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Environmental Assessment

White Mountain National Forest Forest-wide Invasive Plant Control Project

White Mountain National Forest

Coos, Grafton, and Carroll Counties in New Hampshire

Oxford County in Maine

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Japanese Knotweed along Rt. 3 in Franconia, NH

White Mountain National Forest
Non-Native Invasive Plant Control Project
- Foreword -

The Environmental Assessment that follows is a result of a proposal to implement a 10-year Forest-wide, non-native invasive plant species (NNIS) eradication and control project on the White Mountain National Forest. We are proposing this project in order to achieve the NNIS goals and objectives described in the *White Mountain National Forest Land and Resource Management Plan* (Forest Plan). The need to perform this project was determined by comparing the current condition on the Forest with the desired future condition of the Forest as well as the goals and objectives contained in the Forest Plan.

As a result of an initial public scoping period carried out in April and May of 2006 and an interdisciplinary team review of the project's objectives, the team developed three alternatives to study in detail and determine the potential environmental consequences that would result from implementing each alternative. Potential issues were also developed from the public scoping and the interdisciplinary team's input and were also used in developing the alternatives. The potential issues were combined into one issue statement – *the Forest should not use herbicides*. Briefly stated, the alternatives are:

<u>Alternative 1 (No Action)</u> – new NNIS control projects would not be implemented. Designed as a basis of comparison for the remaining two action alternatives.

<u>Alternative 2 (Proposed Action)</u> – the Forest would implement an integrated NNIS control project over the next 10 years to control both existing and new infestations. Mechanical, chemical (herbicide) and biological (purple loosestrife beetles) control techniques would be used that conform to applicable federal and state laws and regulations as well as a set of protocols developed for this project.

<u>Alternative 3 (Mechanical and Biological Control)</u> – essentially the same as Alternative 2, but omits the use of chemical (herbicide) treatments. This alternative would rely primarily on mechanical control methods for treating NNIS infestations.

The Proposed Action (Alternative 2) is the preferred alternative.

The effects of these alternatives in relation to the pertinent goals and objectives of the Forest Plan and the one issue statement are briefly summarized in Table 2-5 of the Environmental Assessment and not repeated here. Chapter 4 of the Environmental Assessment provides a detailed discussion of the possible environmental consequences of implementing each alternative.

Based on public comments received during the 30 Comment Period and the final Environmental Assessment, the deciding officer (Deputy Forest Supervisor) will then make the following decisions and provide his rationale:

- Is the range of alternatives adequate to address public issues, interdisciplinary team concerns, and to meet the Purpose and Need for Action?
- Which of the alternatives best addresses relevant issues for this project?
- Would the decision to implement an Alternative pose any significant environmental impact that would require an environmental impact statement?
- Does the decision to implement an Alternative meet applicable federal, state, and local laws and policies, including consistency with the Forest Plan?
- Do the proposed mitigation measures meet Forest Plan Standards and Guidelines?

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1.0 Proposed Action and Purpose and Need

1.1 Introduction - we are proposing to implement a 10-year Forest-wide, non-native invasive plant species (NNIS) eradication and control project. We are proposing this project in order to achieve the NNIS goals and objectives described in the *White Mountain National Forest Land and Resource Management Plan* (Forest Plan). Comparing the NNIS goals and objectives outlined in the Forest Plan to the current state of NNIS infestations on the Forest identified a need to take action in order to stem the rate of infestation and to eradicate current infestations. This document provides the details of an environmental analysis of our proposed action as well as two other possible management alternatives. In this report, we describe the process and considerations used in developing the proposed action and two other possible management alternatives, the environment where the proposed action would occur, and the resources potentially impacted by the alternatives. We then set out to disclose the effects of the three alternatives on these resources and evaluate their effectiveness in achieving the goals and objectives of the Forest Plan.

Common Barberry *(Berberis vulgaris)*

Currently, there are in excess of 180 known sites of NNIS on the Forest. Surveys have identified 24 species or complexes of non-native invasive plants on the Forest, with an additional 11 species that have the potential to develop infestations on the Forest. Sometimes referred to as "noxious weeds," these plants have characteristics that permit them to rapidly invade and dominate in new areas, often out-competing other vegetation for light, moisture, and nutrients. The introduction and rapid spread of invasives can threaten native plant communities, which may include threatened, endangered, or sensitive plant species. Subsequently, these community changes can alter habitats, affecting animal communities as well. The threat posed by NNIS plants to the health of these ecosystems created the need for action and subsequently, this environmental analysis.

1.2 Purpose of and Need for Action - the purpose of this project is to protect and restore naturally-functioning native ecosystems on the Forest by controlling or managing NNIS plants. This project also seeks to accomplish several resource goals and objectives identified in the *White Mountain National Forest Land and Resource Management Plan* revised in September, 2005, which include:

Goals- Forest Plan NNIS Goals, p. 1-6:

- The Forest will remain as free of non-native invasive species (NNIS) as reasonably possible.
- A weed-free user's ethic will be encouraged in all resource area programs with potential to spread NNIS.

- While some NNIS may occasionally be found on the Forest, occurrences will not be so widespread as to cause negative impacts to native communities.
- Prevention is the most economical and environmentally desirable method to minimize NNIS occurrence, and planning for all activities will consider NNIS prevention and mitigation of possible effects.
- The Forest Service will cooperate with adjacent landowners, towns, state agencies, and private organizations to prevent NNIS from being established on the Forest. Eradication efforts will be effective and cause minimal negative effects to other resources.

Objectives- Forest Plan NNIS Objectives, p. 1-7:

- Prevent non-native invasive species (NNIS) not currently on the Forest from becoming established.
- Eradicate new species infestations as quickly as possible. This may include, but is not limited to, physical/mechanical, biological, or chemical treatments.
- For NNIS already occurring on the Forest:
  - Prevent new infestations.
  - Eradicate species that are known to be invasive and persistent throughout all or most of New England. These can spread into, and persist in, native communities and displace native species, thereby demonstrating a threat to the integrity of the natural ecosystem and communities. Prioritize scheduling of species whose dispersal mechanisms typically result in rapid spread of individuals over widespread areas (e.g., wind dispersed) or which are especially difficult to eradicate.
  - Suppress species suspected or known to be invasive in limited areas of New England. These species will typically persist in the environment for long periods once established, and may become invasive under favorable conditions.
  - Contain species about which some concern has been raised regarding their potential to become a management problem. These species have been shown to be invasive under special environmental conditions.

In addition to goals and objectives, the Forest Plan also contains Standards and guidelines that provide specific management direction and guidance for NNIS plant prevention, control and eradication. These standards and guidelines are listed in the Forest Plan starting on page 2-11.

This action is needed because existing populations of NNIS currently occur on the Forest and are degrading natural communities. Past projects to control invasive plants on the Forest have been analyzed on a site-by-site basis. Those projects included mechanical, biological, and chemical controls, all on an extremely limited basis. Due to the scope of the current invasive plant species problem, and in order to be able to treat future infestations more effectively, a broader and more comprehensive approach must be developed.

In order to respond quickly to existing and emerging invasive plant threats, the Forest needs to adopt an approach that provides the decision maker with an analysis of both current and potentially new infestations. As a result of this analysis, we expect to be able to treat current and future infestations that fall within the scope of this analysis over a period of the next ten years.

1.3 Where Actions Would Occur - non-native invasive plant control actions would occur across the White Mountain National Forest (WMNF) wherever NNIS are identified. Actions would be limited to the public lands managed by the WMNF. Most such areas occur along roads, parking areas, skid trails, and recreation trails, in gravel pits, disturbed sites, and power line corridors but some do occur in less disturbed areas. Current site-specific locations are displayed on the site maps in Appendix B and C and the corresponding table of sites is listed in Appendix A.

1.4 What the Decision Will Address - the framework of the decision focuses on control of existing and future non-native invasive plant infestations, consistent with current management direction. A decision on this proposal is limited to the following:

- What type of non-native invasive plant control actions, methods, chemicals and tools would be used.
- Where on the WMNF non-native invasive plant control actions would occur.
- What non-native invasive plants would be controlled.
- What mitigation measures would be required to minimize impacts of our actions.

This proposal and decision would not require amendments to the White Mountain National Forest Plan. The Responsible Official for this decision is the Deputy Forest Supervisor.

1.5 Public Involvement - concerned agencies, local governments, and the public were notified and encouraged to provide any initial comments or issues they may have had about this project starting in the Spring of 2006. This project included an initial public scoping and comment period, as described in the scoping letter dated April 13, 2006, which was mailed to 1,786 addressees using the Forest's National Environmental Policy Act (NEPA) mailing list. Notice of the project was also provided in public notices published in the New Hampshire Union Leader and Lewiston Sun Journal on April 28, 2006 and posted on the White Mountain National Forest website at http://www.fs.fed.us/r9/forests/white_mountain/projects/projects/index.php and at the Forest Service's Schedule of Proposed Actions (SOPA) website at http://www.fs.fed.us/sopa/.

During this initial public comment period, we received responses from 19 individuals. All responses received are included in the Project File. Comments were generally supportive and ranged from fully supporting the effort to specific concerns regarding some of the treatment methods proposed. Several respondents related their experiences in trying to eradicate some of the NNIS plant species and others encouraged us to solicit more assistance from the public in our eradication efforts and to increase the public's awareness of the problem. These responses were useful to the interdisciplinary team to help identify issues and in refining the proposed action and in developing possible alternatives to the proposed action.

The next phase of public involvement includes a formal public comment period following the release of this Environmental Assessment. Based on the responses received during this formal comment period, the environmental assessment and proposed action would undergo a review to identify any needed changes or revisions. The deciding official will then publish his decision along with the Environmental Assessment in its final form.


Glossy Buckthorn *(Frangula alnus)*

1.6 Issue Identification – an interdisciplinary team review of the comments received during the initial public scoping period revealed that there was, in general, support for the Forest to proceed with this project. Alternative weed control techniques were presented, including physically covering the weeds with plastic or paper, and a request to not use chemical treatments in any way.

The following issue was developed as a result of the input from the initial public scoping period: <u>The Forest should not use herbicides.</u> Rationale provided by the public included the following:

- Over the long-term, their use may prove to be detrimental. There has been success with using mechanical methods instead.
- There could be risks to non-target species.
- Their use could contaminate groundwater and habitat and cause more ecosystem havoc.
- Soil quality could be degraded from herbicides.

The team discussed the merits of carrying this issue forward into the alternative development process and concluded it would be appropriate. This was based partly on the public's response to initial scoping and a desire for the analysis to disclose the effects of not using herbicides in relation to achieving the goals and objectives described in the Forest Plan.

This resulted in three proposed alternatives for further development and analysis:

1. No Action Alternative – no active NNIS Plant control program beyond what is currently planned; natural processes at work.

2. Proposed Action – includes mechanical, chemical, and biological control options.
3. Mechanical and Biological Control – includes mechanical and biological control options; no chemical (herbicide) controls would be used.

Several other potential issues dealing with human health and safety, both for the public and the individuals performing the eradication projects, were also discussed. These include possible injuries from workers using tools to perform treatments as well as environmental hazards from weather, insects and potential contact with poisonous or injurious plants. The team felt these would be addressed by mitigation measures developed in the treatment protocols and would not vary in their effects between alternatives except for in comparison to the no action alternative. The risks to both the public and workers associated with applying herbicides are captured in the issue identified as “the Forest should not use herbicides.”

1.7 Related Decision Documents and Laws that Affect the Proposed Action –

The analysis documented in this Environmental Assessment tiers to the Final Environmental Impact Statement and Land and Resource Management Plan for the White Mountain National Forest, signed on September 13, 2005. The legal background and authority for the Forest Plan is found in the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA) as amended by the National Forest Management Act of 1976 (NFMA), implementing regulations found in 36 CFR Part 219.10(f)(1982), the National Environmental Policy Act (NEPA), and implementing regulations found in 40 CFR 1500-1508.

The following is a list of some laws, regulations, executive orders, and rules which were considered during this analysis:

- Archeological Resources Protection Act of 1979 (P.L. 96-95, 93 Statute 721, as amended; 16 U.S.C. 370aa-470mm)
- Native American Graves Protection and Repatriation Act of November 16, 1990 (P.L. 101-601, 104 Statute 3048; 25 U.S.C. 3001-3013)
- Endangered Species Act of December 28, 1973 (P.L. 93-205, 87 Statute 884, as amended; 16 U.S.C. 1531-1536, 1538-1540)
- National Environmental Policy Act of January 1, 1970 (P.L. 91-190, 83 Statute 852; 42 U.S.C. 4311 et seq. and Implementing Regulations at 40 CFR 1500).
- National Forest Management Act of October 21, 1976 (P.L. 94-579, 90 Statute 2743, as amended; 43 U.S.C. 1701 et seq.)
- National Historic Preservation Act of October 15, 1966 (P.L. 89-665, 80 Statute 915, as amended; 16 U.S.C. 470 et seq.)
- Executive Order 11593 (Cultural)
- Executive Order 11988 (Floodplains)
- Executive Order 11990 (Wetlands)
- Executive Order 12898 (Environmental Justice)

- Executive Order 13084 (Consultation and Coordination with American Indian Tribes)
- Executive Order 13112 (Invasive Species)
- Memorandum on Government-to-Government Relations with Native American Tribal Governments, April 29, 1994, President William J. Clinton)
- Secretary of Agriculture Memorandum 1827 (Prime Agricultural Lands)
- State of New Hampshire RSA 430:55, Part Agr 3801 (Invasive Species)

2.0 Alternatives

***2.0.1 Introduction* –** this chapter will describe the three management alternatives that were developed for further consideration in this analysis. These alternatives were developed by an interdisciplinary team that considered the issues developed from the initial public outreach (see section 1.5) as well as the interdisciplinary team's input and expertise. The two action alternatives described in this section conform to the management direction described in the Forest's Land and Resource Management and would not require a Forest Plan amendment. The No Action alternative would not meet all of the Forest Plan goals and objectives, but is used as a baseline to compare the effects of the two action alternatives and to display the effects of not treating NNIS.

***2.0.2 Actions Common to All Alternatives* –** all of the alternatives proposed in this analysis would share the following actions. In the interest of avoiding repetition, these actions are listed here and include the following:

- Education and prevention efforts on the Forest would continue. Public education efforts would strive to educate Forest visitors on the importance of taking preventive measures to stop the spread of NNIS. Education and collaboration with contractors and cooperators performing construction and maintenance projects, State Departments of Transportation, and internal Forest Service personnel and equipment that operate on the Forest would continue as resources permit.
- Any existing weed control projects resulting from prior decisions would continue on the Forest, including:
  - Decision signed on May 6, 2005 for the Popple Vegetation Management Project which includes actions to treat NNIS plants on approximately four acres within the project area by using either chemical or hand treatment methods.
  - NNIS Biological Control Project signed on April 5, 2005 to control Purple Loosestrife with beetles on State Highway 16 between the Rocky Branch and Glen Ellis parking lots.
- Sites that are treated typically will require at least one follow-up treatment in future years, regardless of treatment method.

2.1 Alternative 1 (No Action) – Alternative 1 represents the current condition and serves as a baseline to compare the other alternatives. For the purposes of this analysis, Alternative 1 assumes that no new projects to control NNIS plants, beyond what is described in paragraph

2.0.2 above, would be initiated and current infestations would continue to grow in size and provide a source for other infestations. This alternative provides a way to disclose the effects of allowing invasive plants to progress and spread both naturally and with the unintentional assistance that results from human activity in and around the Forest.

2.2 Alternative 2 (Proposed Action) - Alternative 2 would implement an integrated NNIS plant management strategy involving the use of mechanical, biological, and chemical control methods. Once signed, the decision for this environmental analysis will be in effect for 10 years. If additional NNIS plant species are found on the Forest, beyond what is described in this document, they would be considered for treatment as part of an annual review (see section 2.2.3). The type of method used to treat known and new infestations would depend on several factors such as the species of invasive plant(s), size and distribution of the infestation(s), and location, which includes proximity to water and surrounding vegetation. Treatments proposed under this alternative would be limited to terrestrial NNIS plants. It is possible these species would be found growing in water or wet areas and considered for treatment using the appropriate aquatic formulation of herbicide along with all label instructions, state and federal laws, and applicable safety and mitigation measures prescribed in this document. Submerged and submersed aquatic NNIS species, e.g. *eurasian watermilfoil (Myriophyllum spicatum* L.), would not be considered for treatment in this proposal. Another consideration when deciding an appropriate treatment method would be the infestation's proximity to Wilderness, areas recommended for Wilderness designation, Research Natural Areas, and Candidate Research Natural Areas. In all cases, treatments under this alternative would be limited to public lands under the management of the White Mountain National Forest. The treatment methods, treatment protocols, and annual review process are discussed in more detail in the following sections.

2.2.1 Treatment Methods

The following treatment methods are proposed for use on the White Mountain National Forest:

Mechanical – mechanical treatment methods would be evaluated first for all infestations. Mechanical methods of removing NNIS plants are listed at Table 2.1. However, heavy equipment, such as excavators and bulldozers, would not be considered for use under this project.

Mechanical control would be the preferred treatment in Wilderness, areas recommended for Wilderness designation, Research Natural Areas, and Candidate Research Natural Areas. Chemical and biological control methods are allowed in these areas if mechanical methods alone would not achieve eradication objectives. All plant parts with viable reproductive material would be removed from the site and disposed of in designated disposal sites. Mechanical methods may be used alone or in preparation for treatment with chemical herbicides.

Table 2.1 Mechanical Treatment Methods	
Method	***Description of Action***
Pull	Manually pull entire plant, including roots.
Girdle	Used on larger diameter woody stems and trees. Using a hatchet or similar tool, cut through the bark encircling the base of the tree, approximately six inches above the ground, making certain the cut goes well below the bark through the cambium layer. Effective at killing the top of the tree. Resprouts are common and may require a follow-up treatment with a foliar herbicide.
Cut Stem	Cut stem with hand or power tools (e.g. weed-whip or mower). Can be used alone or in combination with application of systemic herbicide.
Root Stab	Cut root below ground level.
Suffocate	Spread light-impervious material, such as black plastic, over the plant to starve it of light. Follow-up monitoring is necessary to evaluate success and eventually remove the light-impervious material.

