3.3.7 Non-native Invasive Species

Issue Statement – Non-native Invasive Species (Indicator 24)

There is a need to evaluate current management direction for non-native invasive species (NNIS). NNIS, which include aquatic and terrestrial animals and plants, have the potential to cause a variety of negative impacts to terrestrial and aquatic ecosystems on the Forests. However, the current Forest Plans do not specifically address NNIS as an issue. Forest Plan revision may change the management direction for NNIS.

Indicator – Miles of New Maintenance Level 1 Roads and Temporary Roads

This indicator is a surrogate for acreage of terrestrial non-native invasive plants. Although infestations of such species occur along utility right-of-ways, trails, and other disturbance corridors, this indicator is useful for distinguishing among alternatives because currently the vast majority of terrestrial non-native invasive plant impacts are along roads. Since miles of maintenance level 2, 3, 4, and 5 roads will likely be the same in all alternatives, the difference among alternatives will be in miles of maintenance level 1 roads and temporary roads needed for forest management activities.

This indicator is also a surrogate for acreage of lands infested by earthworms. This indicator is useful for distinguishing among alternatives because there is a significant correlation between the presence of exotic earthworms and the presence of roads (Holdsworth et al. 2003). Earthworms can be spread by moving dirt infested with adults or their eggs. For the reasons stated above, the alternatives will be compared by miles of maintenance level 1 roads and temporary roads.

Indicator – Water Access

This indicator is a surrogate for the risk of spread of non-native invasive aquatic plants and animals and for one terrestrial species, non-native earthworms. These NNIS are frequently spread when they are carried intentionally or unintentionally from one body of water to another by recreationists. They may be transported on boats, recreational equipment, and personal gear. There is a significant correlation between the presence of exotic earthworms and the presence of boat landings (Holdsworth et al. 2003). The rate of spread of aquatic NNIS or earthworms would be proportional to the amount of recreational water use, which would be reflected among alternatives by the amount of water access.

Analysis Area

The area covered by the analysis of direct and indirect effects includes all lands administered by the Chippewa and Superior National Forests. The area covered by the cumulative effects analysis for the Chippewa is land of all ownerships within the Drift and Lake Plains Section, and land of all ownerships within the Northern Superior Uplands for the Superior.

Table NIS-1. Non-native invasive species known on Chippewa and Superior National Forests

