Non-native Invasive Plant Species

INTRODUCTION

Non-native invasive species (NNIS) were identified as a minor Need for Change issue. Approaches to address NNIS are also included in the Vegetation Management major Need for Change issue.

NNIS have been recognized as a major threat to conservation of native biological diversity (Westbrooks 1998). NNIS out-compete native species and homogenize ecosystems, thereby threatening to destroy the distinctiveness of communities whose component species evolved in the absence of these aggressive competitors. NNIS can also degrade forage quality on range lands, compete with desirable regeneration after timber harvest, and reduce the diversity of habitat niches available to a wide variety of wildlife species.

Issues and Indicators

Issue Statement

Forest Plan management strategies may affect the spread and control of NNIS.

Background

NNIS have been recognized at the national level as one of the four major threats to the ecological sustainability of National Forest Systems (NFS) land. NNIS spread via a variety of pathways. For most species, invasion and spread are facilitated by some type of human-caused habitat alteration, especially those alterations that include soil disturbance. Typical alterations that can encourage NNIS include roads, hiking and horse trails, grazing allotments, utility corridors, wildlife openings, and vegetation management. Some of these factors, such as trails, grazing allotments, and utility corridors, are not likely to change much by alternative. However, road construction and wildlife opening construction are likely to vary according to the amount of land that is allocated to MPs that emphasize vegetation management. Road construction is directly related to the amount of timber harvesting that is conducted in areas that do not already have adequate access.

Indicators

Amount of timber harvest 3/8 of a mile or more from currently existing roads by alternative - As an index to the risk of invasion and spread of NNIS plants, we projected the acreage of timber harvest in areas that are 3/8 of a mile or more from the nearest currently existing system road or state-maintained road. Generally, harvest units that have system road access within 3/8 of a mile do not require construction of new system or temporary roads. Areas within 3/8 of a mile of a system road were considered to be already vulnerable to NNIS; timber harvest activity outside this accessible area was considered to be an index to areas that may become more susceptible due to management. Acreage of timber harvest 3/8 of a mile or more

from the nearest road was projected by Spectrum modeling. Although harvests that use helicopter yarding of logs generally require less road construction than conventional harvests and, therefore, have less potential for facilitating NNIS invasion and spread, we did not separate the indicator by yarding method. Specific information on site limitations is necessary to determine where helicopter yarding is needed, but such information was not available to use in the model, so the model had no basis for projecting the locations of helicopter harvests in relation to existing roads. Therefore, this indicator should be considered an index to potential NNIS invasion and spread associated with new roads, rather than a precise estimate of acreage to be affected by new roads.

Amount of maintained openings by alternative - As an additional indicator of vulnerability to NNIS invasion and spread, we tracked the predicted amount of maintained openings by alternative. We used the estimated future amounts of the high elevation grasslands community and the woodlands, savannas, and grasslands community to approximate maintained openings (see *Terrestrial Ecosystem Diversity* section of Chapter 3). Total acreage of maintained openings was projected by assuming that the mid-range goal of 5 percent maintained openings will be met in MPs 2.0, 3.0, 4.0, 4.1, 6.1, and 6.3, outside of suitable West Virginia northern flying squirrel habitat.

Scope of Analysis

Projected amounts of the indicators were assessed through the 100-year planning horizon. Analysis over the entire planning horizon allowed us to evaluate potential temporal differences in the amount of harvesting in areas more than 3/8 of a mile from roads. Limiting the analysis to the early decades of the planning horizon would have ignored any potential changes over time in the spatial pattern of harvesting relative to existing roads. However, projections beyond the first decade or two must be viewed with caution because of the potential for changes in management emphasis and harvest methods, as well as substantial uncertainty over factors beyond the control of the Forest, such as continued acid deposition, global climate change, human population growth, and arrival of new NNIS.

For direct and indirect effects, the indicators were analyzed for all NFS land within the Forest boundary. For the cumulative effects discussion, we considered potential activities on other land ownerships within the Forest boundary. Potential activities on other ownerships could not be quantified reliably, so the cumulative effects analysis is a qualitative discussion of the extent to which Forest Service activities are likely to contribute to overall NNIS risk within the Forest boundary.