Japanese Knotweed herbicide treatment along Rt. 3 in Jefferson, NH

Chemical – controlled hand application of herbicides approved by the Environmental Protection Agency and available "off the shelf." Application of chemical treatments would meet or exceed standards and requirements prescribed by all applicable state and federal laws and regulations. This includes adherence to state permitting and licensing requirements for the application of herbicides. Safety would be of primary concern during applications. All applicators would wear personal protective equipment that meets or exceeds standards prescribed by the product's label and applicable laws and regulations. Herbicides proposed for use have been selected based on their effectiveness and low toxicity. Application methods would include dabbing, brushing, or spraying herbicide on cut stumps, basal bark, foliage, or stems (see Table 2.2). Spray applications would direct a narrow spray of herbicide directly on target plants with minimal overspray or drift. Herbicide would NOT be applied by aerial application (plane or helicopter) or via the use of a truck mounted spray device.

Table 2.2 Techniques of Herbicide Application Considered for Use in Alternative 2	
Technique	***Description***
Dabbing/brushing	Direct hand application of herbicide to cut surface of stem via absorbent materials (i.e. foam tipped paint-brush, absorbent glove, weed wand, etc)
Foliar spraying	Portable spraying equipment (backpack or hand held) consisting of a tank capable of holding mixtures of herbicides in liquid form. Herbicides are sprayed directly onto foliage of target species.
Cut stem	Stems of target individuals are cut off at ground level with loppers or saw and herbicide applied directly to cut stem using spray or brushing technique.
Basal bark	Herbicide mixed with an oil carrier and applied via dabbing/brushing directly onto lower stem of target species. Oil carrier allows herbicide to penetrate bark and kill target plant.

Chemical treatments within 250 feet of surface waters would be restricted to registered aquatic formulations of the herbicide in order to protect aquatic organisms.

The number of treatments per year would vary by species treated, and would be scheduled to minimize negative impacts to non-target resources. Generally, there would be one chemical application per site per year, with follow-up monitoring and, if necessary, treatment in subsequent years. All necessary state and federal permits would be acquired prior to any project implementation.

Table 2.3 Herbicides Considered for Use in Alternative 2			
Common Chemical Name	***Some Examples of Brand Names***	***Targeted Use***	***Target Species - Examples***
triclopyr	Brush-B-Gone®; Garlon3A®; Habitat®; Vine-X®, Garlon 4®	Cut stem and/or basal bark treatment; foliar spot spray. Broad-leaf selective.	Oriental bittersweet, swallowworts, buckthorns
glyphosate	Glialka®; Glifonox®; Glycel®; Muster®; Rondo®; Roundup®; Sting®; Spasor®; Sonic®; Tumbleweed®	Cut stem and/or basal bark treatment; foliar spray. Non-selective.	honeysuckle, barberry, Norway maple, burning bush, autumn olive, garlic mustard, buckthorns
glyphosate – aquatic formulation	Rodeo®; Glyphos Aquatic®; Pondmaster®; Accord®; Eagre®	Cut stem; wand or glove application near open water. Non-selective.	Purple loosestrife, yellow-flag iris, common reed, knotweeds, buckthorns

Table 2.3 Herbicides Considered for Use in Alternative 2			
Common Chemical Name	***Some Examples of Brand Names***	***Targeted Use***	***Target Species - Examples***
clopyralid	Confront®	Foliar spray on composites and legumes. Broad-leaf selective.	Thistles, knapweeds

Biological **–** involves releasing specific insects that feed on specific plant species. The insects are typically native to the home range of the species targeted for removal. Biological control of plants is already a common practice on federal, state and private land in all New England states. All species proposed for use have extensive and successful records of prior use in the United States (Van Driesche et al., 2002). On the WMNF, biological control is proposed only to treat infestations of purple loosestrife.

Table 2.3. Biological Control Insects Proposed		
Bio-Control Insect	Scientific Name	Method of Impact
Black-margined loosestrife beetle	*Galerucella calmariensis*	Leaf eater
Golden loosestrife beetle	*Galerucella pusilla*	Leaf eater
Loosestrife root weevil	*Hylobius transversovittatus*	Root borer

Most purple loosestrife sites on the WMNF are too small to support a population of bio-control insects. The use of bio-control would be considered only for sites where eradication via other means is too difficult to achieve due to costs, or there would be an undesirable effect on non-target vegetation, especially rare plants. None of these insects would completely eliminate the target plants (Tu et al., 2001)

All release sites would be monitored for their effectiveness. The Forest released purple loosestrife *Galerucella* beetles on the Saco Ranger District in 2005. The results of this release are being monitored over the next five years.

2.2.2 Treatment Protocols

In addition to Forest Plan standards and guidelines, the following protocols would be used when developing a treatment project and in determining which treatments to apply at particular NNIS sites.

1. Annually, proposed NNIS control project sites shall be evaluated and approved by an interdisciplinary team prior to project implementation. The interdisciplinary team shall include the following personnel (or their designee):
   a. Forest botanist
   b. Forest or District biologist
   c. Forest soil scientist
   d. Forest hydrologist
   e. Forest archaeologist
   f. Forest fisheries biologist
   g. Other personnel as needed (i.e. recreation, timber, etc)

2. All control treatments would be designed so that they are effective, based on the species phenology and life history, yet have the fewest undesired impacts to native vegetation.
3. No ground disturbing control activities may take place within or directly adjacent to any known or newly discovered threatened, endangered, or regional forester sensitive plant occurrences.
4. Projects involving the removal of dense thickets of invasive shrubs shall not take place prior to August 1st in order to protect nesting songbirds or will require inspection for nesting activity prior to treatment.
5. Any NNIS treatment project resulting in any part of a project area greater than ¼ acre in size containing less than 20% vegetated ground would be seeded with an appropriate mix of native plant seeds.
6. Field personnel involved in NNIS control treatments would be able to visually distinguish between target NNIS plants and non-target vegetation.
7. Mechanical methods would be evaluated first for all infestations, and used principally for shallow rooted species on sites with fewer than 30 stems (unless otherwise noted for that species below) that are less than 1 cm in diameter.
8. Herbicides would be selected based on the invasive species being treated and other site conditions.
9. If chemical control is the proposed control technique, only highly target specific chemical control such as cut stem, basal bark, wand or glove application may be implemented in areas within or directly adjacent to threatened, endangered, or regional forester sensitive plant occurrences.
10. Bio-control release of beetles would be considered as a method of last resort for the control of purple loosestrife. Beetles would only be used on large loosestrife infestations where other methods of control are deemed too costly, inefficient, or impactive.

Table 2.4 Summary of Available Treatments for Each NNIS*

Species Common Name	*Mechanical*	*Chemical*	*Biological*
Norway maple **Tree of Heaven** **Barberry** **Olive** **Winged Euonymus** **Buckthorn** **Non-native shrub honeysuckle** **Privet** **Locust** **Oriental bittersweet** **Multiflora rose**	**plant size < 1 cm dia. or < 0.5 meters in height**	**glyphosate or triclopyr**	
Goutweed **Fig buttercup** **Moneywort** **Swallowwort**	**small infestations < 10 plants**	**glyphosate or triclopyr**	
Knapweed **Thistle**	**small infestations < 100 plants**	**clopyralid or glyphosate**	

Table 2.4 Summary of Available Treatments for Each NNIS*			
Species Common Name	***Mechanical***	***Chemical***	***Biological***
Garlic mustard **Dames rocket** **Bittercress**	**infestations < 500 plants**	**glyphosate or triclopyr**	
Knotweed **Common Reed** **Giant hogweed** **Wild Chervil**	**small infestations < 50 plants**	**glyphosate**	
Purple loosestrife	**small infestations < 10 plants**	**medium infestation 10 - 500 plants glyphosate**	**larger, concentrated infestations: Black-margined loosestrife beetle, Golden loosestrife beetle, or Loosestrife root weevil**
Bittersweet nightshade **Coltsfoot** **True forget-me-not**	**small patches < 50 plants**	**glyphosate or triclopyr**	
Mile-a-minute vine **Japanese stiltgrass** **Ornamental jewelweed**	**small patches < 500 plants**	**glyphosate or triclopyr**	
Yellow-flag iris	**small infestations < 20 plants**	**aquatic version of glyphosate**	

* Treatments are prescribed on a site specific basis and may vary based on specialist's evaluation of the particular infestation.

2.2.3 Annual Review

Approximately one year following approval and implementation of this alternative, and annually thereafter, the Forest Botanist would be responsible for leading a review to achieve the following objectives:

- Document the full extent and location of treatments conducted since the previous review. This includes mapping treatment locations, treatment methods, site conditions, and species targeted.
- Review new infestations of invasive plants located on the Forest and in surrounding areas to develop and refine subsequent annual and long-term treatment strategies. This review would be done in light of projected resources to perform treatments.
- Review the latest research and literature on NNIS plant control, to include new treatment methods and new herbicides for consideration in developing the following year's treatment plan.
- Review the effectiveness of previous treatments and incorporate lessons learned into the following year's treatment strategy.
- Publish the following year's annual NNIS invasive treatment plan.

The annual review would allow for the treatment of many NNIS occurrences as they arise on the Forest, without having to initiate an entirely new analysis each time. This would allow us to treat infestations more quickly, effectively, and more cost efficiently. New occurrences that do not conform to the strategy established by this environmental assessment would require a separate analysis process. For example, there are currently no occurrences of true aquatic NNIS (e.g., Eurasian water milfoil) on the WMNF. Treatment for these species is substantially different from the terrestrial species listed in Table 2.4, so a separate analysis, including public involvement, would be initiated if these types of new infestations were found.

2.3 Alternative 3 (Mechanical and Biological Control) – omits the use of chemical treatments as described in Alternative 2. This alternative would rely primarily on mechanical control methods for most treatments, only infestations of purple loosestrife would be considered for biological control.

2.4 Alternatives Eliminated from Detailed Study – other techniques to control NNIS plants were also considered but dismissed. Prescribed fire and scorching are control techniques that were considered; however, these techniques require additional personnel for safety, which, given the size of infestations on the Forest, would be very inefficient compared to other available means. Therefore an alternative which would include these techniques was eliminated from detailed study.

2.5 Comparison of Alternatives – Table 2.5 briefly summarizes some of the differences between the alternatives. The objectives and issue were described in Sections 1.2 and 1.6 respectively. These points of are developed in much more detail in Chapter 4.

Table 2.5 Comparison of How Each Alternative Meets Goals and Objectives and Addresses the Issues

Objective or Issue	*Alternative 1 (No Action)*	*Alternative 2 (Proposed Action)*	*Alternative 3 (Mechanical and Biological)*
Goal: Forest remains free of NNIS	Infestations continue to spread in occurrences and acreage.	Potential to treat the highest number of infestations and acres. Projections indicate this alternative would come the closest to approaching this goal.	Potential to treat the second highest number of infestations and acres. Projections indicate this alternative will be more effective at achieving this goal than Alt. 1 and less effective than Alt. 2 due to the greater effectiveness and efficiency of treatment options in Alt. 2.
Goal: weed-free user's ethic encouraged	Continues to promote weed-free ethic.	Continues to promote weed-free ethic.	Continues to promote weed-free ethic.
Goal: NNIS occurrences will not negatively impact native plant communities	Decrease in diversity and abundance of native plant communities.	Provides the highest responsiveness to treat infestations threatening native plant communities.	Provides a higher responsiveness to treat infestations threatening native plant communities than Alt. 1 and less than Alt. 2 due to the greater effectiveness and efficiency of treatment options in Alt. 2.

Table 2.5 Comparison of How Each Alternative Meets Goals and Objectives and Addresses the Issues

Objective or Issue	*Alternative 1 (No Action)*	*Alternative 2 (Proposed Action)*	*Alternative 3 (Mechanical and Biological)*
Goal: planning will consider NNIS prevention and mitigation	Planning continues to consider NNIS prevention and mitigation.	Planning continues to consider NNIS prevention and mitigation.	Planning continues to consider NNIS prevention and mitigation.
Goal: cooperate with externals to prevent spread of NNIS on Forest	Cooperation with externals to prevent spread of NNIS continues.	Cooperation with externals to prevent spread of NNIS continues.	Cooperation with externals to prevent spread of NNIS continues.
Objective: prevent NNIS not on Forest from becoming established	Dependent on external's eradication and control programs. Cross border spread of NNIS would increase, originating from the Forest and subsequently spreading back onto the Forest.	Dependent on external's eradication and control programs. Cross border spread of NNIS should decrease the most of the Alts. from species originating on the Forest and subsequently spreading back onto the Forest.	Dependent on external's eradication and control programs. Cross border spread of NNIS should decrease less than Alt. 2 originating from the Forest and subsequently back onto the Forest.
Objective: eradicate new NNIS infestations quickly	Fails to eradicate new infestations beyond currently approved treatments.	Potential to eradicate the highest number of new NNIS infestations of the Alts, due to the use of more effective and efficient treatment methods.	Potential to eradicate some new NNIS infestations, but less than Alt. 2. Due to the use of less effective and efficient treatment methods compared to Alt. 2.
Objective: for existing NNIS – prevent new infestations	Fails to prevent new infestations resulting from existing infestations beyond currently approved treatments.	Potential to prevent the highest number of new NNIS infestations resulting from existing infestations of the Alts, due to the use of more effective and efficient treatment methods on existing infestations.	Potential to prevent some new NNIS infestations resulting from existing infestations, but less than Alt. 2. Due to the use of less effective and efficient treatment methods on existing infestations.
Objective: for existing NNIS - eradicate species known to be invasive throughout New England	Fails to eradicate NNIS infestations beyond currently approved treatments.	Potential to eradicate the highest number of NNIS infestations of the Alts, due to the use of more effective and efficient treatment methods.	Potential to eradicate some NNIS infestations, but less than Alt. 2. Due to the use of less effective and efficient treatment methods compared to Alt. 2.
Objective: for existing NNIS – suppress species known to be invasive in limited areas of New England	Suppression accomplished solely through education and cooperation with externals.	Potential to suppress the highest number of NNIS infestations of the Alts, due to the use of more effective and efficient treatment methods.	Potential to suppress some NNIS infestations, but less than Alt. 2. Due to the use of less effective and efficient treatment methods compared to Alt. 2.
Objective: for existing NNIS – contain species where concern is raised for their potential to become a management problem.	Containment accomplished solely through education and cooperation with externals.	Potential to contain the highest number of NNIS infestations of the Alts, due to the use of more effective and efficient treatment methods.	Potential to contain some NNIS infestations, but less than Alt. 2. Due to the use of less effective and efficient treatment methods compared to Alt. 2.

Table 2.5 Comparison of How Each Alternative Meets Goals and Objectives and Addresses the Issues

Objective or Issue	*Alternative 1 (No Action)*	*Alternative 2 (Proposed Action)*	*Alternative 3 (Mechanical and Biological)*
Issue: the Forest should not use herbicides	No herbicide use beyond currently approved projects.	Uses herbicides, but with no measurable effect due to low toxicity and low levels of herbicide use.	No herbicide use beyond currently approved projects.

3.0 Affected Environment

3.1 Introduction – this section describes the current condition of the environment on the Forest as it relates to NNIS plant populations and their current impacts to various resources. This description of the affected environment uses information gathered from research, Forest inventory and monitoring databases, and field observations performed by resource specialists working on the Forest. The description of the affected environment will be used as a common baseline or frame of reference to analyze and describe the effects of implementing each of the proposed alternatives. A description of the effects of each of the alternatives will follow in Section 4, Environmental Consequences.

3.2 Forest Plan Management Direction – the 2005 White Mountain National Forest Land Resource Management Plan provides goals and objectives specific to the prevention, treatment and control on NNIS plant populations on the Forest. These goals and objectives are listed in section 1.2 of this document.

3.3 Non-Native Invasive Plants - the plants and plant communities of the White Mountain National Forest are largely native, naturally occurring species. The landscape of the Forest is also largely un-invaded by non-native species. Of the 3,000 species known to occur in New England, roughly 1,000 are introduced, non-native species. Approximately 100 plant species out of the 1,000 non-native species are considered invasive or potentially invasive on the New England regional level. However, on the WMNF only 24 species (or in some cases, complexes of species in the same genera) meeting this criteria are currently mapped as having infestations on the Forest, and invading natural communities on some level. We refer to this group of species as the “A list” (Table 3.1).

Table 3.1 Non-native Invasive Plant List “A List” Species: Species of immediate concern that warrant treatment. These species are currently invading native plant communities on the Forest.

Species Common Name	**Scientific Name**	**Ecosystems threatened by this invasive plant**
Asiatic honeysuckles	**Lonicera tartarica*, **L. morrowii*, and **L. x bella*	Openings, edges, forested areas, and shores of rivers and lakes

Table 3.1 Non-native Invasive Plant List "A List" Species: Species of immediate concern that warrant treatment. These species are currently invading native plant communities on the Forest.		
Species Common Name	**Scientific Name**	**Ecosystems threatened by this invasive plant**
Autumn olive	**Elaeagnus umbellata*	Barrens and open lands
Barberrys	***Berberis thunbergii & *B. vulgaris*	Openings, edges, and forested areas
Bishop's Gout-weed	**Aegopodium podagraria*	Open lands, cultural sites, stream banks, and forested areas
Bittersweet nightshade	*Solanum dulcamera*	Openings, edges, and forested areas
Black locust	*Robinia pseudoacacia*	Openings, edges, and forested areas
Coltsfoot	*Tussilago farfara*	Openings, edges, forested areas, and stream and river banks
Common Buckthorn	**Rhamnus cathartica*	Openings, edges, and forested areas
Common Reed	*Phragmites australis*	open wetlands and edges
Garlic mustard	**Alliaria petiolata*	Openings, edges, and forested areas
Glossy Buckthorn	**Frangula alnus*	Openings, edges, and forested areas
Japanese knotweed	**Polygonum cuspidatum*	Shores of rivers and lakes and edges
Knapweeds	*Centaurea biebersteinii* other *Centaure*a species possible	Barrens and other open lands
Moneywort	*Lysimachia nummularia*	Forested areas, stream and river banks, and wetlands
Multiflora rose	**Rosa multiflora*	Open lands and edges
Norway Maple	***Acer platanoides*	Openings, edges and forested lands
Oriental bittersweet	**Celastrus orbiculatus*	Openings, forested areas and edges
Privets	**Ligustrum obtusifolium,* other possible privet species*: L. vulgare, L. ovalifolium, and L. sinense*	Openings, edges, and forested areas
Purple Loosestrife	**Lythrum salicaria*	Wetlands and wet ditches
Reed Canary Grass	*Phalaris arundinacea*	Wetlands, roadsides and open lands
Thistles	*Cirsium arvense & C. palustre*	Barrens and other open lands
True forget-me-not	*Myosotis scorpioides*	Forested areas, stream and river banks, and wetlands
Winged euonymus (Burning bush)	***Euonymus alatus*	Openings, edges, and forested areas
Yellow-flag iris	**Iris pseudoacorus*	Wetlands, edges, and stream and river banks

* Prohibited by NH law from sale, transport, or distribution.
** Prohibition begins on January 1, 2007

An additional 11 species (or in some cases, complexes of species in the same genera) are thought to have a high potential to occur on the Forest over the next 10-15 years. These species are thought to have the potential to be invasive on the Forest, based on findings from other regions; these species (referred to as the "B list") are being surveyed for on an annual basis.