Species	Forest	Life History/Habitat Summary	Ecological Risk*
ANIMALS			
Rusty crayfish, *Orconectes rusticus*	CNF SNF	Lives 3-4 years; eats aquatic plants, invertebrates, fish eggs, small fish; occupies many aquatic habitats (Gunderson 2003)	High
Earthworms Lumbricidae	CNF SNF	Detritivores that eat dead plant material and fungi; occupy variety of terrestrial habitats	High
PLANTS			
Goutweed *Aegopodium podagraria*	SNF	Perennial herb; spread by seed and rhizome; disturbed uplands (Voss 1985)	Low
Common ragweed** *Ambrosia artemisiifolia*	CNF	Annual herb; spread by seed; disturbed uplands (Whitson et al. 2001)	Low
Garlic mustard *Alliaria officinalis*	CNF	Biennial; spread by seed; upland forests (Rowe and Swearingen 1997)	High
Burdock *Arctium minus*	CNF	Perennial; spread by seed; occupies disturbed sites (Gleason and Cronquist 1963)	Low
Wormwood *Artemisia absinthium*	CNF	Perennial herb; spread by seed; disturbed uplands (Gleason and Cronquist 1963)	Low
Hoary alyssum *Berteroa incana*	CNF	Annual herb; spread by seed; disturbed uplands (Gleason and Cronquist 1963)	Low
Hemp, *Cannabis sativa*	CNF	Herb; spread by seed (Gleason and Cronquist 1963)	Low
Plumeless thistle *Carduus acanthoides*	CNF	Annual or biennial; spread by seed; occupies disturbed upland sites (Lym and Christianson 1996)	Moderate
Field sandbur** *Cenchrus longispinus*	CNF	Annual grass; spread by seed; disturbed uplands (Whitson et al. 2001)	Low
Spotted knapweed *Centaurea biebersteinii* (=*maculosa*)	CNF SNF	Short lived perennial, spread entirely by seeds, dry to mesic uplands (Wilson and Randall 2002)	High
Canada thistle *Cirsium arvense*	CNF SNF	Perennial, spread by seed and rhizome, occupies disturbed sites (Lym and Christianson 1996)	Moderate
Bull thistle *Cirsium vulgare*	CNF SNF	Biennial, spread by seed, occupies disturbed sites (Lym and Christianson 1996)	Low
Field bindweed *Convolvulus arvensis*	CNF	Perennial vine; spread by seed; disturbed uplands (Voss 1996)	Low
Cypress spurge *Euphorbia cyparissias*	SNF	Perennial herb; spread by seed and rhizome; disturbed uplands (Voss 1985)	Low
Leafy spurge *Euphorbia esula*	CNF SNF	Aggressive perennial, spread by seed and rhizome, dry to mesic uplands (Lym and Zollinger 1995)	High
Orange hawkweed *Hieracium auranticum*	CNF SNF	Perennial, spread by seed and rhizome, widespread in disturbed upland sites (Callihan et al. 1982)	Low
King-devil hawkweed *Hieracium piloselloides*	SNF	Perennial, spread by seed and rhizome, widespread in disturbed upland sites (Gleason and Cronquist 1963)	Low
St. Johnswort *Hypericum perforatum*	SNF	Perennial, spread by seed and rhizome, dry to mesic uplands (Fitzsimmons and Burrill 1993)	Low
Oxeye daisy *Leucanthemum vulgare*	CNF SNF	Perennial, spread by seed and rhizome, widespread in disturbed upland sites (Gleason and Cronquist 1963)	Low
White campion *Lychnis alba*	CNF	Annual or perennial; spread by seed; disturbed uplands (Gleason and Cronquist 1963)	Low
Purple loosestrife *Lythrum salicaria*	CNF SNF	Aggressive perennial; spread by seed and rhizome; wetlands and road ditches (MNDNR 1998)	High

Table NIS-1. Non-native invasive species known on Chippewa and Superior National Forests - *continued*

Species	Forest	Life History/Habitat Summary	Ecological Risk*
Curlyleaf pondweed *Potamogeton crispus*	CNF	Perennial floating-leaved aquatic; ponds and lakes (MNDNR 1999)	High
Tall buttercup *Ranunculus acris*	CNF	Perennial; spread by seed; disturbed uplands (Gleason and Cronquist 1963)	Low
Common buckthorn *Rhamnus cathartica*	CNF SNF	Perennial shrub to 20 ft., spread by seed; woodland understories (MNDA 1998)	Moderate
Perennial sowthistle *Sonchus arvensis*	CNF	Perennial; spread by seed; disturbed uplands (Voss 1996)	Low
Common tansy *Tanacetum vulgare*	CNF SNF	Perennial; spread by seed and rhizome; disturbed uplands (Voss 1996)	Low
Poison ivy** *Toxicodendron radicans*	CNF	Perennial vine; variety of upland habitats (Gleason and Cronquist 1963)	Insignificant

Source: Project file or reference cited above
*Species represents either an insignificant, low, moderate, or high threat to natural communities.
**Native species considered in this analysis because they are listed by the state as noxious weeds.

3.3.7.a Affected Environment for Non-native Invasive Species

Miles of New Maintenance Level 1 Roads and Temporary Roads

Prior to European settlement, non-native invasive earthworms and plants were not a problem in the analysis area. Earthworms did not exist in the portions of North America that were glaciated during the last Ice Age (Gundale 2002), and native plants dominated the landscape. Disturbance processes occurred at a variety of temporal and spatial scales, and these disturbances created a range of early seral habitats. In habitats with exposed mineral soil (such as flood-deposited sediments or areas burned down to mineral soil), native plant species adapted to early successional habitats (for example, fireweed [*Epilobium angustifolium*]) would colonize, and they would flourish until being replaced by later successional plants.