These indicators are interpreted as indicators of the potential for invasion and spread of terrestrial plant NNIS. Insect and pathogen NNIS are discussed in the context of forest health in the *Vegetation Management* section of Chapter 3. Aquatic NNIS are discussed in the *Water, Aquatic, and Riparian* section of Chapter 3. Invasive terrestrial vertebrates currently are not a serious problem on the Forest and are not analyzed in detail.

CURRENT CONDITIONS

Currently, 95 species of NNIS plants are known or suspected to occur on the Forest (Ecology AMS, Forest Plan Project record). Of these species, 22 are considered highly invasive, with the potential to invade natural habitats and replace native species. These include species that are well-known for seriously disrupting the plant species composition of forested communities, such as tree of heaven (*Ailanthus altissima*), garlic mustard (*Alliaria petiolata*), Tartarian honeysuckle (*Lonicera tatarica*), and Japanese stiltgrass (*Microstegium vimineum*). Thirty-one species primarily occur in disturbed areas, but are capable of spreading into adjacent undisturbed areas. These include many agricultural weeds and domestic plants that have escaped cultivation, such as Japanese barberry (*Berberis thunbergii*), tall fescue (*Festuca elatior*), yellow sweet clover (*Melilotus officinalis*), and princess-tree (*Paulownia tomentosa*). Twenty-seven species have less invasive potential, and are generally found in disturbed areas with full sun or partial shade. These include many naturalized species like Queen Anne's lace (*Daucus carota*), English plantain (*Plantago lanceolata*), and curly dock (*Rumex crispus*). The remaining 15 species are known to be invasive elsewhere, but their invasive potential on the Forest is not known.

No comprehensive survey of invasive plants has been conducted on the Forest, although NNIS plants are often included in project-level surveys for threatened, endangered, and sensitive plants. During the late 1990s, Candidate Research Natural Areas and grazing allotments totaling several thousand acres were surveyed for NNIS, but no representative sampling effort that would allow estimation on a Forest-wide basis has been attempted. Therefore, the full extent and severity of NNIS infestation is not known.

Currently over 350,000 acres of NFS land lie within 3/8 of a mile of a system road. This comprises about 39 percent of all NFS land. There are approximately 21,000 acres of herbaceous openings on NFS land, as measured by the high elevation grasslands and woodlands, savannas and grasslands communities (see *Ecosystem Diversity* section of this chapter). This comprises about 2 percent of all NFS land. There likely is some overlap with the land within 3/8 of a mile of a road, but openings comprise such a small percentage of land that the overlap is not a substantial factor in the evaluation of these indicators. These areas represent a rough index of land that may be most susceptible to new infestations of NNIS plants.

ENVIRONMENTAL CONSEQUENCES

Resource Protection Methods

Laws, Regulations, and Policies

Numerous laws, regulations, and policies govern the management of NNIS on National Forest System lands. National laws and regulations have also been interpreted for implementation in the Forest Service Manual and Handbook. Some of the more influential laws, regulations, and policies governing management of NNIS are listed in Table IS-1 below:

Table IS-1. Major Laws, Policies, and Regulations Influencing Management of NNIS on National Forest System Land

Act/Law/Regulation/Policy	Law/CFR/FSM/FSH Number
National Forest Management Act	16 U.S.C. 1600-1614
National Forest Planning Regulations – diversity requirements	36 CFR 219.26, 36 CFR 219.27(g)
Lacey Act	18 U.S.C. 42
Federal Plant Pest Act	7 U.S.C. 150aa
Federal Noxious Weed Act	7 U.S.C. 2801
Executive Order on Invasive Species	E.O. 13112
USDA noxious weed regulations	Departmental Regulation 9500-10
Forest Service Directives on noxious weeds	FSM 2080
Forest Service National Strategy and Implementation Plan for Invasive Species Management	U.S. Forest Service 2004
Forest Service Eastern Region Non-native Invasive Species Framework	U.S. Forest Service 2003
Forest Service Eastern Region Native Plant Framework	U.S. Forest Service 2004

Forest Plan Direction and Implementation

The revised Forest-wide direction was developed within the context of national and regional guidance on NNIS management (see last three references in Table IS-1). This guidance prohibits the use of NNIS species in revegetation and stabilization work, and encourages efforts to slow or prevent NNIS spread. The guidance emphasizes prevention, early detection/rapid response, control/management, and rehabilitation/restoration.