Table 3.2 Non-native Invasive Plant List "B List" Species: Species not currently identified from the WMNF, but occur in the surrounding landscape or are expected to occur in the next 10-15 years.

Species Common Name	Scientific Name	Ecosystems threatened by this invasive plant
Cypress spurge	*Euphorbia cyparissias*	Open lands, open stream and river banks
Dame's rocket	*Hesperis matronalis*	Openings, edges, riparian areas and forested areas
Fig buttercup	*Ranunculus ficaria*	Stream and river banks, floodplain forest, and wetlands
Giant hogweed	**Heracleum mantegazzianum*	Openings, stream and river banks, forested areas
Japanese stiltgrass	*Microstegium vimineum*	Openings, edges, stream and river banks, and forested areas
Mile-a-minute vine	*Polygonum perfoliatum*	Openings, edges, and forested areas
Narrow-leaved bittercress	*Cardamine impatiens*	Stream and river banks, forested areas, and edges
Spurges	*Euphorbia esula & E. cyparissias*	Open lands
Swallowworts	**Cynanchum rossicum & *C. nigrum*	Openings, edges, and forested areas
Tree of Heaven	**Ailanthus altissima*	Openings, edges, and forested areas
Wild chervil	*Anthriscus sylvestris*	Openings and edges

* Currently prohibited by NH law from sale, transport, or distribution.
** Prohibition begins on January 1, 2007

NNIS inventories have been on-going since 2001. Current inventory on the Forest shows NNIS on over 183 sites (totaling less than 1% of the Forest). Currently these infestations are made up of various combinations of 24 individual species. These sites range from single plants occupying less than one one-hundredth of an acre to a ten acre infestation of Morrow's honeysuckle consisting of thousands of plants. 62% of all mapped infestations occupy less than one-tenth of one acre and only 2% are larger than one acre. Forest-wide non-native invasive trees, shrubs and vines constitute 36% of all invasions and include infestations of honeysuckle, burning bush, and barberry. 57% of infestations are herbaceous plants with the majority consisting of Japanese knotweed, purple loosestrife and coltsfoot. Infestations occur in a variety of habitats with the majority occurring along roadsides, parking lot margins, historic cultural sites, developed sites, and disturbed stream/river banks. Overall invasive plant infestations occupy less than one one-hundredth of the overall ownership of the White Mountain National Forest. This represents an early stage of infestation.

3.3.1 NNIS Characteristics

The characteristics and occurrence of these species on the WMNF is listed below. They are categorized by vegetation type (woody trees and shrubs, herbaceous, or grass).

3.3.1.1 Woody Trees and Shrubs Species

Norway maple (*Acer platanoides*)
Norway maple is widely used in the landscape as an ornamental species. Its seeds are dispersed via wind and it can quickly out compete native trees species in a forested setting once established. It currently does not occur on the WMNF, but is widely planted in landscapes surrounding the Forest. There are several documented infestations in areas directly adjacent to the Forest

Tree of Heaven (*Ailanthus altissima*)
This tall tree is native to Asia. It was introduced as a street tree due to its ability to tolerate highly compacted soils. It spreads vegetatively and by seed via wind. It prefers open areas, but can colonize forested areas. There are currently no infestations of this species on the WMNF, and few in the White Mountain region. This species poses a significant risk to wildlife openings, edges, and post timber harvest areas if it becomes established.

Barberrys *(Berberis thunbergii and B. vulgaris)*
These plants are often used as ornamentals and therefore are frequently found adjacent to former or current residential areas. These species are commonly found at cultural sites such as old homesteads. Barberrys have also invaded mixed deciduous/coniferous forest on the WMNF. They spread vegetatively and by birds carrying seeds.

Oriental bittersweet (*Celastrus orbiculata*)
Bittersweet is a climbing vine with orange berries in clusters at the leaf axils. This native of Asia can overrun native vegetation, over topping other species and weighing the limbs and crown of trees, making them susceptible to wind and snow damage. The seed is spread by birds. This species is increasing rapidly in areas surrounding the WMNF, but has a limited distribution in wildlife openings and edges on the Forest.


Autumn olive (*Elaeagnus umbellatus*)

Autumn olive (*Elaeagnus umbellata*)
Autumn olive was introduced from Asia and widely planted for wildlife habitat. It is intolerant of shade and prefers drier sites. It spreads by animal-dispersed seeds and can form dense stands in barrens and wildlife openings shading out forbs and grasses. It currently occupies wildlife openings and edges in the WMNF and edges and old fields in areas surrounding the Forest.

Winged Euonymus or Burning Bush (*Euonymus alatus)*
This species is widely planted as an ornamental in the area surrounding the Forest. It is anticipated that the number of infestations on and around the WMNF would increase in future years requiring careful inventory and removal activities. It has a fibrous root system and spreads by animal-dispersed seeds. It can grow under a forest canopy. There is currently only one known site on the Forest.

Privets (*Ligustrum obtusifolium* and possibly other *Ligustrum* species)
At least one out of this complex of privets occurs in edge and forested areas of the WMNF. The species is currently known from old homestead sites near cellar holes and is escaping into the surrounding forested area. These species can occur in a variety of habitats including open fields, woodlands and on the edge of the woods and in shade under a forest canopy. The leaves are still green well into fall, making that an ideal time to treat because they are easily recognized and most native plants are dormant. Privets are difficult species to identify to species level when not in flower and were planted heavily for ornamental purposes in the past.

Asiatic Honeysuckles *(Lonicera tartarica, L. morrowii, L. x bella)*
At least two out of the three species of Asiatic honeysuckle occur in woodlands and on the edge of the woods and in shade under a forest canopy. The leaves are still green well into fall, making that an ideal time to treat because they are easily recognized and most native plants are dormant. This is the second most widespread species on the Forest. Many private lands within and around the National Forest have larger infestations.

Buckthorns (*Rhamnus cathartica & Frangula alnus)*
Buckthorns can grow in full shade of a forest canopy. The leaves are still green well into fall, making that an ideal time to treat because they are easily recognized and most native plants are dormant. There are only a few sites currently known on the WMNF for both species, but infestations of Frangula alnus are some of the largest NNIS infestations on the WMNF. Many private lands within and around the National Forest have infestations of these species.

Black locust (*Robinia pseudoacacia*)
Black locust is a highly clonal tree species that is native as far north as southwestern Pennsylvania. It spread vegetatively and by dispersing seeds. It is not native to the WMNF and is an invader of poor soils in open habitats such as edges and wildlife clearings. Although it can grow in forested environments it is not as aggressive under shaded conditions. It is currently documented from multiple locations throughout the WMNF.

Multiflora rose (*Rosa multiflora*)
Multiflora rose was introduced from Asia, and widely planted for wildlife habitat and as a living fence. It is intolerant of shade and prefers drier sites. It spreads by animal-dispersed seeds and can form dense stands in barrens and wildlife openings shading out forbs and grasses. It currently occupies only one location in the WMNF in a natural opening created by a blow-down. It is widespread to the west and south of the Forest and we anticipate further infestations of this species along edges and in old fields in and around the Forest.

3.3.1.2 Herbaceous Species

Bishopsweed, Goutweed or Snow-on-the-mountain (*Aegopodium podagraria*)
Bishop's goutweed is a perennial that is planted as ground cover around homes. It can escape into forest edges and takes over forest openings especially old homestead properties. It spreads via rhizomes.

Garlic mustard (*Alliaria petiolata*)
Garlic mustard is a biennial that can spread prolifically in undisturbed forest under a full canopy. The toothed leaves of the first-year rosettes resemble violets and give off the odor of garlic when crushed. These rosettes remain green through the winter, flowering early in the spring. The white-flowered second year plants are 1 to 4 feet tall. It easily out-competes native forest plants by monopolizing light, moisture, nutrients, and space. Garlic mustard tends to form dense patches. Seeds remain viable for five to seven years (Tu et al. 2001). This plant is a major threat to the woodland flora our region. It is abundant to the west and south of the Forest. The WMNF has only a single mapped infestation of this species.

Garlic mustard (*Alliaria petiolata*)

Wild chervil (*Anthriscus sylvestris*)
Not yet documented from the WMNF, this species is rapidly spreading throughout a variety of habitats open habitats in western and northern New England. Primarily an invader of open lands such as roadsides and hay fields it is spreading via the interstate system towards NH and the WMNF. This species is a member of the carrot family (*Apiaceae*) and strongly resembles Queen Anne's lace and other members of this family with fern like leaves and white, flat-topped inflorescences. This species is a target for early detection and rapid response efforts.

Narrow-leaved bittercress (*Cardamine impatiens*)
Not yet documented from the WMNF, this biennial species is rapidly spreading throughout a variety of habitats in New England. The habitats from which it has been documented vary from dry calcareous ridges in Vermont to shady moist stream banks in Connecticut. A member of the mustard family this plant has heavily dissected leaves that clasp the main stem and small white flowers that appear in early spring. This species is a target for early detection and rapid response efforts.

Spotted knapweed (*Centaurea biebersteinii*)
This species is found along roadsides and in openings across the forest and in the surrounding landscape. It crowds out native forbs and can contribute to erosion due to its poor root system. Treatment priority would be given to this species due to its currently limited distribution on the Forest.

Thistles (*Cirsium arvense and C. palustre)*
Although not widespread in or around the WMNF, these species have the potential to impact wetland and wildlife opening resources on a large scale. Due to their current limited distribution these species will be targeted for early detection and rapid eradication efforts whenever located. Canada thistle is native to Europe, not Canada as the name suggests. It is a dioecious perennial that can spread 10-12 feet in one season to form clones that crowd out native plants. Swamp thistle is a biennial that invades disturbed, moist areas.

Swallowworts (*Cynanchum rossicum* and *C. nigrum*)
These two nearly identical species can only be distinguished when they are in flower in early summer. They are members of the dogbane family (Apocynaceae), the same family to which milkweeds belong. In fact, the fruiting body of these species closely resembles that of milkweed. The swallowworts are perennial vines that smother and suffocate surrounding vegetation. No current locations are known on the WMNF, but there are multiple infestations of both species on lands adjacent to the WMNF. This species is a target for early detection and rapid response efforts.

Spurges (*Euphorbia esula and E. cyparissias*)
Neither of these species has documented locations on the WMNF. Both are highly invasive in other parts of the northeast and several infestations of both species have been identified from the local area. Due to their current limited distribution these species would be targeted for early detection and rapid eradication efforts whenever located. The species are similar in appearance and habitat preference in the eastern United States with leafy spurge being slightly larger and ranging into drier conditions. Both have very deep roots (15 feet), are allelopathic, crowd out native plants, and are unpalatable as wildlife forage.

Giant hogweed (*Heracleum mantegazzianum*)
This aggressive European weed invades open, disturbed areas. The plant juice contains a chemical that causes severe blistering of the skin of humans and animals when exposed to light. It is persistent on sites that remain disturbed and is especially undesirable at campgrounds and boat landings. It resembles cow parsnip, and other members of the Carrot family (Apiaceae). It is currently not known from any locations in or around the WMNF. This species is a target for early detection and rapid response efforts.

Dame's rocket (*Hesperis matronalis*)
This biennial species is similar to garlic mustard in its habitat preferences. This species has been spread due to its use in wildflower meadow mixes and now poses a threat to wetland, open, and riparian habitats on the WMNF. It grows in great abundance in several wildflower plantings along interstates leading to the WMNF. It is currently not known from WMNF lands and is therefore a target for early detection and rapid response efforts.

Yellow-flag iris (*Iris pseudoacorus*)
Yellow-flag iris is a popular ornamental that frequently escapes via water into stream and river systems or wetland habitats. It is easily recognizable due to its yellow flowers (the only yellow flowered iris growing in the wild in the WMNF). Numerous infestations of this species are found on and adjacent to WMNF lands.

Moneywort (*Lysimachia nummularia*)
Moneywort is an invader of wetland, stream bank and moist woodland habitats. It has paired leaves along a creeping rhizome and a comparatively large yellow flower in late spring. It has a limited distribution in and around the WMNF typically associated with nearby old homestead sites.

Purple loosestrife (*Lythrum salicaria*)
This highly invasive plant was originally introduced as a garden ornamental, is very aggressive in wetlands. It crowds out native plants and it does not provide preferred food or cover for wildlife. It has a very limited distribution on the WMNF, but is becoming more abundant on the surrounding lands.

True forget-me-not (*Myosotis scorpioides)*
This species is an invader of wetland and stream bank habitats. It has pale blue flowers with a yellow center that arise from a central stalk above alternate hairy leaves. It has a limited distribution in and around the WMNF typically associated with nearby old homestead sites or wet areas of trails and old roads.


Purple loosestrife (*Lythrum salicaria*)

Japanese knotweed (Polygonum cuspidatum)
This member of the buckwheat family is a creeping perennial with bamboo-like stems and creamy white flowers. The creeping rhizomes spread rapidly, and new plant colonies can grow from small fragments carried downstream. The roots provide poor erosion control making this plant a threat to riparian areas. This species is the most abundant NNIS on the WMNF and in the surrounding landscapes. It primarily occupies roadsides, and river and stream banks.

Mile-a-minute vine (*Polygonum perfoliatum*)
This species is an annual vine distantly related to Japanese knotweed. It has triangular bluish leaves, stems covered with small re-curved barbs, and produced a blue fruit in mid to late summer. The nearest documented location for this species in northwestern Connecticut, but it is a prolific seed producer and is somewhat cryptic. The seeds are bird dispersed. It is anticipated that this species may infest the WMNF within the next 10-15 years. This species poses a significant risk to wildlife openings, edges, and post timber harvest areas if it becomes established. It is a target for early detection and rapid response efforts.

Fig butter cup (*Ranunculus ficaria*)
This species is a small ephemeral member of the buttercup family with a large yellow flower in early spring. The leaves typically wither and die by mid summer. The plant spreads primarily via movement of underground bulblets that are moved by spring or fall flood waters. It can also

spread via seed. It is currently not known from any locations in or around the WMNF. This species is a target for early detection and rapid response efforts.

Bittersweet nightshade (*Solanum dulcamera*)
This species is a small woody vine that typically occupies disturbed forest openings, edges and open lands. The vine has odd spade-shaped leaves, distinct purple flowers with strongly re-curved petals, and a foul odor when crushed. There are documented occurrences near the WMNF, but no mapped infestations of the Forest. It is suspected that this species does occur on the Forest, but it has yet to be documented. This is not a high priority NNIS, but if it were to be documented on the WMNF eradication efforts would be undertaken.

Coltsfoot (*Tussilago farfara*)
Coltsfoot is a member of the Aster family (Asteraceae). The flowers of this species strongly resemble those of dandelion and it is one of the earliest blooming plants in the spring. The large deltoid shaped leaves arise after the flowers. This species is ubiquitous on the WMNF along stream banks, in seeps and along roadway edges. Its impact on native plants and native plant habitats is somewhat in question. Widespread control of this species on the WMNF is not feasible; however site specific control efforts are desirable when specific resources are threatened by this species.

3.3.1.3 Grasses

Japanese stiltgrass *(Microstegium vimineum)*
This small grass runs along the ground rooting in at each leaf node. The species is difficult to identify until it is well established. It has lime-green leaves that taper evenly at both ends and a small stripe of reflective hairs down the mid-rib of each leaf. The plants also stand on stilt-like roots. This species can infest a variety of habitats including lawns, stream and river shores, wet meadows, moist openings and rights-of-way. Currently there are no known infestations on or near the WMNF. The nearest documented infestation is in Adams, MA. This species anecdotally appears to be moving along the Appalachian Trail and has spread from northern CT to northern MA in just two years. . It is anticipated that this species may infest the WMNF within the next 10-15 years. This species poses a significant risk to wildlife openings, edges, and post timber harvest areas if it becomes established. It is a target for early detection and rapid response efforts.

Common Reed Grass *(Phragmites australis)*
This large, non-native genotype of common reed grass invades wetlands and displaces species valued as forage for migratory wildfowl. It can grow 14 feet high and form dense mono-specific patches.

Reed Canary Grass (*Phalaris arundinacea)*
Highly aggressive, vegetatively spreading perennial grass invades wetlands, roadsides, and open lands. It is ubiquitous on the WMNF and in New England. Widely dispersed due to its use in conservation seed mix. It is suspected to have both native and non-native gene strains.

Reed Canary Grass (*Phalaris arundinacea)*

3.3.2 Rate of Spread

The increase in the number of weed infestations on the Forest is largely unknown. Additional infestations are documented on an annual basis, but it is unclear whether these represent new infestations or simply newly documented infestations. It is suspected that most new infestations discovered on the WMNF are likely the result of an increased and organized survey effort that has been on-going since 2001. Yet, increasingly areas outside the Forest boundary are becoming more heavily infested with NNIS, thereby creating a more readily abundant and available seed source for NNIS expansion onto the WMNF. Although the level of infestation in the White Mountain region remains low in comparison to more developed regions in southern New Hampshire, Massachusetts, and Connecticut, the level of infestation is certainly on the rise.

