa*	Transport of seeds and soil by tires, equipment, shoes, animal fur.	Open sunny areas; road edges,	phyto-photo toxin on skin. Displaces native species.
Japanese knotweed *Polygonum cuspidatum*	Human – garden escapee, rivers carry viable plant parts	Open road edges, edge of woods, lakeshores, river banks	Aggressive vegetative spreader, forms dense thickets, shades out all other plants
Buckthorns *Rhamnus cathartica & R. frangula*	Seeds dispersed by birds and mammals, Human planting	Open and shaded - variety of disturbed woodlands and edges, sometimes open prairie.	Can shade out herbaceous and woody species. Increased nest predation. Poor quality food source for wildlife.
Asiatic honeysuckles *Lonicera tartarica, L. morrowii, and L. x bella*	Seeds dispersed by birds and mammals; Human planting.	Open and shaded - Forests, woodlands, edge habitat and openings.	Suppression of forest regeneration, tree growth, and herbaceous layer. Increased nest predation. Poor food source for birds
Siberian pea-shrub *Caragana arborescens*	Human –garden escapee, transport of seeds by tires, equipment, shoes.	Open areas; semi-shaded woods	Displaces native shrubs.

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Category A (High risk)-Species of immediate concern. These species are documented on the Forest and are currently invading native plant communities on the Forest. Control is warranted. (shaded boxes are plants found more often in shade)			
Species	**Vectors**	**Habitat**	**Effect**
Reed canary grass *Phalaris arundinacea*	Movement of rhizomes; seed, by equipment and human planting.	Open eetlands, riparian areas, wet fens, marshlands, floodplains, wet prairies, and wet ditches.	Out competes native plants, alters soil hydrology, and promotes silt deposition, erosion, and constriction of waterways.
Common Reed-grass *Phragmites australis*	Rhizome spread; seed & rhizomes by equipment	open wet areas	Out competes native plants, alters soil hydrology, and promotes silt deposition, erosion, and constriction of waterways.
Garlic mustard *Alliaria petiolata*	Equipment, vehicles, clothing, and wildlife.	Shaded mesic forest, roadsides and trails	Dominates forest floor, may negatively impact some butterfly species including the rare West Virginia White.
Japanese barberry *Berberis thunbergii*	Seeds dispersed by birds and mammals, human planting.	Shaded - forests, woodlands, and edge.	Shade out native species. Changes in soil properties and nutrient cycling.
Oriental bittersweet *Celastrus orbiculata*	Seeds dispersed by birds and mammals, Human planting.	Shaded - Forests, woodlands, and edge.	Can limit growth of herbaceous and woody species by shading them out.
Forget-me-not *Myosotis arvensis*	Human –garden escapee	Forests, woodlands, and edge.	Dominates forest floor,
Curly Pondweed *Potamogeton crispus*	Boating and fishing equipment, humans, and downstream flow	Heavily used fertile lakes, rivers, and other water bodies, highly disturbed lakebeds	Shades out native aquatic plants, reducing biodiversity. Inhibits recreational uses, changes nutrient cycles, reduces water quality and precipitates algae blooms.
Eurasian water milfoil *Myriophyllum spicatum*	Transport of plant parts by boating and fishing equipment, humans, and downstream flow	Fertile lakes, rivers, and other water bodies, highly disturbed lakebeds, lakes receiving nitrogen and phosphorus-laden runoff.	Shades out native aquatic plants, reducing biodiversity and habitat heterogeneity. Inhibits recreational uses, changes nutrient cycles, reduces water quality and precipitates algae blooms.

Category B Species known to be invasive and present within the forest, invasion in natural communities uncertain. Monitor.			
Species	**Vectors**	**Habitat**	**Effect**
Black locust *Robinia pseudoacacia*	Planted by humans, spreads by root suckering and stump sprouting.	Open and habitat; grasslands	Shades out native species.
St. John's-wort *Hypericum perforatum*	road work, vehicles, shoes	Open, and semi-open roadsides, forest edges, wildlife openings	displaces native species, mildly poisonous to wildlife
Common tansy *Tanacetum vulgare*	Humans, machinery, animals	Open areas, mostly disturbed sites such as roadsides	Crowd out native open-land species
Purple crown vetch	Human – planted for soil stabilization	Open areas, road edges, persists	Aggressive vegetative spreader, forms dense thickets,

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Bishop's Goutweed *Aegopodium podagraria*	Human- garden escapee	Open areas, old homesites	Forms dense patches that exclude other plants
Narrow-leaved cattail *Typha angustifolia and hybrid cattail*	vegetative	Open -Marsh, roadsides,	more aggressive than T. latifolia, takes over quality marshland. Peatlands where hydrology is altered
Sweet William *Dianthus barbatus*	Human- garden escapee	Semi-shade -forests, woodlands, riparian areas.	Dominates forest floor
Brittle-stem Hemp-nettle *Galeopsis tetrahit*	Transport of seeds and soil by tires, equipment, shoes, animal fur.	Shade - Forests, woodlands, and edge.	Dominates forest floor

Category C: the "Watch List" Species known to be ecologically invasive, but are not yet documented on the Forest. If detected they will likely be added to the "A List".

Japanese stiltgrass, *Microstegium vimineum*

Porcelain berry, *Ampelopsis brevipedum*

Black swallow-wort, *Vincetoxicum nigrum*

Yellow flag iris, *Iris pseudacorus*

Giant hogweed, *Heracleum hantagazzianum*

Any other species known to be invasive in natural communities

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