Forest Plan direction for NNIS management does not vary much across the Management Prescriptions (MPs); therefore most NNIS direction is contained in the Forest-wide direction. Treatment of NNIS in the plan direction differs greatly between the 1986 Forest Plan and the revised management direction. NNIS were not considered a major management problem at the time the 1986 Forest Plan was written, so there is very little direction in the 1986 Forest Plan to address NNIS. In the 1986 Forest Plan, the Forest-wide direction contains one general statement calling for managers to favor native species when revegetating disturbed areas. MP 6.1 in the 1986 Forest Plan contains one standard requiring case-by-case analysis prior to planting exotic plants on range allotments.

In contrast, the revised 2006 Forest-wide direction contains several goals, standards, and guidelines that address NNIS. The most extensive is a goal outlining an integrated pest management approach toward NNIS management. This goal calls for prevention of new infestations, preparation of a Forest-wide NNIS management plan, project-level evaluation and implementation of NNIS management, and cooperative work with users of NFS land to control NNIS. The 2006 Forest-wide direction requires inspection of gravel and borrow sources for NNIS prior to use, and a new goal in the direction calls for developing sources for weed-free mulch to use in erosion control and revegetation work. The revised direction requires that projects with the potential to contribute to the spread or establishment of NNIS include mitigation measures to reduce the risk, and it calls for including language in special use permits

to reduce the risk of NNIS invasion and spread. Other direction describes general items to consider when developing site-specific NNIS management strategies.

Effects Common to All Alternatives

All of the action alternatives are subject to plan direction that calls for reducing the risk of NNIS invasion and spread on all projects. Thus the NNIS risks discussed below probably are somewhat greater under Alternative 1 (no action) than under the action alternatives. However, the risks cannot be completely eliminated under any alternative.

Mineral Exploration, Development, and Leasing

Natural gas leasing is the most common form of mineral development on the Forest. Typically it disturbs only minor amounts of land in any given area, but the roads, pipelines, and clearings associated with gas production present an opportunity for NNIS invasion and spread. Because the NNIS indicator focuses on timber harvest operations, it does not measure the increased risk due to gas development. However, evaluation of the typical disturbance associated with gas wells gives some idea of the potential risk. Maximum gas well density in areas that are developed typically is about one well per square mile. An estimated 15.5 acres of clearing are associated with each gas well, most of which constitutes pipeline clearing. Because pipelines are linear features, they can provide travel corridors for NNIS plants. However, monitoring on the Forest has shown that typical pipeline corridors are narrow, and the tree canopy usually closes over them three to five years following disturbance. Therefore, shade-intolerant NNIS have a very short window of opportunity to invade along gas pipeline corridors. After canopy closure over the pipeline, a typical operation involves approximately two acres of well-site clearing and two acres of access road that remain open. If shade tolerant NNIS become established in any of the disturbed areas, they may invade surrounding forested areas.

Development of other federal minerals currently is rare on the Forest, but such development could occur in the future under any of the plan alternatives. Effects from development of minerals other than gas are difficult to predict because they vary depending on the mineral being developed, recovery methods (subsurface vs. surface mining), the intensity of surface disturbance, and the effectiveness of reclamation. However, any mineral development activity is likely to involve at least some ground disturbance that will increase the risk of NNIS invasion and spread. The level of risk will increase in proportion to the amount of the disturbance.

Vegetation/Timber Management – Mechanical Treatments

The primary risk of NNIS invasion and spread from mechanical vegetation management is associated with the roads that are necessary for access. The effects due to timber harvest access roads will be analyzed by alternative later in this chapter.

Other aspects of mechanical vegetation management that affect NNIS risk include log landings, skid trails, and the openings that result from even-aged regeneration cuts. All of these features provide possible invasion points for NNIS that prefer full sun or partial shade, and they may allow previously established NNIS to spread. Log landings, skid trails, and harvest areas may be

traversed by mechanical equipment that can spread NNIS seeds or plant parts. The tree canopy will eventually close over all of these openings, which will limit further invasion and spread of shade-intolerant NNIS. However, if shade-tolerant NNIS become established, they may persist and invade the surrounding forest.