Nationally, the rate of spread has been estimated at 3% per year (National Invasive Species Council 2001) and at 8-12% per year (USDA FS 1999 Stemming the Invasive Tide). The national rate of spread is an average that does not take into account localized variables such as rainfall, temperature, plant hardiness zones, NNIS species composition, and other factors that alter the rate from geographic region to geographic region. Locally there is no reliable data available to develop a localized rate of spread for the WMNF or northern New England. Given the climate and landscape condition of the Forest, and the comparably low level of current infestation, it is anticipated that the rate of spread for the WMNF is on the lower end of the national scale. At a rate of spread of 3 percent per year, if no control was undertaken, infestations on the WMNF would increase by roughly 50% in ten years and nearly double in size and distribution in twenty years.

Concerted efforts to control existing and future infestations of NNIS at the proposed rate of control (10-50 acres annually) would allow for an immediate reduction in the number of infested acres on the Forest, but would likely not result in the complete eradication of NNIS from the WMNF. There are many variables that effect the outcome of rate of spread modeling for NNIS. Applying a 3% rate of spread over a ten year period, with a control rate of 50 acres per year, and not considering any other factors, indicates that there would be a slight increase in the number of acres infested on the WMNF. However, this result is impacted by an adjustment of any number additional factors, primarily annual project selection. By targeting NNIS species with the largest seed production and rates of viability, it is possible to reduce the rate of spread. Increasing the number of acres treated annually also has a dramatic effect on the overall rate of spread.

3.3.3 Past Control Efforts

Small scale, annual control efforts involved hand-pulling, cutting, or digging individual NNIS plants. These efforts have been typically associated with other management goals, such as wildlife opening maintenance. Efforts to hand pull and dig the non-native honeysuckle at the Saco Ranger District have been on-going since 2002. Two other specific projects have been approved in their own decisions. The first is an NNIS Biological Control Project signed on April 5, 2005 to control purple loosestrife with beetles on NH State Highway 16 between the Rocky Branch and Glen Ellis parking approximately 10 miles south of Gorham, NH. It is too early to effectively gauge the effectiveness of this project, however a recent field review of this site confirmed the continued presence of beetles, indicating a successful over-wintering following their release. The second decision (not yet implemented) signed on May 6, 2005, is for the Popple Vegetation Management Project and includes actions to treat NNIS plants on approximately four acres within the project area using either chemical or hand-treatment methods.

3.4 Native Plant Communities - the White Mountain National Forest supports a diverse mixture of native plant communities; including five Outstanding Natural Communities: montane circumneutral cliffs and associated talus slopes, old growth enriched upland forest, northern white cedar - hemlock swamp, northern white cedar seepage forest, and pitch pine - scrub oak woodland (USFS 2006). Native plant communities range from alpine to enriched hardwood forest to acidic fens and open bogs. Most native plant community types are potentially susceptible to NNIS infestation under suitable conditions. These conditions include availability of a seed or propagule source, occurrence of natural or human-induced disturbance, and appropriate climate conditions for the NNIS. Several communities are likely to remain NNIS-free into the foreseeable future because they lack suitable conditions. These include alpine and sub-alpine habitats where climate conditions and an available seed or propagule source is not readily available and highly acidic bogs and poor fens where nutrient levels may be so poor as to prevent NNIS infestation.

Most native plant communities on the WMNF are currently free of NNIS. Currently only those native plant habitats that receive significant disturbance, such as river and stream banks, openings, mid to low slope forested areas, edges, and wetlands contain infestations.

3.5 Wildlife - wildlife on the WMNF occupy a range of different habitat conditions, from windswept alpine mountaintops to dense softwood valleys. Disturbed, open habitats such as managed wildlife openings and road corridors are more likely to be infested with non-native invasive plant species (NNIS), although there is a possibility that some species may also be found in mature forest habitats or under closed canopies. For this project, it is assumed the harsh weather conditions of the alpine zone make it unlikely NNIS would occur there.

The only issue related to wildlife was the concern raised regarding consequences of chemical application. In order to cover a wide range of species, effects analysis will focus on four species groups: mammals, birds, amphibians, and invertebrates. In addition, effects to rare wildlife may be found in the effects to Threatened, Endangered, and Sensitive Species.

3.5.1 Mammals

Mammals on the WMNF include large animals such as moose, deer, and bear, and small animals such as red squirrels, mice, and voles. Mammals that are not considered rare are generally distributed throughout the Forest in suitable habitat. (Effects to rare mammals may be found in the Threatened, Endangered, and Sensitive Species section). Many types of habitats are used, including all ages of hardwoods and softwoods, managed wildlife openings, wetlands, and riparian habitats. Some mammals are specific in their habitat requirements, but many are found in a variety of habitats. NNIS are most likely to be found in open sunlight conditions where disturbance has occurred, so mammals most likely to be affected by this project are those that utilize wildlife openings (e.g., mice, deer), wetlands (e.g., beaver, muskrat), and other open habitats.

3.5.2 Birds

The WMNF provides a variety of habitats that support songbirds, raptors, and waterfowl. Some birds spend the entire year on the Forest as resident species; others are here only during the summer or winter. All of the treatments proposed in this project would be implemented between spring and fall; no winter migrants would be affected.

NNIS affect birds both positively and negatively. In some cases, fruiting shrubs and vines provide a food source and dense shrubs can offer protected nesting sites. On the other hand, NNIS can dramatically alter the existing native plant community, reducing or eliminating other food or cover sources such as grasses or herbaceous wetland vegetation. Birds are especially keyed to structural conditions for nesting and cover, and NNIS infestations can drastically alter existing habitats.

3.5.3 Amphibians

The WMNF provides a variety of habitats that support amphibians in both terrestrial and aquatic habitats. NNIS may especially affect this group of species because wetland habitats on the WMNF are somewhat limited naturally. Because of this, evaluation of effects will focus specifically on wetland situations. Because of widespread reporting of frog/tadpole abnormalities (e.g., hind leg deformities), it is assumed that frogs are more susceptible to environmental changes.

3.5.4 Invertebrates

There are a wide range of invertebrate species that occupy the WMNF. Effects to rare species may be found in the Threatened and Endangered Species section. The standard invertebrate species used to evaluate effects from chemical treatments is the honeybee, so that species will be used as an indicator for all effects here.

3.6 Soils - the White Mountain National Forest has a vast array of soils. Soils at higher elevations - generally above 2,500 feet - tend to be moderately deep to shallow and on steep terrain. They are often very bouldery. Soils at moderate to low elevations - generally less than 2,500 feet - are usually deep, and well- or moderately well-drained sandy loams, fine sandy loams, and sands. Soil erosion hazards range from low to high erosion potential.

3.7 Aquatic Environment - the aquatic environment on the White Mountain NF includes over two thousand miles of perennial and intermittent streams, hundreds of acres of lakes, ponds, and wetlands, as well as numerous springs and seeps. Additional details about these features can be found in the White Mountain NF Land and Resource Management Plan Final Environmental Impact Statement (USDA Forest Service, 2005b). These water resource features are superimposed on a landscape of igneous and metamorphic rock smoothed by glaciers and covered, in large part, by surficial glacial materials such as till.

The WMNF comprises a portion of nine hydrologic units at the 8-digit Hydrologic Unit Code scale known as sub-basins. These are the Upper and Lower sub-basin of the Androscoggin River, the Saco River, the Pemigewasset River, the Presumpscot River/Casco Bay, and four different sub-basins of the upper Connecticut River. Within these larger watersheds, there are 24 ten-digit hydrologic unit codes, known as watersheds which range in size from 75 – 308 square miles. Forest Service ownership in these watersheds varies from less than 1% to 98%. (USDA Forest Service, 2005b).

Water quality on the Forest generally meets water quality standards except for a few locations related to bacterial contamination and some atmospheric deposition effects (USDA Forest Service, 2005b). All surface waters in New Hampshire and Maine are listed as impaired due to mercury related to atmospheric deposition. Currently, no water resource features within the White Mountain National Forest are listed as not meeting water quality standards due to the presence of herbicides or sediment.

Public water supply watersheds in the Forest are described in the FEIS (USDA Forest Service, 2005b). Public water supply systems are those drinking water systems, publicly or privately owned, that serve at least twenty-five people or fifteen service connections for at least sixty days per year. There are sixty-seven public water supply intakes on the White Mountain National Forest that serve over 39,000 people with high quality drinking water. Only 6 percent are surface water sources. In addition, there are numerous smaller water supply sources which supply single households, most of which are managed through a special use permit. A large portion of these smaller systems utilize surface water, usually a spring.

3.8 Aquatic Organisms - aquatic habitats within the White Mountain National Forest are home to some 18 species of amphibians and approximately 20 species of fish. In addition countless species of macroinvertebrates are also found within these waters. The majority of habitat on the Forest is coldwater streams which are home to roughly six species of fish and roughly half of the amphibian species found throughout the entire Forest. Other habitats include vernal pools, small ponds, lakes, and wetlands.

3.9 Threatened, Endangered and Sensitive (TES) Species – a separate Biological Evaluation was completed for this project and assessed potential effects to seven species listed as threatened or endangered under the Endangered Species Act. Potential effects were also considered for some 66 additional plant and animal species designated as Regional Forester sensitive species, a Forest Service assignment designed to identify and conserve rare species in order to avoid federal listing as threatened or endangered. Of these 73 total species, 42 (12 animals and 30 plants) were analyzed in detail as potentially being affected by this project. The other species are found in alpine, subalpine, or aquatic habitats not expected to be impacted by terrestrial NNIS in the next 10 years, therefore there would be no effect to them from any alternative in this project.

No TES species is currently being impacted by NNIS occurrences on the WMNF. More detailed information concerning habitat requirements and evaluation of the potential for these species to be affected by NNIS is available in the *Biological Evaluation of the White Mountain National Forest Non-Native Invasive Plant Control Project on Federally Endangered, Threatened, and Proposed Species and Regional Forester Sensitive Species* (Prout and Mattrick, 2006). Additional details on these species is also located in the Biological Evaluation (BE) and Species Viability Evaluation (SVE) analysis appendix conducted as part of the 2005 Forest Plan (Prout 2005, USDA Forest Service 2005b).

3.9.1 Federally Listed Animals

3.9.1.1 Timber Wolf, Eastern Cougar, and Canada Lynx

These three mammals are addressed together because, for the purpose of this project analysis, they share similar habitat characteristics. All are wide-ranging predators who are most limited on the WMNF by prey abundance and distance to source populations. Canada lynx prey almost exclusively on snowshoe hare, while wolves and cougars prey on deer and moose. Lynx are found in softwood and mixed wood types, especially in regenerating or thick, dense conditions where snowshoe hare are most abundant. Lynx denning habitat can be of any forest type, but is generally found in mature stands where natural disturbance events such as windthrow create blowdown or 'jackstrawed' trees. Wolves and cougars use a variety of timber types, most often tied to the prey they hunt. All three were considered extirpated from the Forest until last year, when Canada lynx tracks were confirmed in the northern part of the Forest (Pilgrim and Schwartz 2006).

3.9.1.2 Indiana bat

Indiana bat habitat consists of fairly open hardwoods, especially those that offer cracked or peeling bark for roosting. Hickory, black locust, and elm are considered optimal roost tree species. In the northeast, Indiana bats are most prevalent in the Lake Champlain Valley, a mosaic of open farmlands, small woodlots, and slow-moving streams. In terrestrial habitats, Indiana bats feed primarily on moths and beetles (Kurta and Whitaker 1998).

A single Indiana bat record exists for the WMNF from 1992. Survey effort since that time has not produced another individual nearby. Evidence summarized in Prout (2005) shows additional occurrences of Indiana bats here would be unlikely, primarily due to distance from winter hibernacula and lack of optimal roosting habitat.

3.9.2 Federally Listed Plants

3.9.2.1 Small Whorled Pogonia

Suitable habitat for small whorled pogonia is unremarkable woods consisting of mixed hardwood and softwood species with a strong component of oak, eastern white pine, and paper birch. The species is not known, nor is it predicted to occur on enriched soils or in forests dominated by spruce/fir. Predictive models indicated that suitable habitat for small whorled pogonia on the WMNF exists in limited quantities and is restricted to areas south of route 302 (Sperduto, 1993).

Two small populations are known from the Forest and neither is currently infested with NNIS, although the habitat type is susceptible to infestation.

3.9.3 Regional Forester Sensitive Animals

No Regional Forester sensitive species is currently being impacted by NNIS occurrences on the WMNF. The affected environment of individual species are discussed separately in the following subsections.

3.9.3.1 Eastern Small-Footed Bat

Little information is available about eastern small-footed bats in New England. They are generally found in hilly or mountainous areas in both deciduous and coniferous forests. In winter, eastern small-footed bats appear to prefer more severe environmental conditions than other hibernating bats, seeking out dry passages in relatively cold caves where temperatures drop below freezing and humidity is low (Barbour and Davis 1969). Forested conditions may be important near hibernacula in influencing humidity and temperature levels within the hibernacula (Erdle and Hobson 2001).

In summer, maternity roosts have been found under rocks on hillsides and open ridges, in cracks and crevices in rocky outcrops and talus slopes, beneath the bark of dead and dying trees, and in buildings (Webb and Jones 1952, Hitchcock 1965, Tuttle 1964, Barbour and Davis 1969, Handley 1991, Whitaker and Hamilton 1999). Stone walls may also be used for roosting (SVE Mammal Panel 2002). Although this species has been reported roosting under tree bark, the significance of trees or snags as potential roost habitat has yet to be determined (SVE Mammal Panel 2002). Proximity to water may also be important for roost site location (Erdle and Hobson 2001).

Based on other similarities in known behavior between western and eastern small-footed bats, it is assumed that eastern small-footed bats mostly feed over ponds and along stream margins in woodlands, as well as along cliff ledges, catching similar prey such as moths, flies, caddisflies, beetles, true bugs, and leafhoppers (Choate et al. 1994, Bat Conservation International 2001).

Occurrences on the WMNF are sparse. Eastern small-footed bats have been recorded in the Bartlett Experimental Forest (M.Yamasaki, pers. com. 2003) and the closest known hibernaculum is near the WMNF boundary in Gorham, NH. In 2004, 3 bats were captured at two different sites on the Forest (Bat Conservation and Management 2004).

3.9.3.2 Northern Bog Lemming

Habitat for northern bog lemmings is described as mossy spruce woods, low elevation spruce-fir, hemlock and beech forests, sphagnum bogs, damp weedy meadows, and alpine sedge meadows DeGraaf and Yamasaki (2001). Underground burrows and shallow surface runways are used to move within their home range, which is presumably very small. Home range size of southern bog lemmings (*Synaptomys cooperi*), a related species, is estimated at 0.11-0.14 acre (Getz 1960).

Northern bog lemmings are considered extremely rare in New England. This may be due in part to the difficulty in confirming subspecies identification. There is one extant occurrence of this species from the WMNF, although two other historic occurrences are also known (summarized in DeGraaf and Yamasaki 2001). They are widely separate from each other.

The area for cumulative effects analysis is the WMNF because the Forest supports the majority of the known occurrences in the local area.

3.9.3.3 American Peregrine Falcon

Peregrine falcons nest on high cliffs or ledges often overlooking riparian habitats. Peregrines usually occupy the same cliff each year arriving back at the eyrie site between March and April. Courtship begins and eggs are generally laid in April to early May with young fledging in early to mid-July. Medium-sized birds are the major food item taken by peregrine falcons. Falcons require an area with abundant prey and often nest on cliffs overlooking riparian habitat. Because prey is taken in flight, openings may be beneficial, especially near riparian areas.

Peregrine falcons have steadily increased in population size and have recolonized historic eyeries on the WMNF.

The area of cumulative effects analysis for peregrine falcons is the WMNF and towns immediately surrounding the Forest. Many active peregrine eyeries are located close to the edge of the Forest boundary (both inside and outside of the boundary). Incorporating town boundaries will allow the analysis to include these features without having the scale of analysis exceed a reasonable size.

3.9.3.4 Common Loon

Common loons breed on lakes with adequate fish resources for foraging. Nesting can occur on small ponds, but loons are generally found on larger lakes, especially with islands that are more protected from nest predators. Since loons are fairly heavy birds, larger lakes also provide a longer take-off distance. Clear water to a depth of 10 feet is essential for foraging, as is an area of shallow water for teaching young to forage (SVE Bird Panel 2002, Fichtel 1985, Strong 1985). Young rearing areas tend to be less than two meters (6.5 feet) deep and less than 150 meters to land.

The Forest's potential loon habitat is very limited. In the last decade, the WMNF has not supported more than 3 territorial pairs at once (K. Taylor, pers. com.)

The area of cumulative effects analysis for common loons is the WMNF. Loon habitat is discrete and unconnected from other large waterbodies nearby, therefore analysis can focus on habitat within the Forest.

3.9.3.5 Wood Turtle

Wood turtles use a variety of aquatic and terrestrial habitats. Winter is spent hibernating in slow-moving streams, rivers, and some ponds. In spring, turtles emerge from hibernation and females search for upland nest sites with open canopies and sandy or gravelly substrates. In addition to natural nesting sites such as sandbars, cut banks, or other eroded features, manmade sites such as gravel pits, railroad beds, and road grades have also been used (Brooks et al. 1992, Buech et al 1997).

Although wood turtles usually stay in the vicinity of permanent streams, they will spend much of the summer season in upland habitats, including bogs, wet meadows, upland fields, farmland, and deciduous forests (Harding and Bloomer 1979, DeGraaf and Yamasaki 2001). A variety of grasses, forbs, shrubs, and vines are used for food and cover from predators.

The area of cumulative effects analysis is the WMNF and the towns that surround it. Wood turtle habitat is somewhat limited on the Forest. Some sites, however, are connected to other suitable areas just outside the Forest boundary. This analysis area will allow a more reasonable evaluation of the effects to the population.