Since the time of European settlement non-native invasive plants and earthworms have been introduced into the analysis area, both intentionally and unintentionally. Because they lack pathogens and predators, some such plants have become persistent, aggressive invaders of disturbed habitats and native plant communities. They may become the dominant component of vegetation, thus reducing native plant diversity and impacting wildlife habitat. Furthermore, ecological disturbance regimes have changed since European settlement. Some of these disturbances, such as roads, are kept permanently in an early seral state, and thus provide excellent habitat for non-native invasive plants. Likewise, the introduction of earthworms into areas that had been earthworm-free has resulted in impacts to soils and soil processes (University of Minnesota Duluth 2003, Hendrix and Bohlen 2002), and vegetation (for example, Holdsworth et al. 2003, Hale et al. 2000), including TES plants (Gundale 2002).

Preliminary estimates for non-native invasive plant acreage on the Forests are 800 acres for the Chippewa and 1850 acres for the Superior (USDA Forest Service 2003a); however, no systematic Forest-wide inventory has been completed. The vast majority of non-native invasive plant populations on both Forests occur on roadsides. Other areas where such plants occur are gravel pits, powerline corridors, parking areas, campsites, trails, and portages. Few non-native invasive plants, either terrestrial or aquatic, occur in undisturbed native plant communities, although this could be changing with populations of purple loosestrife or the recent discovery of garlic mustard on the Chippewa. The acreage infested with earthworms is also poorly known on both Forests. A Forest-wide inventory on the Chippewa in 1999 showed that approximately 45% of the sampled plots had earthworms (USDA Forest Service 2002b); no comparable data exists for the Superior.

Terrestrial non-native invasive species currently known from the Forests are displayed in Table NIS-1. The ecological risk (USDA Forest Service 2002a) that these species pose is also summarized in Table NIS-1. Garlic mustard, spotted knapweed, leafy spurge, purple loosestrife, and earthworms are the biggest ecological threats to native plant communities.

To analyze the potential effects of Forest Plan alternatives on terrestrial non-native invasive plants and earthworms, the projected miles of new maintenance level 1 roads and temporary roads were compared by alternative (see Appendix F for road mileages). The projected miles of roads indicate the scale of terrestrial NNIS infestation that would be expected by alternative; however, the actual acreage of terrestrial NNIS infestation would probably be much less. The time scale for this analysis is 10 years and 100 years from the beginning of forest plan implementation.

Indicator – Water Access

Much of the above discussion comparing the pre- and post-European settlement condition of terrestrial non-native invasive plants and animals applies to aquatic non-native invasive plants and animals as well. Currently, three aquatic NNIS (purple loosestrife, curlyleaf pondweed, and rusty crayfish) are known from the Forests (Table NIS-1). The introduction of purple loosestrife and curlyleaf pondweed on the Forests is impacting native plant diversity, waterfowl habitat, and has the potential for impacting hydrologic processes in wetlands. Similarly, the introduction of rusty crayfish on the Superior has the potential to impact native crayfishes, aquatic food webs, and aquatic vegetation (USDA Forest Service 2003b).

On the Superior, rusty crayfish currently are known from 18 lakes, based on anecdotal observations from MNDNR and from inventory results (USDA Forest Service 2003b); about half of these lakes border or are within the BWCAW. On the Chippewa, rusty crayfish are currently known from 14 waterbodies, based on anecdotal observations from MNDNR and Forest Service inventory results. In lakes where this species is present, it is abundant relative to native crayfish numbers, or it is the only species present (USDA Forest Service 2003b).

Purple loosestrife is currently known from over a dozen occurrences on each the Superior and Chippewa. Most of these occurrences are either wet roadside ditches or wetlands. Curlyleaf pondweed is currently known from one waterbody on the Chippewa.

To analyze the potential effects of Forest Plan alternatives on aquatic NNIS and earthworms, the level of water access was compared by alternative (see DEIS section 3.8.4 for water access descriptions).