Vegetation/Timber Management – Salvage Harvest

Effects due to salvage harvest are similar to those from other forms of vegetation management. However, if harvest activities facilitate NNIS invasion, salvage areas have the added risk of being open due to prior natural disturbance. Therefore, larger areas may be at risk of invasion by shade-intolerant NNIS. The extent and intensity of effects due to salvage harvesting is impossible to predict because the amount of salvage harvesting is dependent on unpredictable natural disturbances.

Range Management – Livestock Grazing

Range allotments are particularly vulnerable to NNIS invasion and spread. Because they are maintained in a permanently open state, they are always at risk of invasion by shade-intolerant NNIS. Also, hay, livestock feed, manure, and agricultural vehicles and equipment can facilitate entry by NNIS seeds and plant parts. However, range management is not expected to expand in the foreseeable future. Acreage devoted to range allotments has been declining slowly over several decades, and the revised Forest-wide management direction calls for maintenance of existing grazing capacity. Based on current trends and the revised management direction emphasis, new allotments likely would be limited to newly acquired lands that contain pastures. Therefore, range management is not likely to create any new disturbed areas that would be vulnerable to NNIS invasion and spread. If the decline in range acreage continues, some range land would be replaced by forested habitat, which could reduce the risk of NNIS invasion and spread.

Fire Management – Fire Suppression

Fire suppression activities cause ground disturbances (e.g., fire lines), which can serve as invasion pathways for NNIS. This invasion risk would be managed by prompt rehabilitation of disturbed areas using non-invasive plants, generally local native species when they are available and practical to use. Fire suppression in fire-maintained landscapes has the potential to worsen invasion and spread of fire-sensitive NNIS. However, fire suppression can also prevent catastrophic disturbance by wildfire, which potentially can open up large areas to NNIS invasion and spread. The extent and intensity of these effects is difficult to predict because of the unpredictability of wildfires.

Fire Management – Prescribed Fire Use

Like fire suppression, prescribed fire use involves ground-disturbing fire lines that can act as NNIS invasion pathways. Prescribed fire can inhibit the invasion and spread of fire-sensitive NNIS, but it can also expose soil to potential new invasions of opportunistic NNIS. An objective in the 2006 Forest Plan direction calls for using prescribed fire on 10,000 to 30,000 acres over

the next decade, but the degree of increased or decreased risk of NNIS invasion and spread within that area depends on site-specific factors that cannot be quantified accurately through a Forest-wide analysis.

Roads – Construction, Reconstruction, Maintenance, and Decommissioning

Roads constitute one of the major pathways for NNIS invasion and spread, which is why the NNIS indicator focuses on timber management that requires the construction of new roads. Risks due to road construction and reconstruction differ by alternative and are discussed later in this chapter. Road maintenance perpetuates roads as potential invasion corridors, and the equipment used to maintain roads can spread NNIS seeds and plant parts.

Road decommissioning, which is not reflected in the indicator that is analyzed later in the chapter, can reduce NNIS invasion risk by eliminating roads as potential invasion corridors. Road decommissioning also has the potential to control or eliminate established NNIS occurrences along existing roads. However, if road decommissioning involves seeding, mulching, and use of heavy equipment, NNIS seeds and plant parts could be introduced. Shade-intolerant NNIS would persist only until the tree canopy closes, but shade-tolerant NNIS could persist longer and spread into surrounding forested areas.

Recreation – Developed Recreation

Developed recreation sites create a risk of NNIS invasion and spread wherever they disturb ground. Developed facilities also attract large numbers of visitors, who can spread NNIS seeds or plant parts on their vehicles, pets, and clothing. However, developed recreation sites are expected to cover a small fraction of National Forest System land under all alternatives. The main risk of NNIS invasion and spread due to developed recreation probably would be limited to the vicinity of these sites, and therefore is not likely to affect a substantial portion of the Forest.

Recreation – Dispersed Recreation

Facilities associated with dispersed recreation (e.g., foot bridges, pit toilets) do not disturb much land, so they have very limited potential for facilitating invasion and spread of shade-intolerant NNIS. In contrast, trails through forested areas can serve as dispersal corridors and establishment sites for shade-tolerant NNIS, potentially affecting large areas of land. Seeds and plant parts can be transported along these trails by hiking boots, bicycles, horses, and pets. However, 2006 Plan direction gives priority to maintenance of existing trails over construction of new trails, and the current trail system has been difficult for the Forest to maintain in recent years. If this trend continues, substantial new trail construction is not likely, and the potential for NNIS spread due to dispersed recreation would be limited mostly to existing trails.