3.9.3.6 Boulder Beach Tiger Beetle

Habitat conditions from Leonard and Bell (1999) and Wilson and Larochelle (1999) were documented as part of the Forest Plan revision process (WMNF 2005) and summarized here. Boulder beach tiger beetles are found along the margins of clear, clean mountain streams to moderate-sized rivers with some degree of shading. Adults prefer sandy areas near the water, always without vegetation, but sometimes with cobble present. Larvae are found primarily in sandy-loam soil, often some distance from the water's edge.

No recent occurrences are known from the WMNF. However, the majority of the historic records and all of the recent records in New Hampshire have been from rivers that are bounded on one or both sides by the WMNF, or are close to the Forest's boundary (WMNF 2005).

The area of cumulative effects analysis for boulder beach tiger beetle includes the 12-digit subwatersheds encompassing the Forest. Using watersheds is reasonable for evaluation of a stream species and the subwatershed level will allow the analysis to include suitable habitat just outside the boundary of the Forest.

3.9.3.7 Warpaint Emerald

The habitat for this dragonfly includes bogs, fens, and heaths. Breeding requires small pools of open water (e.g., human footsteps in saturated moss) where eggs are laid. Limited observations suggest adults may focus on small temporary pools rather than permanent areas of open water. Adults will travel relatively long distances (6 miles/day), which may be necessary to find appropriate breeding conditions (Natureserve 2006).

Only one recent (2001) occurrence of this species is known, from a bog.

The area of cumulative effects analysis is the WMNF. Although there are suitable habitats outside the Forest, only one occurrence is known and these are not the habitats where NNIS are currently abundant.

3.9.4 Regional Forester Sensitive Plants

3.9.4.1 Missouri Rock-cress, Robbins' Milk Vetch, Scirpus-like Sedge, Piled-up Sedge, Fogg's Goosefoot, Prairie Goldenrod, White Mountain Silverling, Douglas' Knotweed

The habitat for these species includes typically open, dry sunny locations with limited soil accumulation and often low in organic matter. These habitats include talus slopes, rocky outcrops, balds, ledges, and cliffs. There are typically few occurrences of each species on the WMNF due to either limited habitat or small areas of suitable growing conditions within appropriate habitat. Population numbers are typically low at each site, but in some instances as with prairie goldenrod can number in the thousands at one location. These species occur across the Forest from the Appalachian Trail corridor in Lyme, NH to Square Dock Mountain in Stoneham, ME. Several of these species have anomalous occurrences in atypical habitats on the WMNF. For example, White Mountain silverling, which of this complex of plants has the largest number of populations on the WMNF, occupies mostly rock outcrops or talus slopes in full sun. However, it does have several other occurrences along the cobbly shores of the Saco River. These anomalous populations although interesting from an ecological viewpoint do not alter the analysis of this species as a denizen of rock outcrops.

The habitats occupied by this complex of species are not considered at high risk of invasion by NNIS at the present time. They are typically dry, and both nutrient and soil depauperate. These conditions do not favor a wide variety of NNIS, but due to the proximity of these habitats to hiking trails and there tendency to be subject to natural disturbances such as colluvial action and wind and ice scour they are analyzed.

3.9.4.2 Goldie's Fern, Butternut, Mountain Sweet Cicely, American Ginseng, Pink Wintergreen, Sweet Coltsfoot, Three-leaved Black Snakeroot

The RFSS species listed above occupy enriched forested sites. The habitat is typically mesic to moist, heavily shaded and high in both nutrients and organic matter. It is often underlain by calcareous bedrock. There is typically a deep layer of decaying leaves and more often than not the species contained within this complex are found on lower slopes or at the toe of a slope. Tree species associated with these sites are sugar maple, white or green ash, basswood, and northern white cedar. The habitat for these species occurs primarily on the Pemigewasset Ranger District, but pockets of suitable habitat and occurrences occur on all districts. When encountered individuals of these species are often found in large numbers and widely scattered across the suitable habitat, making accurate inventory difficult. Equally frustrating is the absence of these species from seemingly suitable if not perfect habitat.

The habitats occupied by this complex of species are considered at high risk of invasion by NNIS at the present time. The enriched soils are suitable for rapid growth and colonization by most NNIS that threaten the WMNF. Due to the lower elevation of this general habitat type it is also host to a variety of Forest recreation and timber activities. These ground disturbing activities create highly suitable habitat for NNIS invasion.

3.9.4.3 Bailey's Sedge, Wiegand's Sedge, Anderson's Sphagnum, angerman's Sphagnum, A Sphagnum, Adders Tongue Fern

The RFSS species listed above occupy moist open lands. The habitat is typically moist to wet, exposed to full sun and high in organic matter. The nutrient levels at sites vary from highly enriched roadside ditches to quite poor fens and bogs. Habitats found within this complex include roadside ditches, pond margins, bogs, fens, marsh lands, and wet meadows. Habitats for these species occur across the WMNF in highly disturbed as well as remote areas. Individuals of these species are found in varying numbers in often very concentrated populations when located. Most have highly specific ecological requirements even within suitable habitat. These species are difficult to locate and most are hard to identify.

The habitats occupied by this complex of species are considered at high risk of invasion by a small number of NNIS at the present time. The high soil moisture content and frequent proximity to natural or human induced disturbance make these habitat susceptible to invasion by common reed, Japanese knotweed, purple loosestrife and several shrub species including glossy buckthorn in particular.

3.9.4.4 Broad-leaved Twayblade, Heart-leaved Twayblade, Northern Comandra

The RFSS species listed above occupy moist, shaded habitats and forested seeps, and other shaded wet sites. Some records do exist from more open areas but in the WMNF nearly all sites are moderately to densely shaded. The species typically occur on acidic to intermediate soils, but heart-leaved twayblade is known to occur on more basic soils. Habitats found within this complex include shaded bogs and fens, forested seeps, wet cold woods, coniferous shrub swamps, and krummholz. Habitats for these species occur across the WMNF, but most known occurrences are found on the Saco and Androscoggin Ranger Districts. Individuals of these species are found in varying numbers in often very concentrated populations when located. Most have highly specific ecological requirements even within suitable habitat. These species are often difficult to locate and population numbers can vary greatly from year to year.

The habitats occupied by this complex of species are considered at low risk of invasion by NNIS at the present time. Acidic nature of many of the soils supporting these species discourages invasion by many NNIS. Furthermore, most known occurrence are located in remote areas not subject to high levels of disturbance (although some do exist along hiking trails) or in close proximity to source populations of NNIS.

3.9.4.5 Autumn Coralroot, Nodding Pogonia

These two RFSS species typically occupy non-enriched hardwood forest sites on the Saco Ranger District although either species has the potential to occupy any such woodland type across the entire Forest. Both species are orchids, and thus have peculiar life histories making accurate and annual monitoring a challenge. Both species vary greatly in population numbers, and sometimes locations from year to year. This variance in location is due to the ability of an individual to lay dormant underground for several consecutive years prior re-emerging. A dramatic drop or increase in collected population numbers does not indicate an actual decline or increase in the population. Only long-term monitoring accurately reveals the true population status of an occurrence of these species. Autumn coralroot occupies unremarkable hardwood dominated forests. There are few, if any habitat preference indicators for the species. Encounters with it are random and unpredictable. Rare are more than a handful of individuals found at any single location. On the other hand, Nodding pogonia has very specific habitat preferences. On the WMNF and at other New England occurrences it occupies south facing slopes in American beech dominated forests, occurring only in areas of deep beech leaf build up on the forest floor.

The habitats occupied by this complex of species are considered at moderate to high risk of invasion by NNIS at the present time. The soils are often suitable for rapid growth and colonization by most NNIS that threaten the WMNF. Additionally, this general habitat type it is also host to a variety of Forest recreation and timber activities. These ground disturbing activities create highly suitable habitat for NNIS invasion.

3.9.4.6 Auricled Twayblade

This RFSS species occupies temporarily flooded and seasonally ice-scoured riverbanks in northern forests. The species is typically associated with sandy alluvial or outwash soils that are often sparsely, or completely unvegetated. It is largely intolerant of shade, but is occasionally over hung by alders or dogwoods along a river or stream bank. The plants are small and often difficult to locate in large stretches of seemingly suitable habitat. Due to the disturbance prone nature of its habitat, populations of this species are occasionally naturally extirpated or transported by river action and ice scour.

The habitats occupied by this complex of species are considered at moderate to high risk of invasion by NNIS at the present time. Some of the most abundant and highly invasive species known to exist on the WMNF occur in this habitat type including Japanese knotweed, common reed, and purple loosestrife. The high level and intensity of natural disturbance also creates suitable habitat for NNIS invasion.

3.9.4.7 Canada Mountain Rice Grass

The habitat for this species includes open, dry sunny locations with a sandy or rocky substrate often low in organic matter. These habitats include sandy roadside, exposed ledges, open woodlands, young woods, open shrublands. There is only a single occurrence on the WMNF where the species is at the edge of its natural range.

The habitat occupied by this species is considered at high risk of invasion by NNIS at the present time. They are typically dry, and both nutrient and soil depauperate, conditions that typically do not favor NNIS invasion. In this case, the known occurrence is roadside and the high level of disturbance experienced by this habitat makes it subject to invasion.

3.10 Environmental Justice - in accordance with E.O.12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,* Minority Populations, Low-Income Population and Indian Tribes were considered in the analysis. There are no known identifiable groups of minorities or Indian Tribes living within the vicinity of the analysis area. As this is proposed to be a Forest-wide project, locations of low income populations are scattered throughout the Forest and surrounding areas and are reflective of the economic range found within the counties the Forest occupies.

4.0 Environmental Consequences

This Chapter discloses the environmental impacts that would occur by implementing each alternative described in Section 2. It presents the scientific and analytical basis for the comparison of alternatives presented in Table 2-5.

Unless otherwise stated, the analysis area for direct and indirect effects is the White Mountain National Forest. Since all of the proposed actions considered in this analysis would only occur on the Forest, and they would typically address relatively small, localized infestations dispersed throughout the Forest, it is appropriate to focus the analysis area for direct and indirect effects to the Forest. The temporal scale of the direct and indirect effects analysis is from this decision to 10 years into the future. This is the anticipated length of time for which a decision based on this analysis will be relevant and any proposed actions will take place.

Additionally, unless otherwise stated, the analysis area of cumulative effects is Grafton, Carroll, and Coos Counties, NH and Oxford County, ME. The temporal scale of analysis is 10 years previous and 10 years into the future from this decision. Ten years in the past coincides with the point in time at which non-native invasive species management became a higher priority on the Forest and 10 years into the future is the anticipated length of time for which a decision based on this analysis will be relevant.

4.1 Alternative 1 (No Action) - under the No Action Alternative, with the exception of two on-going NNIS control projects, no additional projects would be considered. This alternative serves as a basis of comparison for the two action alternatives.

4.1.1 Effects to Non-Native Invasive Plants (Alt. 1)

<u>Direct and Indirect Effects to NNIS Plants (Alt. 1)</u> - existing NNIS infestations would continue to persist at all currently mapped and as yet undiscovered locations. These infestations would continue to spread vegetatively and via seed at their current locations. Seed and propagule dispersal to new locations would occur over time creating additional infestations at currently un-

infested locations. NNIS prevention practices, such as equipment cleaning and educational activities may somewhat limit new introductions to the Forest. It is expected that NNIS would be present in ever increasing numbers on the Forest and spread into currently un-infested, less disturbed and higher quality ecological habitat.

Cumulative Effects to NNIS Plants (Alt. 1) - under Alternative 1, none of the 183 infestations currently mapped or future infestations on the Forest would be treated. Although NNIS currently occupy a small percentage of the overall Forest (less than 1%), this percentage would increase in abundance and distribution over time. NNIS infestations would continue to spread at their current locations and disperse themselves via wind, birds, and animals (including humans and associated activities) to new locations both on and off the WMNF.

At a rate of spread of 3 percent per year, if no control was undertaken, infestations on the WMNF would increase by roughly 50% in ten years and nearly double in size and distribution in twenty years. It is certain that without the implementation of control efforts, the number of acres infested would likely grow rapidly.

Other activities (timber harvesting, recreation, and other projects) taking place on the WMNF are not expected to change substantially from what has occurred historically or currently planned activities.

With the combination of no NNIS control taking place on the Forest, little control being implemented in the analysis area outside the WMNF, and increasing development surrounding the Forest, it is reasonable to conclude that NNIS would continue to spread throughout the region. The uncontrolled spread of NNIS from sources on and off the WMNF would allow for an increase in NNIS infestation and a general decrease in ecological function within the analysis area. This uncontrolled spread could, in turn, produce immeasurable negative effects to soil productivity

4.1.2 Effects to Native Plant Communities (Alt. 1)

Direct and Indirect Effects to Native Plant Communities (Alt. 1) - native plant communities near current and future infestations would likely decline (Horseley and Marquis 1982, Swearington 2004, National Invasive Species Council 2001). NNIS reduce diversity in natural communities primarily because they displace native components and are often able to out-compete native species for resources such as water, nutrients, and sunlight. Small structural or functional changes in plant communities caused by NNIS can have large impacts on natural ecosystems. When noxious weeds dominate over native plant communities, native plant species diversity is decreased. Noxious weeds can out compete native species because they produce abundant seed, have fast growth rates, have no natural enemies, and are often avoided by large herbivores. Some noxious weeds also produce secondary compounds, such as exotic buckthorns or spotted knapweed, which can be toxic to other native plant species, or animals. Weed infestation can therefore lead to a decrease in native plant species, which can alter the ability of wildlife to find suitable, edible forage. Failure to successfully control NNIS would result in continued infestation, thereby decreasing the diversity and abundance of native species and natural plant communities. The result of this increased area of infestation would be a decrease in ecological function across the Forest.

Cumulative Effects to Native Plant Communities (Alt. 1) - since none of the proposed NNIS control actions would occur under Alternative 1 and because most NNIS locations on private lands are currently not being controlled, the failure to control NNIS on the White Mountain National Forest could indirectly result in an increasing spread of NNIS throughout northern New Hampshire and western Maine, with associated adverse effects on native plant communities. Additional activities including housing and commercial development, forest management, and recreational activities in areas outside the White Mountain National Forest also have the potential to adversely effect native plant communities within the analysis area

4.1.3 Effects to Wildlife (Alt. 1)

Direct and Indirect Effects to Mammals (Alt. 1) - under Alternative 1, no direct disturbance to mammals would occur. NNIS infestations would continue to grow and spread on the WMNF. Mammals would not be directly affected by this, but could be indirectly affected as habitat components are modified. Loss of more palatable grasses and herbaceous forage as NNIS encroach may reduce food quantity or quality for herbivores, especially in wildlife openings. On the other hand, some fruiting NNIS such as Japanese barberry are likely spread by small mammals and may provide a food resource not previously available.

Some NNIS may change the structural composition of infestation sites, which indirectly could lead to changes in cover. Increases in brushy cover could provide improved habitat for small mammals and make predation more difficult for hunters. Alternatively, the homogenized communities often resulting from NNIS infestations may reduce cover provided by native plant communities, leading to the opposite effect.

Cumulative Effects to Mammals (Alt. 1) - the spatial scope of all wildlife cumulative effects analysis includes the WMNF and towns immediately surrounding it. Although this is an administrative boundary rather than an ecological one, it encompasses many potential NNIS source populations near the Forest (New England Wild Flower Society unpublished inventory data). The temporal scope of cumulative effects analysis includes the last 10 years (the time at which NNIS management was initiated for the WMNF) and the next 10 years (the life of this project's decision). Although effects may continue beyond this time, there are so many variables potentially affecting habitat (e.g., rates of disturbance, colonization by NNIS not currently occupying the WMNF, rates of spread, effectiveness of prevention and education programs, rates of other sources of mortality or survivorship, etc.) that to analyze effects to wildlife beyond 10 years would be purely speculative.

Many other actions have the potential to affect mammals. Development that eliminates habitats, actions such as timber harvesting that alter habitat (positively for some and negatively for others), and influences from human disturbance are some ways that mammals have been affected in the past and would continue to be affected in the future within the analysis area. Over the next 10 years, timber harvest, recreational use, and development outside the Forest would continue to alter habitat conditions. Other disturbances such as wind or ice storms, insect infestations (both native and non-native), and disease factors can affect mammals and their habitats. The lack of action to control NNIS would also lead to habitat changes as described above. These effects would most likely occur in disturbed and open areas such as wildlife openings, wetland edges, and along man-made corridors (e.g., powerline rights-of-way and roads). Some sites that currently provide suitable habitat would likely become infested as NNIS spread, leading to loss of foraging, cover, and denning habitat. This would have more effect on small mammals such as mice and voles that have small home ranges, but could also impact larger animals such as deer, moose, and bear that rely on native vegetation for forage. Although some additional fruiting sources may be provided by non-native invasive shrubs, more mammals would be negatively affected by the homogenization of habitats. The extent of these effects would depend on how close sites were to source populations of NNIS and how many other sources of food and cover these species have available within their home ranges. It is impossible to predict how quickly habitats would be altered by NNIS infestations or to know with certainty how much currently suitable habitat would be lost over the next decade, However, without any NNIS treatment, it is likely that habitat quality, especially for open habitats, would be visibly reduced.

<u>Direct and Indirect Effects to Birds (Alt. 1)</u> - Alternative 1 would result in similar effects to birds as those described for mammals above. Continued spread of NNIS would alter existing habitats, especially those that are more open and therefore more susceptible to NNIS infestation. Managed wildlife openings are often dominated by grassy or herbaceous vegetation. Infestations of NNIS shrubs or densely growing species such as Japanese knotweed could cause substantial habitat changes and reduce or eliminate suitable habitat. Wetland birds may be especially impacted as habitat is somewhat limited on the WMNF and some NNIS such as common reed (*Phragmites*) can completely engulf the open water area of a shallow wetland. This in turn may lead to structural changes that may eliminate nesting or foraging habitat for many wetland birds.