Other aquatic and terrestrial NNIS, such as Eurasian watermilfoil, zebra mussel, spiny waterflea, curlyleaf pondweed (on the Superior), and garlic mustard (on the Superior), are not currently known within Forest boundaries. The following analysis applies both to NNIS present on the Forests and to the risk of new invaders.

3.3.7.b Environmental Consequences for Non-native Invasive Species

Effects Common to All Alternatives

Resource Protection Methods

Numerous federal and state laws, regulations, and policies provide direction for integrated pest management on lands administered by the Forest Service. Some of the more important ones include: the federal Noxious Weed Act of 1974, the Forest Service Noxious Weed Strategy of 1996, Forest Service Manual 2080, Executive Order 13112 from February 1999, the federal Plant Protection Act of 2000, the National Invasive Species Management Plan of 2001, Minnesota Statutes chapter 84D (harmful exotic species) and sections 18.75 to 18.88 (noxious weeds).

General Effects Common to All Alternatives

An NNIS strategy based on integrated pest management would be developed under all the alternatives. Such a strategy would emphasize prevention and education, and would include a means for prioritizing management.

Under all alternatives, NNIS occurrences would be monitored to help form short and long-term management plans and to help detect and respond to changing infestation patterns.

Non-native invasive species would continue to spread on both Forests. As they spread, they would continue to have negative impacts to the ecosystems where they are found. These potential impacts include: displacing native flora and fauna, changing the structure of native terrestrial and aquatic plant communities, disrupting aquatic food webs, disrupting hydrologic processes of wetlands, increasing erosion, impacting recreational use of lakes and rivers, and altering soils and soil processes. Infestations of non-native invasive species would continue to exist at various densities and population sizes.

Direct and Indirect Effects

Miles of New Maintenance Level 1 Roads and Temporary Roads

The direct effect of all alternatives would be the increased dispersal of terrestrial non-native invasive plants and earthworms into uninfested habitat. The indirect effect of all alternatives would be creation of suitable habitats into which non-native invasive species could spread. Many different types of activities could create suitable habitat and disperse non-native invasive plants and earthworms. For example, construction and use of new motorized trails for ATVs, as well as cross-country ATV travel, would contribute to the spread of terrestrial NNIS. However, the activity that would account for the majority of non-native invasive plant and earthworm spread would be road construction.

Appendix F shows the miles of new maintenance level 1 roads and temporary roads that are projected to be constructed by alternative within the next one hundred years. The level of non-native invasive plant and earthworm infestation would be proportional to the amount of road constructed. On the Superior in the next ten years, the greatest amounts of NNIS spread would be expected in Alternatives A and C, with intermediate amounts in Alternatives Modified E, F, and G, and the least spread in Alternatives B and D. On the Superior in the next 100 years, the greatest amounts of NNIS spread would be expected in Alternatives A, C, and Modified E, with intermediate amounts of spread in Alternatives B, F, and G, and the least amount in Alternative D. On the Chippewa in the next ten years, the greatest amount of NNIS spread would be expected in Alternatives A and C, with intermediate amounts in Alternatives Modified E and G, and the least spread in Alternatives B, D, and F. On the Chippewa in the next one hundred years, the greatest amounts of NNIS spread would be expected in Alternative C, with intermediate amounts in Alternatives A, B, Modified E, F, and G, and the least spread in Alternative D.

The mileages in Appendix F represent an overestimation of the effects of the alternatives on terrestrial non-native invasive plants and earthworms. Not every species would infest every mile of roadside, and some species, like oxeye daisy and orange hawkweed, would continue to be much more common than other species, like common buckthorn. Infestations would be less likely on winter roads than on summer roads. Furthermore, forest succession and closing of the forest canopy over temporary roads would probably help limit the spread of non-native invasive plant species, many of which need high light levels to thrive. Implementation of Forest Plan guidelines for NNIS would also help minimize spread of these species.