Recreation – Motorized Recreation Use

Effects associated with motorized recreation are largely due to the roads that are necessary to facilitate motorized access. Because roads are rarely constructed solely for motorized recreational use, motorized recreation is likely to occur on roads that would have been

constructed anyway for management access reasons. Effects due to roads are analyzed by alternative later in this analysis.

Although motorized recreational use likely will not require much road construction beyond that needed for management access, motorized recreation use could increase the risk of NNIS invasion and spread beyond the risk associated with management-related use of the roads. Motorized recreational use could increase the number of vehicles using the roads, which increases the chances of spreading NNIS seeds and plant parts. Also, public vehicles would not be subject to any inspection or cleaning prior to entering NFS land, so there is no opportunity to mitigate the potential for spread. MP 3.0, which emphasizes motorized recreation, would have the highest potential for NNIS invasion and spread due to public vehicles.

Soil, Water, Riparian, Aquatic – Active Restoration

Active soil, water, riparian, and aquatic restoration has the potential to spread NNIS through the use of contaminated mulch or seeds in revegetation activities, although direction to use weed-free seed and favor native species would lessen this risk. However, active restoration is likely to affect a very small fraction of National Forest System land, so the potential for spread is likely to be minor. Active restoration could contribute to the control of NNIS by reforesting disturbed areas that might otherwise be vulnerable to NNIS invasion and spread.

Soil, Water, Riparian, Aquatic – Passive Restoration

Passive soil, water, riparian, and aquatic restoration generally does not involve use of seeds or mulch, so it has no potential to contribute to NNIS invasion and spread. Passive restoration that involves reforestation could help control NNIS by restoring areas that might otherwise be vulnerable to NNIS, although reforestation would likely be an exception rather than the rule.

Wildlife/Fish Habitat Restoration

Construction of new wildlife openings and savannas creates new areas of disturbed ground that are vulnerable to NNIS infestation. Seed and mulch used to establish vegetation on new openings can introduce NNIS seeds and plant parts, although plan direction requiring noxious weed-free seed would limit this risk to some extent. Tractors and brush hogs used to maintain openings can spread NNIS seed and plant parts from one opening to others. Shade-intolerant NNIS likely would be limited to the openings and immediately adjacent edge, but any shade-tolerant NNIS that become established in the openings could subsequently invade surrounding forested areas. The MPs that include new wildlife openings in the desired condition (2.0, 3.0, 4.0, 4.1, and 6.1) call for three to eight percent of the landscape in openings. For shade-intolerant NNIS, this would represent the maximum potential area that could become infested. Shade-tolerant NNIS, however, could spread beyond the openings, and the area that potentially could be affected is difficult to predict. Differences in wildlife openings by alternative are discussed later in this analysis.

Forested habitat restoration that reforests open areas has the potential to reduce establishment opportunities for NNIS plants. However, if it involves seeding, mulch, or use of mechanical

equipment, it could introduce NNIS seeds or plant parts to the site. Any shade-intolerant NNIS would persist only until the forest canopy closes, but shade-tolerant NNIS could persist beyond canopy closure and invade surrounding forest. Restoration of habitat structure in forested areas also has the potential to introduce NNIS through the same pathways, although the vulnerability to shade-intolerant NNIS is lower. Thus, forested wildlife habitat restoration has the potential to reduce NNIS risk in some ways and raise it in other ways; the degree to which these two effects cancel each other out is difficult to predict.

Direct and Indirect Effects by Alternative

Amount of Timber Harvest 3/8 of a Mile or More from Currently Existing Roads

Acreage of timber harvest more than 3/8 of a mile from a currently existing road is projected to rise gradually during the planning horizon under all alternatives (Figure IS-1). Alternatives 1, 2, 2M, and 3 show a similar pattern of increasing acreage through the ninth or tenth decades, whereas acreage peaks under Alternative 4 in the sixth decade, with a generally declining trend thereafter. All alternatives show a fluctuating pattern within the overall trend. The generally increasing trend over time is driven by the model's objective to maximize value. Other factors being equal, one of the ways the model maximizes value is to harvest first in stands with the lowest costs, which generally means stands closest to existing roads. The pattern of harvesting in accessible stands first matches past management well, and it is reasonable to assume that the pattern will continue in the future. However, if resource issues that are not reflected in the model drive harvesting in less accessible areas early in the planning horizon, this indicator could understate the level of harvesting in less accessible areas in the early decades and overstate it in the later decades.