<u>Cumulative Effects to Birds (Alt. 1)</u> - cumulative effects for birds would be similar to those described for mammals above, since they are also affected by the same kinds of activities. Development would continue to reduce available habitats, although effects of this would be more obvious outside the Forest. Increasing human use levels have been noted as a potential stressor and cause of declining populations, but this has yet to be proven. Natural disturbance such as ice storms and wind events and human disturbance caused by timber harvest would continue to alter vegetative conditions, increasing habitats for some species and reducing it for others. Birds are functionally more mobile than small mammals, so it may be easier for them to find other suitable habitat, assuming it exists. However, open habitats (both upland and wetland) are somewhat limited on the WMNF and suitable habitats may not support additional individuals. NNIS has more potential than other actions to reduce habitat suitability over large areas on the WMNF. Over time, degradation or loss of these limited habitats could reduce local population viability of more uncommon species.

<u>Direct and Indirect Effects to Amphibians (Alt. 1)</u> - there would be no direct effects as a result of implementing Alternative 1. Indirectly, species that use wetlands may be especially vulnerable because these habitats are limited on the Forest. NNIS such as common reed (*Phragmites*) and purple loosestrife can drastically alter habitat conditions by choking out other native species. This in turn negatively impacts species that utilize wetland conditions for breeding and foraging. Amphibians may have a harder time moving through dense vegetation formed by NNIS and/or

may find suitable prey harder to find as reduced plant diversity affects their invertebrate prey base.

Cumulative Effects to Amphibians (Alt. 1) - wetland habitats are somewhat more protected than upland habitats from development and other activities due to implementation of State Best Management Practices and permitting requirements. On the WMNF, Forest Plan standards and guidelines also provide direction to conserve these habitats. However, over the next 10 years, it is expected that untreated NNIS infestations would lead to loss of habitat quality for amphibians. It is doubtful that such infestations would lead to the elimination of species from the WMNF in the next 10 years, but populations may be reduced. Assuming other suitable habitats outside the Forest would also be impacted by NNIS, local populations may become smaller and more isolated.

Direct and Indirect Effects to Invertebrates (Alt. 1) - the standard invertebrate species used to evaluate effects from chemical treatments is the honeybee, so that species will be used as an indicator for all effects here. There would be no direct effects to honeybees under Alternative 1. Indirectly, NNIS may expose a different pollen source as well as reducing existing sources of certain species, but it is not expected that this would have a measurable effect in the short term.

Cumulative Effects to Invertebrates (Alt. 1) - over the next 10 years, NNIS occurrences are expected to become more numerous throughout the analysis area. They would undoubtedly reduce the native pollen sources in site-specific locations. However, it is not expected that they would eliminate them all or reduce them to the level that honeybee populations would be measurably impacted.

4.1.4 Effects to Soils (Alt. 1)

Direct and Indirect Effects to Soils (Alt. 1) - the consequences of noxious weed infestation can include alteration of the structure, organization, or function of ecological systems (Olson, 1999). Noxious weeds can increase soil erosion, leading to a disproportionate loss of biologically active organic matter and nitrogen. Noxious weeds have the ability to deplete soil water and nutrients to levels lower then native plant species can tolerate, allowing noxious weeds to out compete native vegetation. Many noxious weeds are early successional species, meaning they colonize areas that have been recently disturbed. Since noxious weeds have the ability to deplete available resources to lower levels then native vegetation, they can quickly dominate the disturbed site. At the watersheds level, noxious weeds can alter the seasonal water flow. Noxious weeds create more erosion than native plant species because they have fewer shallow roots, which would soak up and hold water. Noxious weeds also have less canopy closure then native plants. This increases the amount of sunlight directly hitting the soil, increasing the amount of water evaporated at the soil surface. This creates a hard crust on the soil, which becomes difficult for additional moisture to penetrate. When moisture cannot penetrate into the soil, it leads to increased soil surface run-off. The moisture held by the soil helps maintain stream levels throughout the summer. When noxious weeds are present, there is an increase in erosion and surface run-off, leading to a deterioration in watershed conditions.

Cumulative Effects to Soils (Alt. 1) - the cumulative effects analysis area for NNIS is the White Mountain National Forest. This area was chosen because the effects of herbicides to soils should be limited to only the White Mountain National Forest. The temporal scale of analysis is 10 years previous and 10 years into the future from this decision. Ten years in the past coincides with the point in time at which non-native invasive species management became a higher priority on the Forest and 10 years into the future is the anticipated length of time for which a decision based on this analysis will be relevant.

Although NNIS currently occupy a small percentage of the overall Forest (less than 1%), this percentage will increase in abundance and distribution over time. NNIS infestations would continue to spread at their current locations and disperse themselves via wind, birds, and animals (including humans and associated activities) to new locations both on and off the WMNF.

Other activities (timber harvesting, recreation, and other projects) taking place on the WMNF are not expected to change substantially from what has occurred historically or currently planned activities. With no NNIS control taking place on the WMNF it is reasonable to conclude that the NNIS would continue to spread throughout the region. The uncontrolled spread of NNIS from sources on and off the WMNF would allow for an increase in NNIS infestation in the analysis area and a general decrease in ecological function within the analysis area. This in turn could produce immeasurable negative effects to soil productivity.

4.1.5 Effects to Water Resources and Aquatic Life (Alt. 1)

Direct and Indirect Effects to Water Resources and Aquatic Life (Alt. 1) - taking no action to control NNIS infestations would not result in any direct or indirect short term adverse impacts to water resources related to the presence of NNIS. This includes water quality, water quantity, and morphology of water resource features such as streams, lakes, and wetlands. This is because of the limited extent of these species on the WMNF. However, over time, it is probable some species may increase in population despite education and prevention methods. In particular, species which take advantage of disturbance will continue to spread. This includes some species which prefer wet areas such as riparian and wetland sites. One example is purple loosestrife (*Lythrum salicaria*) which is an extremely successful invader of wetlands that have been subjected to some type of disturbance, such as drawdown, siltation, drainage, and ditching (Bender, 2006). By replacing native vegetation on a large scale in wetlands, changes could occur to these features such as altered water chemistry and nitrogen cycling (Fickbohm and Shu, 2006). However, Standards and guidelines combined with preventative practices on the Forest would continue to limit disturbance to localized occurrences in wetlands and riparian areas by preventing activities which result in ground disturbance. Other areas, such as stream crossings, which are subject to regular ground disturbing activities, such as road maintenance would continue to provide opportunities for NNIS to spread. The extent of this type of spread is not expected to be of such an extent as to cause direct or indirect effects impacts to water quality or other water resources.

Cumulative Effects to Water Resources and Aquatic Life (Alt. 1) - the cumulative effects area for water resources is all water resources on the WMNF, including all water resources features such as riparian and wetlands areas. The timeframe is long term and depends on the rate of spread of NNIS species. As described here, long term refers to the time it takes for NNIS species to reach an extent which causes widespread impacts to water resource features such as water quality changes. It is possible that a natural limit or extent of NNIS spread is reached before that happens.

Activities such as timber harvesting, recreation, road maintenance, and others which occur on the WMNF are not expected to change substantially from what is currently occurring. These incluces stream crossings and water resource features adjacent to all types of roads, recreation trails, skid trails, landings, and other activities adjacent to such as wetlands, streams, and lakes. If no active NNIS control was implemented on the WMNF, it is plausible that NNIS species would continue to spread using these areas as pathways. As described in the effects to native plant communities, it is expected that NNIS populations for all species would continue to increase in the WMNF. This includes species which prefer wet areas such as riparian and wetland species. In addition, locations outside the Forest may not be treated for NNIS, resulting in a larger seed pool and potential for transport on the Forest. This combination with lack of treatment on the WMNF, could result in large mono-species NNIS populations in wetland and riparian areas. This effect could increase with time, until a limiting factor such as elevation or other site characteristics limit the spread of NNIS. The effect of not treating invasive species on the WMNF is not well understood at this time because the long terms effects of larger patch sizes on aquatic habitats and ecosystems is difficult to predict. However, impacts could include changes to water chemistry, nitrogen cycling (Fickbohm and Shu, 2006), hydrologic functions (Mitsch and Gosselink, 2000), and streambank/shoreline characteristics over the long term.

4.1.6 Effects to Threatened, Endangered and Sensitive (TES) Species (Alt. 1)

A summary of the determinations of effects to threatened, endangered and sensitive species is presented in Table 4-1.

Table 4-1 Summary of Determinations of Effects for Species That May Be Impacted by NNIS in the Next Decade.[1]

No Effect	May impact individuals, but not likely to result in a trend towards federal listing or loss of viability	Likely to result in a trend towards federal listing or loss of viability	Not likely to adversely affect
Gray wolf	Northern bog lemming	Wood turtle (Alt. 1)	Small whorled pogonia (Alt. 1 & 3)
Eastern cougar	American peregrine falcon (Alt. 1)	Butternut (Alt. 1 & 3)	
Canada lynx	Common loon		

[1] Alt. = alternative

Table 4-1 Summary of Determinations of Effects for Species That May Be Impacted by NNIS in the Next Decade.[1]

No Effect	May impact individuals, but not likely to result in a trend towards federal listing or loss of viability	Likely to result in a trend towards federal listing or loss of viability	Not likely to adversely affect
Indiana bat	Wood turtle (Alt. 2 & 3)		
Bald eagle	Boulder beach tiger beetle		
Eastern small-footed bat	Warpaint emerald		
American peregrine falcon (Alt. 2 & 3)	Missouri rock-cress (Alt. 1 & 3)		
Pied-billed grebe	Robbins milk-vetch (Alt. 1 & 3)		
Osprey	Bailey's sedge (Alt. 1 & 3)		
Brown's ameletus mayfly	Piled-up sedge (Alt. 1 &3)		
Third ameletus mayfly	Scirpus-like sedge (Alt. 1 & 3)		
White Mountain fritillary	Wiegand's sedge (Alt. 1 & 3)		
White Mountain butterfly	Fogg's goosefoot (Alt. 1 & 3)		
Alpine bearberry	Autumn coralroot (Alt. 1 & 3)		
Arnica	Goldie's fern (Alt. 1 & 3)		
Dwarf White Birch	Northern comandra (Alt. 1 & 3)		
Alpine bitter cress	Auricled twayblade (Alt. 1 & 3)		
Head-like sedge	Broad-leaved twayblade (Alt. 1 & 3)		
Oakes eyebright	Heart-leaved twayblade (Alt. 1 & 3)		
Proliferous red fescue	Prairie goldenrod (Alt. 1 & 3)		
Mountain avens	Adder's tongue fern (Alt. 1 & 3)		
Moss bell-heather	Mountain sweet cicely (Alt. 1 & 3)		
Boott's rattlesnake root	American ginseng (Alt. 1 & 3)		
Alpine cudweed	White Mountain silverling (Alt. 1 & 3)		
Mountain sorrel	Sweet coltsfoot (Alt. 1 & 3)		
Viviparous knotweed	Canada mountain rice grass (Alt. 1 & 3)		
Wavy bluegrass	Douglas' knotweed (Alt. 1 & 3)		
Alpine meadow grass	Pink wintergreen (Alt. 1 & 3)		
Robbins cinquefoil	Three-leaved black snakeroot (Alt. 1 & 3)		
Silverleaf willow	Anderson's sphagnum (Alt. 1 & 3)		
Dwarf willow	Angerman's sphagnum (Alt. 1 & 3)		
Alpine brook saxifrage	A sphagnum (Alt. 1 & 3)		
Arizona cinquefoil	Nodding pogonia (Alt. 1 & 3)		
Moss campion			
Alpine meadowsweet			
Boreal blueberry			
Mountain hairgrass			
Small whorled pogonia (Alt. 2)			
Missouri rock-cress (Alt. 2)			
Robbins milk-vetch (Alt. 2)			
Bailey's sedge (Alt. 2)			
Piled-up sedge (Alt. 2)			
Scirpus-like sedge (Alt. 2)			
Wiegand's sedge (Alt. 2)			
Fogg's goosefoot (Alt. 2)			

Table 4-1 Summary of Determinations of Effects for Species That May Be Impacted by NNIS in the Next Decade.[1]

No Effect	May impact individuals, but not likely to result in a trend towards federal listing or loss of viability	Likely to result in a trend towards federal listing or loss of viability	Not likely to adversely affect
Autumn coralroot (Alt. 2)			
Goldie's fern (Alt. 2)			
Northern comandra (Alt. 2)			
Butternut (Alt. 2)			
Auricled twayblade (Alt. 2)			
Broad-leaved twayblade (Alt. 2)			
Heart-leaved twayblade (Alt. 2)			
Prairie goldenrod (Alt. 2)			
Adder's tongue fern (Alt. 2)			
Mountain sweet cicely (Alt. 2)			
American ginseng (Alt. 2)			
White Mountain silverling (Alt. 2)			
Sweet coltsfoot (Alt. 2)			
Canada mountain rice grass (Alt. 2)			
Douglas' knotweed (Alt. 2)			
Pink wintergreen (Alt. 2)			
Three-leaved black snakeroot (Alt. 2)			
Anderson's sphagnum (Alt. 2)			
Angerman's sphagnum (Alt. 2)			
A sphagnum (Alt. 2)			
Nodding pogonia (Alt. 2)			

[1] Alt. = alternative

4.1.6.1 Effects to Federally Listed Animals (Alt. 1)

Direct and Indirect Effects to Federally Listed Animals (Alt. 1) **-** there would be no direct effect to federally listed animals (gray wolf, eastern cougar, Canada lynx, and Indiana bat) under Alternative 1. Two of the species (gray wolf and eastern cougar) are not currently present on the WMNF, therefore they could not be affected by implementation of any alternative. The remaining species are all long-ranging species with few occurrences on the Forest. Suitable habitat is widespread across the Forest for all of these species except Indiana bat, which spends non-winter months in a mosaic of mature hardwood forests and open foraging areas such as stream corridors and wildlife openings. Mature trees with sloughing or peeling bark are required for roosting and caves or similar sheltered sites are used for winter hibernacula. Extensive research and surveys in New York, Vermont, and New Hampshire have shown that the suitability of habitat on the WMNF is suboptimal for Indiana bats compared to other locations because the White Mountains do not support the types of roost tree species (e.g., shagbark hickory, American elm) generally used by reproductive females.

Indirectly, NNIS may impact the quality of herbaceous forage for prey species, but this would have no measurable effect since the current number of infestations on the WMNF is small in relation to overall prey habitat and increases of NNIS infestations in the immediate future would still result in proportionately small changes to overall habitat levels for these species.

Cumulative Effects to Federally Listed Threatened and Endangered Animals (Alt. 1) **-** since there are no direct or indirect effects, there would be no cumulative effects under Alternative 1.

4.1.6.2 Effects to Federally Listed Plants (Alt. 1)

Direct and Indirect Effects to Federally Listed Plants (Alt. 1) - existing NNIS infestations would continue to persist at all currently mapped and as yet undiscovered locations. These infestations would continue to spread vegetatively and via seed at their current locations. Seed and propagule dispersal to new locations would occur over time creating additional infestations at currently un-infested locations. There are no documented current or historic occurrences of the small whorled pogonia in any mapped NNIS infestation on the WMNF (NHNHB 2006, MNAP 2006, USFS 2006), therefore there would be no direct impacts to small whorled pogonia. It is reasonable to conclude that if not controlled NNIS plants will begin to infest sites containing TES species over time, including those containing small whorled pogonia. This action would lead to increased, competition for space, light, nutrients, and water resulting in a potential decline in vigor and population numbers of this species.

Cumulative Effects to Federally Listed Plants (Alt. 1) - The vast majority of known small whorled pogonia populations in New Hampshire and Maine occur to the south and/or east of the WMNF. Although the proposed action covers the entire Forest, the overall total acreage proposed for treatment is relatively small because infestations are relatively small (often less than an acre). The effects of this project, given the limited small whorled pogonia populations on the WMNF and the small areas to receive NNIS treatment, would be immeasurable.

NNIS infestations would continue to spread at their current locations and disperse themselves via wind, birds, and animals (including humans and associated activities) to new locations both on and off the WMNF. Other activities (timber harvesting, recreation, and other projects) taking place on the WMNF are not expected to change substantially from what has occurred historically or currently planned activities. Specific ground disturbing activities on the WMNF are reviewed via project level environmental analyses which carefully document TES/RFSS plants and NNIS. Any potential negative impact posed to rare plants, including small whorled pogonia by a project or presence of NNIS is subject to mitigation measures.

Projects occurring outside of the WMNF may or may not be subject to project level NEPA. With the combination of no NNIS control taking place on the Forest, little control being implemented in the analysis area outside the WMNF, and increasing development surrounding the Forest, it is reasonable to conclude that the NNIS would continue to spread throughout the region. The uncontrolled spread of NNIS from sources on and off the WMNF would begin to affect populations of small whorled pogonia within the analysis area. The spread of NNIS to new locations would lead to increased competition for light, nutrients, water, and space.

4.1.6.3 Effects to Regional Forester Sensitive Animals

Effects to Regional Foresters Sensitive Animals (Alt. 1) - many of the Regional Forester sensitive species were evaluated in depth during the 2005 revision of the WMNF Forest Plan. The Biological Evaluation for the Forest Plan revision (Prout 2005) included detailed descriptions of life history, current and historical occurrences, and potential risk factors. In an effort to avoid unnecessary repetition, that information is incorporated by reference and only summarized here. More detailed information is provided for those species not included in the Forest Plan revision Biological Evaluation.

The area of cumulative effects analysis will vary by species. However, for all species, the temporal scale of analysis is 10 years previous and 10 years into the future from this decision. Ten years in the past coincides with the point in time at which non-native invasive species management became a higher priority on the Forest and 10 years into the future is the anticipated length of time for which a decision based on this analysis will be relevant.

Because the Regional Forester sensitive animals are effectively different in terms of habitat and effects, they will be addressed individually.

Direct, Indirect and Cumulative Effects to Eastern Small-footed Bat (All Alternatives) - for the purposes of this project, the habitat and life history requirements are sufficiently similar that effects would be the same as the Indiana bat described above (section 4.1.6.1). Implementation of any alternative would have no effect on eastern small-footed bats.