Another factor that would help to offset the spread of NNIS would be designation of potential wilderness. Designating land as wilderness would create a block of land that would be less susceptible to NNIS because no road construction would be occurring in wilderness, and there would be less human-caused disturbance in land designated as wilderness. However, the magnitude of the effect would be small. On the Chippewa, in Alternatives B and D, which would designate the most wilderness, only 0.9% of lands would be affected. Alternative G would designate a smaller amount of wilderness, followed by

Alternatives A, C, Modified E, and F, which would not experience any reduction in NNIS spread due to wilderness designation because no wilderness is allocated in these alternatives. On the Superior in Alternative D, which would designate the most wilderness, 2.7% of lands would be affected by wilderness designation. Alternative D would have the greatest benefit in the reduction of NNIS spread caused by wilderness designation, followed by Alternative B, and then G. Alternatives A, C, Modified E, and F would not experience any reduction in NNIS spread due to wilderness designation because no wilderness is allocated in these alternatives.

Monitoring of temporary and system roads on the Forests would take place every year. As new occurrences of NNIS are found, integrated pest management actions would be triggered; such actions would be designed to eradicate, suppress, contain, or tolerate new populations, as appropriate.

Water Access

The direct effect of all alternatives would be the continued spread of earthworms and the aquatic NNIS by recreational water use. The indirect effect of all the alternatives would be the creation of suitable opportunities for invasion of NNIS. On the Superior and Chippewa, the amount of NNIS spread would be proportional to the level of water access in each alternative. For both Forests, aquatic NNIS and earthworm spread would be highest for Alternatives A, C, and Modified E, intermediate for Alternatives F and G, and lowest for Alternatives B and D. For NNIS not yet known on the Forests, such as Eurasian watermilfoil, the risk of introduction would be similar to the amount of NNIS spread as described above.

The risk of spread of aquatic NNIS and earthworms via water access would be minimized through implementation of Forest Plan guidelines for NNIS prevention and by on-going education efforts designed to raise recreationists' awareness of NNIS.

Cumulative Effects

The cumulative effects of the Forest Plan alternatives on NNIS would not differ much from the direct and indirect effects. For both the Chippewa and Superior National Forests, past actions influenced the composition and distribution of NNIS in the respective cumulative effects analysis areas. For example, development of a transportation system (such as roads and railroads) provided corridors for the introduction and spread of these species. Mixed land ownership patterns on both Forests have also contributed to development of the transportation system and NNIS spread. Some non-native invasive plant species, like leafy spurge, were brought in unintentionally; other species, like purple loosestrife, were intentionally introduced. Some types of land use in the analysis areas, particularly agriculture, are the frequent albeit inadvertent cause of non-native invasive plant introductions and spread. Cumulatively, these past actions influenced the present composition and distribution of these species in the analysis areas.

NNIS would continue to spread in the analysis areas under all alternatives as a result of present and reasonably foreseeable actions on Forest Service and non-Forest Service lands. The effects of NNIS would continue to be concentrated in developed areas (for example, roadsides, gravel pits) and not undeveloped forestlands. Miles of road increased by 140 miles annually in Minnesota from 1989 to 1999 (MN FRC 1999c), and if this trend continues in the analysis areas, it would contribute to the spread of terrestrial NNIS. Other ongoing land uses in the analysis areas, such as agriculture and timber harvest, would also contribute to the spread of these species, as would recreation.

Timber harvest and road building on non-Forest Service lands would probably increase in Alternatives B and D in response to lowered harvest levels on NFS land. Increased timber harvest and road building activities could lead to increased NNIS spread on non-Forest Service lands, which could in turn lead to NNIS spread onto adjacent Forest Service lands. This effect would probably be less pronounced in Alternatives Modified E, F, and G which have intermediate harvest levels, and the effect would probably be insignificant for Alternative A and C, which have higher harvest levels on Forest Service lands. The net results of considering cumulative impacts would be more overall NNIS spread in Alternatives B and D than when the direct and indirect effects are considered alone, and slightly greater NNIS spread in Alternatives Modified E, F, and G, but little overall increase in NNIS spread

for Alternatives A and C. In summary, Alternatives A, C, and Modified E would have the greatest effects on NNIS, followed by Alternative F and G, which would have intermediate effects. Alternatives B and D would have the least effects on NNIS. This pattern of effects is the same for both Forests.

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