Despite the similar pattern across all alternatives, the amount of projected timber harvest more than 3/8 of a mile from an existing road does differ across alternatives (Figure IS-1). Alternative 1 has the highest amount in most decades, peaking at about 44,000 acres in the ninth decade. Alternative 3 has the lowest amount in most decades, with a peak of about 31,000 acres in the ninth decade. Under Alternatives 2 and 2M, the amount reaches its highest point of about 40,000 acres in the tenth decade, whereas Alternative 4 peaks at about 37,000 acres in the sixth decade. When the indicator is summed across the 10-decade planning horizon, Alternative 1 has a little more than 310,000 acres harvested beyond 3/8 of a mile from a currently existing road, which is the most of any alternative (Figure IS-2). Alternative 3 has the least, estimated at just over 180,000 acres. Alternatives 2, 2M, and 4 are intermediate at around 250,000 acres. According to this indicator, Alternative 1 would have the highest risk of facilitating the invasion and spread of NNIS plants, Alternatives 2, 2M, and 4 would have intermediate risk, and Alternative 3 would have the lowest risk.

It should be emphasized that this indicator only represents the amount of harvested land that is not near an existing road. It does not account for potential future decommissioning of roads, nor does it account for the possibility that harvests in later decades of the planning horizon may occur near roads that are built in the early decades of the planning horizon. Road decommissioning decisions are made as part of project-level analyses, so the extent of potential road decommissioning could not be predicted as part of this analysis. Therefore, this indicator

should not be interpreted as a literal estimate of the amount of land that is susceptible to NNIS invasions and spread. Rather, it is merely a tool for comparing the relative risks of the alternatives.

Figure IS-1.

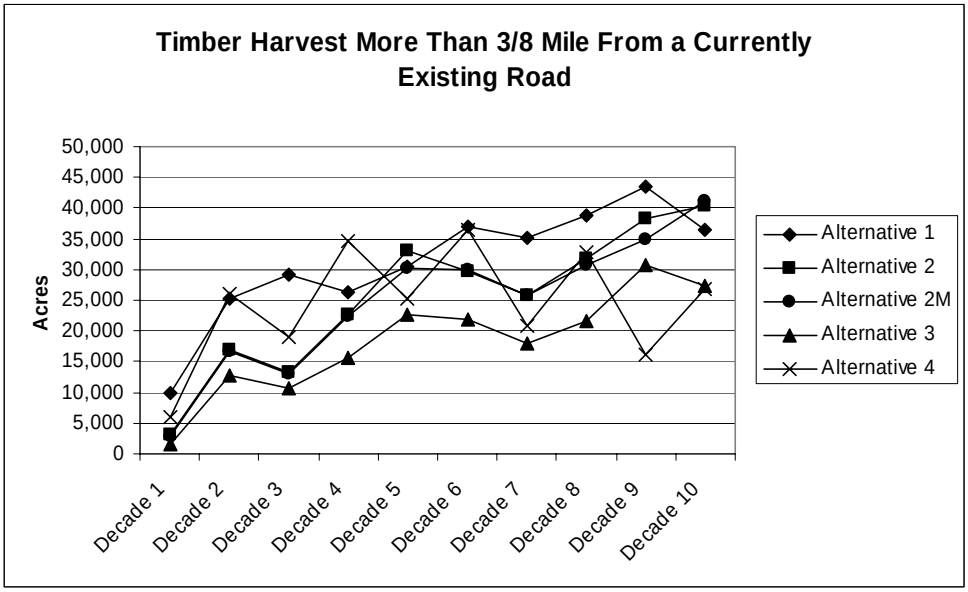
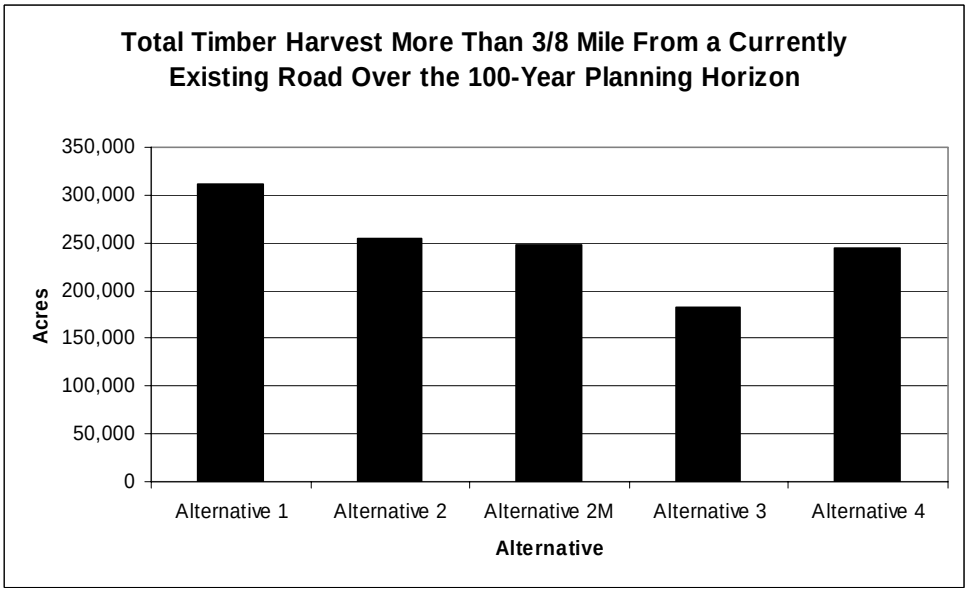