Direct and Indirect Effects to Northern Bog Lemming (Alt. 1) - since no treatments are proposed in Alternative 1, there would be no direct effects to northern bog lemmings. Indirect effects are also unlikely. Most of the habitat types used by northern bog lemmings are not naturally conducive to infestation by NNIS. In addition, only one NNIS occurrence currently exists in the entire Wild River drainage, so suitable habitat is not currently being impacted. However, if new infestations develop or current infestations spread, currently suitable habitat may be diminished in quality. This is especially true in more open habitats such as meadows or bogs, where open sunlight conditions may facilitate spread of opportunistic NNIS.

Cumulative Effects to Northern Bog Lemming (Alt. 1) - timber harvest is probably the main human-caused activity that has altered habitat conditions for bog lemmings. Recreational projects such as trail construction and uses such as mountain biking, especially in places where timber sale operations do not generally occur (e.g., near wet meadows and bogs) may also contribute to disturbance and habitat alteration. All of these activities would be expected to continue. Over the next 10 years, additional NNIS occurrences would be expected in some of the suitable habitat types used by northern bog lemmings. Open meadows would be more vulnerable to infestation due to their open sunlight conditions. Closed mature spruce-fir habitats may be better protected from some NNIS. Because northern bog lemmings are small and occupy small home ranges, disturbance by NNIS infestations has more potential to impact this species than larger, more wide-ranging mammals. However, given that active timber harvest over the last century has not displaced this species, it would seem that it is fairly persistent in the face of change.

Direct and Indirect Effects to American Peregrine Falcon (Alt. 1) - Alternative 1 would have no direct or indirect effects on peregrine falcons. No NNIS occurrences are located on cliffs and it is not expected that future infestations would occur there. It is possible that NNIS could impact the vegetative community in openings and along riparian corridors where peregrines forage, but that is not currently creating an impact to peregrines.

Cumulative Effects to American Peregrine Falcon (Alt. 1) - peregrines have made a steady comeback since the ban on organochlorine pesticides such as DDT. They were taken off the Endangered Species List in 1999 and continue to grow in numbers. On the WMNF, the biggest factor affecting peregrine success is rock climbing activity. Human disturbance during the breeding season can result in failed nesting attempts. Site-specific closures to rock climbing on and off the Forest have been followed by the local rock climbing community and future compliance with these measures is anticipated.

Because NNIS often colonize open, disturbed areas, openings and riparian corridors where peregrines forage are likely infestation sites. Without suppression or control treatments, it is likely that NNIS sites on and off the Forest would spread, through wind, water, or carried by wildlife or humans, into foraging areas. How much that affects the bird community would be based in part on the NNIS species. Fruiting species such as honeysuckle, Oriental bittersweet, or Japanese barberry may provide a substitute food source for the prey species peregrines typically hunt. Other NNIS such as Japanese knotweed or purple loosestrife would likely outcompete native food resources, having a negative impact. Many of the prey species most often hunted by peregrines occupy a wide variety of habitats, from mature woods to urban backyards, so they may be better able to adapt to NNIS changes than species with tighter habitat requirements.

Direct and Indirect Effects to Common Loon (Alt. 1) - there would be no direct or indirect effects to loons in the immediate future. Without control treatments, it is likely that purple loosestrife or common reed could infest shallow areas of suitable loon waterbodies. Loons are very clumsy on land and cannot move far out of the water. Drastic changes to shallow water areas of lakes and ponds could impact access to suitable nesting areas. Infestations may also affect abundance or availability of prey for nestlings.

Cumulative Effects to Common Loon (Alt. 1) - the only other comparable threat that could be controlled by the Forest Service is recreational use levels. Loons are very sensitive to human disturbance during nesting. Recreation use is expected to increase on the Forest over the next 10 years, but Forest Plan standards and guidelines are expected to be sufficient to protect loon habitats (Prout 2005).

Since other sources of potential impact are mitigated through Forest Plan direction, cumulative effects for Alternative 1 would be equivalent to the direct and indirect effects described above.

Direct and Indirect Effects to Wood Turtle (Alt. 1) - there would be no direct or indirect effects to wood turtles in the immediate future. Wood turtles require disturbed, sandy areas for nesting, which are also some of the most readily colonized infestations sites for NNIS. Because of the rocky, mountainous nature of the Forest, suitable nesting habitat near slow-moving streams is limited. Some NNIS colonization of sandbars in wood turtle habitat is already evident on the

Forest (L. Prout, pers. observation). It would not take long for sources near known wood turtle occurrences to spread. NNIS has the potential to severely limit the amount of suitable nesting habitat in the near future.

Cumulative Effects to Wood Turtle (Alt. 1) - other past and potential future threats to wood turtles include habitat loss from development, mortality caused by vehicle collisions, natural succession of disturbed sites, and human activity (especially collection for the pet trade). Forest Plan standards and guidelines for riparian habitats would help protect natural stream function on the Forest. However, development outside the Forest, especially road construction and improvement, would continue to increase the potential for impact to the overall population. Allowing NNIS to spread without controls is likely to reduce wood turtle habitat over the next 10 years. A Species Viability Evaluation completed as part of the revised Forest Plan indicated 'loss of even a few adults can cause eventual demise of a population' (USDA Forest Service 2005b). Therefore, allowing NNIS to grow unchecked could result in a substantial loss of wood turtle population viability on the Forest.

Direct and Indirect Effects to Boulder Beach Tiger Beetle (Alt. 1) - boulder beach tiger beetle habitat is similar to wood turtle in terms of their need for sandy substrates. Wood turtle may have slightly more restrictive requirements, but the direct and indirect effects would be similar for this species.

Cumulative Effects to Boulder Beach Tiger Beetle (Alt. 1) - cumulative effects would also be similar to those described for wood turtle, although the viability concern for boulder beach tiger beetles is less clear. Road maintenance and dam construction seem to be threats that have impacted the species in general in the past (WMNF 2005), although not necessarily within the analysis area. Past logging activity probably damaged habitats, which have since improved with time. Although little information on population status is available, at least one species expert suspects many more recent sightings of this species have occurred and not been published (D. Chandler, pers. com cited in WMNF 2005). Because of the need for sandy substrates, colonization of these habitats by NNIS may impact the species in the same way as wood turtles, although perhaps substantial changes in viability would take longer to become noticeable.

Direct and Indirect Effects to Warpaint Emerald (Alt. 1) - Implementation of Alternative 1 would have no direct or indirect effects on this species in the immediate future because no NNIS are known from its habitat. Over time, NNIS that occupy wetter sites may colonize these areas and reduce habitat suitability. It is unlikely that all suitable habitat would be infested in the next decade and it is likely that unoccupied habitat exists based on lack of sightings. However, microsite conditions for breeding seem to be specific and ephemeral, so suitable breeding habitat may be more restrictive than conditions appear.

Cumulative Effects to Warpaint Emerald (Alt. 1)

Habitat was probably most significantly altered by logging during the 19^{th} century. Many damaged wetlands have since been restored and bogs, heaths, and fens are protected from timber harvesting activities on the Forest. Recreational activities such as hiking may potentially cause impacts to these habitats, but hiking activity may also create microsite conditions necessary for breeding. Habitat changes caused by NNIS are probably the biggest potential threat to this species. Because of this, cumulative effects are essentially the same as the direct and indirect effects described above.

4.1.6.4 Effects to Regional Forester Sensitive Plants (Alt. 1)

Many of the Regional Forester sensitive species were evaluated in depth during the 2005 revision of the WMNF Forest Plan. The Biological Evaluation for the Forest Plan revision (Prout 2005) or the in the Species Viability Evaluation (USDA Forest Service 2005b) included detailed descriptions of life history, current and historical occurrences, and potential risk factors. In an effort to avoid unnecessary repetition, that information is incorporated by reference and only summarized here. More detailed information is provided for those species not included in the Forest Plan revision Biological Evaluation. No Regional Forester sensitive species is currently being impacted by NNIS occurrences on the WMNF.

Many of the Regional Forester sensitive plants occupy similar complexes of habitats. Therefore the effects analysis for all species is similar, so they are treated as a single group with the exception of one species, butternut.

<u>Direct and Indirect Effects to Regional Forester Sensitive Plants (Alt. 1)</u> - there are no current or historic documented occurrences of any RFSS plant species within any known mapped NNIS infestation on the WMNF (NHNHB 2006, MNAP 2006, USFS 2006), therefore there would be no direct impacts to RFSS plants. It is reasonable to conclude that if not controlled, NNIS plants will begin to infest sites containing RFSS species over time. This would be an indirect effect leading to increased competition for light, nutrients, water, and space or displacement by NNIS, ultimately leading to a potential decline in viability or loss of RFSS occurrences on the WMNF. For example, most rare plants occupy a fairly specific habitat niche on the Forest. American ginseng (*Panax quinquefolius*) and Goldie's fern (*Dryopteris goldiana*), as well as several other RFSS species are only found in enriched hardwood forests. This habitat type is highly susceptible to invasions of shrub-like honeysuckles (*Lonicera* species), garlic mustard (*Alliaria petiolata*), and Japanese barberry (*Berberis thunbergii*) that drastically alter water, nutrient, and spatial conditions thereby negatively impacting, or even displacing, the rare species.

Butternut occupies similar habitat to several other RFSS requiring enriched early to mid successional forests. This species exists largely as adult trees and regeneration is scarce, even without the added competition from NNIS at existing sites. The additional stresses caused by the spread of and competition from NNIS could further jeopardize the local viability of this species.

<u>Cumulative Effects to Regional Forester Sensitive Plants (Alt. 1)</u> - ground disturbing activities on the WMNF are reviewed via project level environmental analyses which carefully document RFSS plants and NNIS. Any potential negative impact posed to rare plants, including this complex of RFSS, by a project or presence of NNIS is subject to mitigation measures.

Projects occurring outside of the WMNF may or may not be subject to project level NEPA, therefore mitigation may or may not take place. The combination of no NNIS control taking place on the Forest along with little control is being implemented in the analysis area outside the

WMNF, and increasing development surrounding the Forest leads to a reasonable conclusion that NNIS would continue to spread throughout the region. The uncontrolled spread of NNIS from sources on and off the WMNF would begin to affect RFSS species, including this habitat complex of RFSS within the analysis area. The spread of NNIS to new locations would lead to increased competition for light, nutrients, water, and space or displacement by NNIS. The end result is a potential loss of individuals or occurrences from the WMNF.

The cumulative effects to Butternut are similar to those for the other RFSS, however the outcome for Butternut due to its current scarcity and lack of regeneration is different. The spread and impact of NNIS on this species within the analysis area could jeopardize the local viability of this species.

4.2 Alternative 2 (Proposed Action)

Under the Proposed Action Alternative NNIS would be managed under a program that uses mechanical, chemical and biological means to counter their spread and eliminate known infestations. Through this management program, it is expected most infestations would be eliminated or under control, while some species, due to their pervasiveness, may persist. The result would be that the ecological function of the natural communities in and around these treated infestations should, over time, recover to their natural state.

4.2.1 Effects to Non-Native Invasive Plants (Alt. 2)

Direct and Indirect Effects to NNIS Plants (Alt. 2) – under Alternative 2, NNIS infestations will be eradicated or controlled via a program of integrated pest management under this alternative. Most sites on the Forest are small and will be completely eradicated in a single treatment. Larger more well established infestations may require several treatments to eradicate, while others may only be contained despite repeated treatments. The treatment protocols described in the proposed action are expected to result in a substantial reduction in the number of current and future NNIS sites on the Forest, thereby decreasing the likelihood of continued infestation and spread across the forest.

Cumulative Effects to NNIS Species (Alt. 2) - Nationally, the rate of spread has been estimated at 3% per year (National Invasive Species Council 2001) and at 8-12% per year (USDA FS 1999 Stemming the Invasive Tide), but given the climate and landscape condition of the forest, and the comparably low level of current infestation it is anticipated that the rate of spread for the WMNF would on the lower end of the national scale.

Concerted efforts to control existing and future infestations of NNIS at the proposed rate of control (10-50 acres annually) would allow for an immediate reduction in the number of infested acres on the Forest, but would likely not result in the complete eradication of NNIS from the WMNF. There are many variables that effect the outcome of rate of spread modeling for NNIS. Applying a 3% rate of spread over a ten year period, with a control rate of 50 acres per year, and not considering any other factors, indicates that there would be a slight increase in the number of acres infested on the WMNF. However, this result is impacted by an adjustment of any number additional factors, primarily annual project selection. By targeting NNIS species with the largest seed production and rates of viability, it is possible to reduce the rate of spread. Increasing the number of acres treated annually also has a dramatic effect on the overall rate of spread.

The treatment protocols in the proposed action are expected to result in a substantial reduction of current and future sites of NNIS across the Forest. This will further reduce the likelihood that NNIS will be spread into currently un-infested areas of the Forest and surrounding northern New Hampshire and western Maine. This alternative will contribute to NNIS control efforts by adjacent landowners such as Pondicherry National Wildlife Refuge, and state agencies such as the New Hampshire Department of Transportation. Actions under this alternative will increase the effectiveness of NNIS control and containment across northern New Hampshire and western Maine.

4.2.2 Effects to Native Plant Communities (Alt. 2)

Direct and Indirect Effects to Native Plant Communities (Alt. 2) - this alternative employs an integrated pest management approach to NNIS control. Mechanical, biological and chemical methods would be used to control or eradicate NNIS. The method used would depend on the species to be controlled, size of the infestation, site conditions and other measures set forth in the treatment protocols. All of these actions have the potential to have a negative impact on native plant communities. However, the protocols would greatly minimize the unintentional effects to native plants. Some protocols are specific to a particular practice, while others apply to all control practices.

Mechanical control: Most of the proposed mechanical treatment methods are highly selective, with very little potential for large scale damage to surrounding vegetation when employed on a small scale. Due to the potential for high levels of soil disturbance these methods would be utilized on appropriate species with relatively low population numbers. These techniques include pulling, girdling, hand cutting, and root stabbing. Using personnel who are trained to distinguish between NNIS and native species further reduces the opportunity for negative impacts to non-target plants.

Other mechanical actions are less selective. Mowing is one such method. Mowing may reduce the vigor and reproductive ability of native plants species as well as NNIS. In this proposal, mowing is limited to control of NNIS in/along roadsides, wildlife openings, and rights-of-way, where native plant communities are generally adapted or receive this type of management regime due to other site considerations. Although mowing can be timed in such a way that it favors native plants, and discourages NNIS plants, mowing is generally detrimental to non-target plants. Limiting this practice to areas specified by the protocols would minimize undesirable impacts. Suffocation is another highly non-selective method of NNIS control, which impacts all vegetation, native and NNIS, within the area of application. This method would be used only in areas of severe monocultural stands of herbaceous NNIS, where the potential to impact native plants on a large scale is extremely limited.

Overall, the negative effects of mechanical control on non-target plants would be minimized by the protocols established for this project. Further, these impacts are generally outweighed by the highly beneficial effect to the native plant community as a result of reducing NNIS.

Chemical control: All of the herbicides proposed in this alternative are capable of killing or injuring non-target plants. Five factors can greatly influence the degree to which this may occur: 1) application method, 2) application conditions, 3) season of application, 4) herbicide selection, and 5) operator training.

1) In this alternative, herbicide would be applied by hand through one of several methods. Some methods are very direct; the operator is able to selectively and directly apply herbicide to the target plants. These methods include cut stump or basal bark, and wand or glove application. These methods directly apply herbicide to the target vegetation and because contact with non-target vegetation is extremely unlikely none of these methods would have undesired effects on non-target vegetation. The foliar spray method is slightly less selective. This method, which utilizes a hand held or backpack sprayer, directs a narrow spray of herbicide onto the foliage of the target plant with minimal drift. With this method there is some possibility that non-target vegetation may be sprayed with herbicide.

2) Weather conditions can affect the potential for herbicides to affect non-target plants. Windy days can cause spray drift, and heavy rainfall can wash herbicides off treated plants and carry them in surface runoff to non-target plants. Further, weather conditions can also affect the effectiveness of herbicides. Foliar and some cut stem treatments are more effective on a hot humid day than on cool cloudy one. To minimize the risk of drift, broadcast foliar applications would only occur when wind speeds are less than 10 mph. No herbicide applications would take place 24 hours prior to or during a rain event.

3) Applying herbicides during the growing season can kill or injure non-target plants if the application method is not highly selective. Additionally, the effectiveness of the herbicide in killing the target species is also affected by the season of application. Foliar applications of herbicide are most successful when applied when the target species is in bud, flower, or developing fruit. Cut stem application to woody species is most effective when applied in the late summer through late autumn when energy reserves are being drawn from the stems and branches to the root system.

4) Some herbicides are more selective than others. For example, clopyralid is the most selective herbicide (among those proposed in this alternative), affecting only plants in the aster (*Asteraceae*), buckwheat (*Polygonaceae*), and pea (*Fabaceae*) families. Triclopyr is a broadleaf-specific herbicide; it has little effect on grasses and other monocots. Therefore, application of these herbicides would leave more of the non-target, native vegetation unaffected than a non-specific herbicide such as glyphosate.

5) All herbicide applicators would be licensed or supervised by licensed pesticide applicators. All licensed applicators would have both federal and the appropriate state-issued pesticide certifications and/or licenses. At all NNIS sites where herbicide treatment is to occur, applicators would be required to be able to visually distinguish the target NNIS from non-target species.

Applying the protocols established for this project to specific aspects of the five factors listed above, would greatly minimize the effects of control actions on non-target vegetation. Although herbicide use may kill some individual non-target plants, the overall effect to the native plant community would be positive because it would prevent the loss of species diversity due to uncontrolled NNIS spread.

Biological Control: In this alternative, biological control would be used to control moderate to large infestations of purple loosestrife only. This species currently occupies only a very small percentage of the infested land on the Forest.