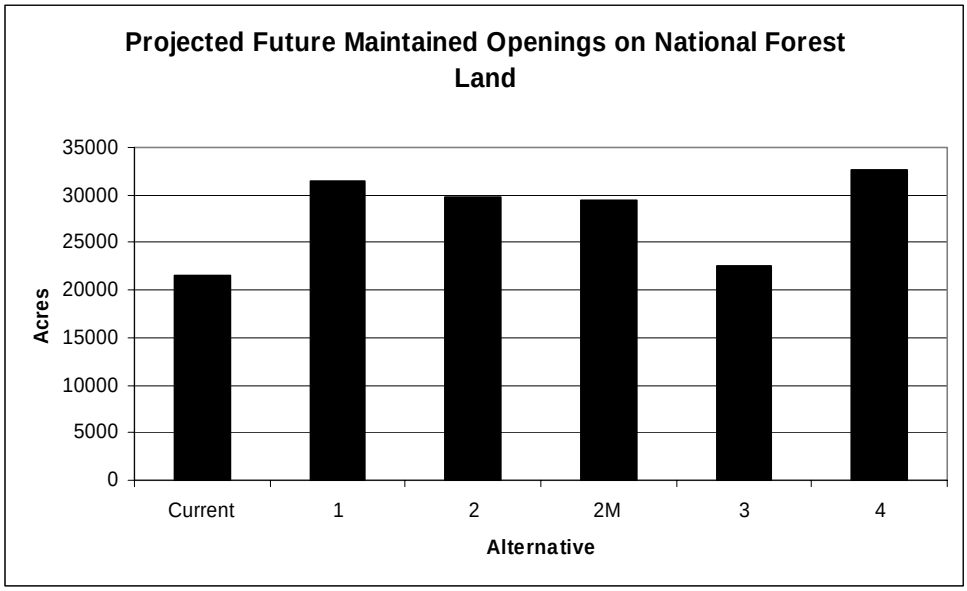
Figure IS-2.



Amount of Maintained Openings

The projected future amount of maintained openings differs across alternatives approximately in proportion to allocation of land to the suitable base MPs that have goals for creating and maintaining openings (Figure IS-3). Alternatives 1, 2, 2M, and 4 all have 30,000 to 33,000 acres of maintained openings, whereas Alternative 3 has about 23,000 acres. The projected future amounts under Alternatives 1, 2, 2M, and 4 all represent a noticeable increase from the current estimate of 22,000 acres. Based on this indicator, Alternatives 1, 2, 2M, and 4 would have a higher risk of facilitating invasion and spread of NNIS plants than Alternative 3.

Figure IS-3.



Cumulative Effects

The primary activities on non-NFS land that can facilitate NNIS invasion and spread include farming, timber harvest, mining, oil and gas development, residential development, and road/highway construction. Currently, there is far more open land on non-NFS land than on NFS land (about 72,000 acres versus 21,000 acres on NFS land, see *Terrestrial Ecosystem Diversity* section in this chapter). These openings on private land are mostly pasture and hay fields, which may have a high potential for invasion by NNIS due to recurrent disturbance, frequent farm equipment use, and livestock grazing. Based on data from the Census of Agriculture (USDA 2004, USDA 1999), the recent trend in hay and pasture land acreage has been flat in the counties that contain the Forest. If these trends continue, the risk associated with agricultural activities would be primarily that of invasions and spread on existing open land, rather than opening new land to invasions. Total area of herbaceous openings on NFS land is projected to range from 23,000 acres under Alternative 3 to 33,000 acres under Alternative 4. Assuming the amount of openings on non-NFS land stays similar to current amounts, the total amount of openings within

the Forest boundary will range from about 95,000 acres (Alternative 3) to about 105,000 acres (Alternative 4) (Figure IS-4). This represents a 2 to 13 percent increase from the current amount. Thus, the Forest Service contribution to cumulative NNIS invasion potential in new open areas ranges from trivial under Alternative 3 to small, but not negligible, under Alternative 4. Due to protective measures that are likely to be implemented on NFS land, the Forest Service contribution to actual NNIS invasion risk should be less than the Forest Service proportion of the total acreage.

Cumulative NNIS invasion risk due to activities that do not involve maintained openings is much more difficult to predict. Timber harvest, mining, and oil and gas development are likely to occur on private lands, but the amount of these activities will depend on commodity prices, land owner economic needs, and the relative value of land for other uses such as residential development and real estate speculation. Such other land uses pose their own risks of NNIS invasion, particularly residential development, which involves access road construction, lawns, seeding, mulching, and use of ornamental plants that may have the potential to escape cultivation. Because most private land owners ultimately need to get some sort of economic return from their land, private land in general is expected to be more intensively used for a variety of activities than is NFS land. Therefore, it is likely that the bulk of the cumulative NNIS invasion risk within the Forest boundary will be due to activities on private land; however, Forest Service activities will contribute to this risk in ways that cannot be expressed proportional to the risk from private activities.

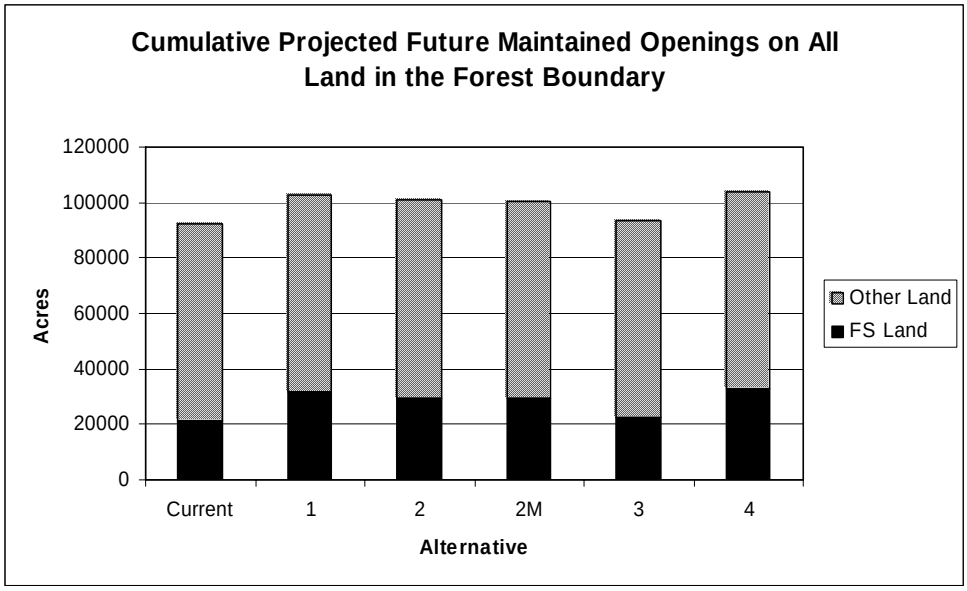



Figure IS-4.