Two beetles are proposed as biological control for purple loosestrife on the WMNF; *Galerucella calmariensis* and *G. pusilla*. These beetles feed preferentially on purple loosestrife, but also feed on other members of the genus *Lythrum* (both native and non-native), swamp loosestrife (*Decodon verticillatus*, unknown whether it occurs on the WMNF), sandbar willow (*Salix interior*, likely to occur on the WMNF), and several species in the rose family (*Rosaceae*). Pre-introduction studies of the beetles to be released determined that normal feeding, egg laying, and development of the beetle was confined to purple loosestrife, but some feeding occurred on members of the *Lythraceae* family when no other choice was available (Blossey et al. 1994). A post-release study in Michigan which further tested 40 species in 14 previously untested families supported the pre-release study, but did note some transient feeding on selected non-targets (Kaufman and Landis 2000). Minor damage was observed on five members of the *Rosaceae* family (*Fragaria x. ananassa, Filipendula rubra, Rosa setigera, Alchemilla mollis, and Rubus idaeus*) (Kaufman and Landis 2000). Of these five only *Rubus idaeus* occurs on the WMNF. Another study noted feeding by the beetles for very brief periods on red osier dogwood (*Cornus sericea*) and speckled alder (*Alnus incana*), which also occur on the WMNF. None of these non-target species were substantially impacted by this feeding during the study periods. (Albright et al.) Damage to all non-target species has been shown in additional studies to be minor (Tewksberry 2004, Schooler et al. 2003, Illinois Natural History Survey 1999). This minor feeding is unlikely to result in a decline of any non-target species. Potential negative impacts to non-target plants caused by the *Galerucella* beetles is far outweighed by the positive benefits of reducing purple loosestrife on the White Mountain National Forest.

The biological control agents proposed for release in this alternative have been very carefully selected, studied, and screened by the Animal Plant Health Inspection Service (APHIS). These insects, which are already present on the Forest, have a very low potential for adverse effects to non-target plants.

Overall, the control actions in this alternative, guided by the project's protocols and integrated pest management methods, would have minimal negative effects on native plant communities. Currently, NNIS infest less than one percent of the Forest land area, mostly in highly disturbed or roadside situations. Potential future infestations are anticipated to be introduced into similar highly disturbed or roadside locations. Any impacts to native plant communities at these sites would not affect the species abundance, distribution, or natural community/population viability on the WMNF. Further, although there may be negative impacts to individual native plants, the overall effect to the native plant community would be highly beneficial due to the reduction in NNIS.

Cumulative Effects to Native Plant Communities (Alt. 2) - The project's protocols, application method, season of application, choice of herbicide (based on selectivity), and operator training would be carefully controlled in order to reduce any deleterious effects on non-target plants. Due to the small acreage to be treated and because herbicide impact on non-target plants and plant communities would be expected to be relatively small, herbicide would contribute only a small adverse incremental effect combined with impacts of other past, present, and reasonably foreseeable future activities. Therefore herbicide use in Alternative 2 would not be expected to result in adverse cumulative effects to non-target plants.

The effects from mechanical control activities on non-target plants and native plant communities would be expected to be minimal, and thus would have little or no incremental effect when combined with the small amount of acreage treated and the impacts of other past, present, and reasonable foreseeable future activities.

The effects of biological control agents on non-target plants and plant communities would be expected to be minimal in this alternative and would therefore have little or no incremental effect when combined with the impacts of other past, present, and reasonably foreseeable future activities. *Galerucella* beetles have been released by the States of New Hampshire and Maine. The WMNF has released *Galerucella* beetles along route 16 between Jackson and Gorham, NH per a prior decision signed on April 5, 2005. The effects of these releases on non-target vegetation are non-existent or incremental when combined with similar activities taking place on the Forest.

Although non-target native plants could be affected by the control activities in this alternative there would be a far greater potential for the loss of these species and their habitats if no treatment occurs and NNIS continue to spread.

4.2.3 Effects to Wildlife (Alt. 2)

Direct and Indirect Effects to Mammals (Alt. 2) - Under Alternative 2, NNIS sites threatening wildlife habitats would be treated by a combination of mechanical, chemical, and biological control methods. Any of these methods would increase direct disturbance to individual wildlife, although this is a negligible impact. Methods being proposed do not require heavy equipment (which is generally noisy and prolonged), and project implementation would generally be of short duration. Treatments would be accomplished with only a few people working at one time, minimizing direct disturbance levels. Project areas are small and mammals are mobile creatures. They would generally move out of the immediate project area with minimal effects to stress levels or energy expenditures.

Mechanical treatments that involve digging up shrubs or trees could damage burrows or den sites in the ground. This would be a very site-specific effect that would only occur if the shrub or tree was immediately adjacent to a burrow or den. Most shrubs or trees that could be dug up would be fairly small; anything large would be cut. Therefore, this effect is expected to be negligible. In theory, larger expanses of NNIS could provide cover for small mammals such as mice, but these species are common and abundant other suitable habitat is currently available. Loss of small, site-specific NNIS occurrences that exist on the WMNF may result in a temporary loss of cover, but no species would be expected to lose a substantial portion of its territory.

Chemical control treatments could affect mammals through dermal exposure, ingestion of treated plants, ingestion through grooming, or ingestion of other animals exposed to chemicals. The effects of using glyphosate, triclopyr, and clopyralid (the chemicals proposed in this project) on a wide range of terrestrial and aquatic animals have been evaluated in risk assessments (SERA 2003a, 2003b, 2004 and accompanying worksheets). Each risk assessment evaluated the toxicity of the chemical on target species (toxicity index) and an evaluation of how much chemical an animal could potentially be exposed to (estimated dose) during typical Forest Service applications. An estimate of potential hazard (hazard quotient) was derived by dividing the estimated dose by the toxicity index. A quotient of one would equate to an anticipated dose equaling an amount likely to have toxic effects. Likewise, quotients less than one would indicate the estimated exposure would not cause toxic effects. In this way, effects to a number of different animals can be compared in a standardized way.

For all chemicals proposed in this project, most of the hazard quotients for both acute and chronic exposure scenarios using typical Forest Service application rates did not exceed one. This essentially means adverse effects to mammals would be unlikely. The only scenario that resulted in a hazard quotient greater than one was a chronic exposure involving a large mammal consuming vegetation treated with triclopyr at the upper range of possible exposure (SERA 2003b). This is considered a conservative analysis for several reasons: 1) in many cases, triclopyr would be used as a cut stem or basal bark treatment. The leafy part of the plant that large mammals would generally eat would be cut first and only the stump treated or just a ring around the trunk would be painted or sprayed. 2) If a foliar spot spray is used, plants would die fairly quickly after treatment, so would not likely be eaten. 3) The exposure assessment assumes a fairly high daily dose, which is unlikely given the size of the treatment areas that would be encountered on the WMNF. A large mammal is very mobile and generally wanders over a fairly large area to forage. It would not stand in one place and eat treated vegetation exclusively for days at a time. Even so, infestations on the WMNF are generally small and would not provide sufficient forage for a large mammal for days at a time. Therefore, it is virtually impossible that a scenario would occur where toxic effects would occur.

Biological control treatment would occur only on purple loosestrife. No adverse effects through contact with mammals would be expected.

<u>Cumulative Effects to Mammals (Alt. 2)</u> – see Alternative 1 for description of the cumulative effects analysis area. The most obvious cause of habitat loss in the analysis area outside of the WMNF is development. Small timber harvests and other vegetative manipulation also have occurred, bringing both positive and negative effects. Past NNIS prevention and control efforts on non-federal lands adjacent to the WMNF have been scarce and many more NNIS occurrences are found outside Forest boundaries. Where they occur, though, the situation is often similar in that infestations are small and localized. Over time, these occurrences would likely spread and new infestations would appear. Assuming most other landowners provide only minimal efforts to control these infestations, it is likely that open habitats throughout the analysis area would be impacted. The next 10 years is not long enough for habitats to be completely altered, but some

mammals could find it more difficult to find suitable forage and cover conditions throughout the analysis area. Through treatments, habitat quality may be better on the WMNF than in other parts of the analysis area, but this is not expected to be a major difference for most mammals.

<u>Direct and Indirect Effects to Birds (Alt. 2)</u> - the most direct impact from mechanical treatments would be if a bird nested in a shrub targeted for treatment. To avoid this, a design criterion was developed that would defer treatment to August 1 or require inspection for nesting activity prior to treatment. Therefore, no direct effects to birds should occur as a result of mechanical treatments. Indirectly, removal of shrubs may reduce nesting habitat at a specific site, however, this is not expected to have a measurable effect on suitable nesting habitat on the WMNF because the proportion of NNIS shrubs compared to existing native nesting habitat is so small.

Similar to mammals, risk evaluations (SERA 2003a, 2003b, 2004 and accompanying worksheets) also examined chemical effects to birds. Hazard quotients were less than one for all chemicals and in all bird scenarios except one. The upper hazard quotient for triclopyr exceeded one for a large bird eating contaminated vegetation at the site of chemical application over a period of time (chronic exposure as opposed to acute). As described in the mammal effects above, the probability of this actually occurring is extremely low because birds don't typically forage in the same place for days on end and treated vegetation would die quickly (before the bird could eat a lot of it). This was only true of large birds; small birds had hazard quotients below one.

Similar to mammals, use of biological controls for purple loosestrife would result in no direct effect to birds, although habitat suitability would be expected to increase indirectly as a result of NNIS suppression.

<u>Cumulative Effects to Birds (Alt. 2)</u> - cumulative effects for birds would be similar to mammals. NNIS control efforts would help maintain suitable habitats for birds on the WMNF, but habitats would continue to be altered by other activities such as development, timber harvest, and recreational use. Some habitat quality would likely be reduced as NNIS infestations grow and spread. Over the next 10 years, this wouldn't likely result in the loss of any species from the area, but as habitat quality decreases, individuals may find it more difficult to find optimal food and cover resources, especially in open habitats. The end result is that timber harvest and development may reduce habitat quality in site-specific locations, but NNIS control treatments would help the WMNF hold more habitat of better quality than surrounding areas.

<u>Direct and Indirect Effects to Amphibians (Alt. 2)</u> - mechanical treatments such as cutting may disrupt individual amphibians within a treatment area. However, this impact is expected to cause negligible effects, as amphibians are mobile creatures and could avoid the immediate area while cutting took place. A few individuals may be trampled and killed by workers, but this should not result in noticeable population losses.

Risk evaluations for amphibians have not been conducted in the same manner as that described for mammals and birds. However, various lab studies on triclopyr and glyphosate (including its surfactant) showed no statistically significant increase in abnormalities at levels that were not lethal (similar research was not available for clopyralid) (SERA 2003a, SERA 2003b). There is some indication that at higher exposure levels (1.2 and 4.6 parts per million), avoidance behavior was inhibited in tadpoles exposed to Garlon 4, and newly hatched tadpoles died or became immobile (Berrill et al. 1994 cited in SERA 2003b). However, all three chemicals do have completed risk evaluations for fish, which are considered more sensitive than amphibians. In all three cases, hazard quotients for fish fell below one, indicating low risk at typical Forest Service application rates (SERA 2003a, 2003b, 2004).

Cumulative Effects to Amphibians (Alt. 2) - amphibians are much more localized than mammals and birds, so habitat alteration over the broad expanse of the analysis area would have less impact to local populations than site-specific changes in occupied territories. It is assumed that some wetlands outside of the Forest boundary would be negatively impacted by NNIS in the next 10 years as described in Alternative 1 above. However, efforts on the WMNF and other public lands would maintain suitable conditions. Control efforts on the Forest would also help to reduce the number of sources from which NNIS could spread to other areas.

There would be no direct effect to amphibians from the release of biological controls. Indirectly, these treatments would improve habitat suitability in wetlands invaded by purple loosestrife.

Direct and Indirect Effects to Invertebrates (Alt. 2) - there would be no direct or indirect effects from implementing mechanical or biological control treatments. There is some risk of honeybees being exposed to chemicals during application, but this risk is small and hazard quotients for all three chemicals proposed in this project area are less than one for honeybees (SERA 2003a, 2003b, 2004 and accompanying worksheets). Even if bees were sprayed directly (an unlikely event given the methods of chemical application being proposed), the risk of negative effects is low. Treating NNIS infestations would help maintain native pollen sources and keep honeybee populations at current levels.

Cumulative Effects to Invertebrates (Alt. 2) - across the analysis area, honeybees obtain more pollen from native species and ornamentals planted in private gardens than from NNIS occurrences. Many of these sources would still be available, regardless of NNIS treatment within the WMNF or outside its boundaries. Therefore, cumulative effects of implementing Alternative 2 would be negligible.

4.2.4 Effects to Soils (Alt. 2)

Direct and Indirect Effects to Soils (Alt. 2) - some ground disturbing activities associated with control methods such as hand pulling or digging could temporarily increase the potential for soil erosion. Project protocols call for large areas of soil left bare of vegetation following treatment to be re-seeded with a mix of fast growing grasses or native plants recommended for soil stabilization and erosion control. These include native plants or annual cover crops intended to stabilize the soil until longer-lived native species re-colonize the site (refer to the project protocols for size of area affected).

Because biological control and herbicides kill but do not physically remove plants and their root systems, their use would not increase the potential for soil erosion. The dead plants would be expected to offer short-term soil stabilization to protect against erosion until new plants reestablish naturally. Where control methods kill most of the standing vegetation leaving large open areas (refer to the project design), re-seeding as described above would help stabilize the soil and prevent NNIS plants in the seed bank from re-establishing. Treating cut stumps of woody NNIS species such as exotic buckthorns and honeysuckles with herbicides would discourage re-sprouting without the soil disturbance required to physically grub the stumps out.

Spraying herbicides inevitably results in the short-term accumulation of herbicide residues in soil. Once in the soil, herbicides can migrate via gravity, leaching, and surface runoff to other soils, groundwater, or surface water. To determine the level of risk from accumulation of herbicide residues on soils and possible contamination of ground and surface water, factors such as persistence (measured in half-life), mobility, and mechanisms for degradation have been reviewed (Table 4-1). Factors influencing herbicide persistence include leaching potential, soil moisture content, amount of organic matter in the soil, microorganisms present in the soil, and molecular binding of chemicals to organic and soil particles. Precipitation patterns following application also heavily influence potential effects to soil, and potential contamination of groundwater and surface water.

Table 4-1. Behavior of Proposed Herbicides in Water (including toxicity data on fish and aquatic animals)

Herbicide	Solubility	Half Life in Water	Toxicity
Glyphosate	Rapidly dissipated through adsorption to suspended and bottom sediments.[1]	12 days to 10 weeks.[1]	Technical grade is moderately toxic to fish. A formulation is registered for aquatic use that is practically non-toxic to fish, aquatic invertebrates, and amphibians.[1] Does not bioaccumulate in fish.[2]

Table 4-1. Behavior of Proposed Herbicides in Water (including toxicity data on fish and aquatic animals)

Herbicide	Solubility	Half Life in Water	Toxicity
Triclopyr	Salt formulation is water-soluble. The ester formulation is insoluble in water.[1]	Salt formulation can degrade in sunlight with a half-life of several hours. The ester formulation takes longer to degrade.[1]	Ester formulation is extremely toxic to fish and aquatic invertebrates. Acid and salt formulation is slightly toxic to fish and aquatic invertebrates.[1] The hydrophobic nature of the ester formulation allows it to be readily absorbed through fish tissues where it is converted to triclopyr acid which can be accumulated to a toxic level. However, most authors have concluded that if applied properly, triclopyr would not be found in concentrations adequate to harm aquatic organisms.[1]
Clopyralid	Highly soluble in water and will not bind with particles in water column.[1]		8 to 40 days.[1] Low toxicity to aquatic animals.[1] Does not bioaccumulate in fish tissues.[3]

[1] Tu et al., 2001a
[2] USDA Forest Service Pacific Northwest Region, 2004.
[3] USDA Forest Service, Unknown date, Pesticide Fact Sheet.

The persistence of a herbicide is defined as the length of time that residues from an application remain active in the soil. A concept known as half-life is commonly used to measure persistence. Half-life is the period of time it takes for 50 percent of an applied herbicide to degrade to relatively harmless components. With a half-life of several weeks or less, the herbicides proposed for use under this alternative have short persistence in the soil; some of the proposed herbicides have half-lives as short as a few days. Soil microbes readily degrade each of the proposed herbicides. More persistent herbicides can offer longer suppression of invasive plants, including less re-establishment from existing seed in the soil, but they are not proposed for use on the WMNF because of their longer persistence in the soil and higher overall toxicity.

The soil mobility (movement through the soil) of the proposed herbicides is varied. Glyphosate and ester formulations of triclopyr bind rapidly to the soil. Clopyralid does not bind strongly to the soil and has a longer half life of 40 days in soil, and thus could leave longer lasting residues in the soil. However, as long the proposed herbicides are used as directed by label specifications and in accordance with the project's protocols (and further outlined in Table 4-2) no long-term impacts to soils or resources are anticipated.

Table 4-2. Soil Guidelines for Herbicide Use on the WMNF		
Herbicide	**Use on aquatic weeds and in wetlands allowed**	**Use on soils with a rapid or very rapid permeability and or a high water table allowed.**
Glyphosate	Yes [1]	Yes
Triclopyr	No	Yes
Clopyralid	No	No

[1] Rodeo® is an example of a proposed formation of glyphosate labeled for aquatic use

<u>Cumulative Effects to Soils (Alt. 2)</u> - the cumulative effects analysis area for NNIS is the White Mountain National Forest. This area was chosen because the effects of herbicides to soils should be limited to only the White Mountain National Forest. The temporal scale of analysis is 10 years previous and 10 years into the future from this decision. Ten years in the past coincides with the point in time at which non-native invasive species management became a higher priority on the Forest and 10 years into the future is the anticipated length of time for which a decision based on this analysis would be relevant.

Physical control methods proposed as part of Alternative 2 might result in some relatively short term effects such as increased soil erosion. As the impacts from the proposed mechanical and biological control activities are essentially negligible, they would contribute little or no incremental effect when combined with impacts of other past, present, and reasonably foreseeable future activities (see Alt. 1 soils effects). Consequently, they are not expected to contribute substantially to any measurable increase in cumulative degradation to soil resources.

With respect to chemical controls described in Alternative 2, areas that would be affected by herbicide treatment are relatively small in size (refer to the project design). The proposed herbicides are expected to degrade quickly in soil, within weeks or several months, by natural processes (Table 4-1) as the impacts from these activities are essentially small to negligible, they would have little or no incremental effect when combined with the impacts of other past, present, and reasonably foreseeable future activities. Therefore, application of herbicides is not expected to result in any appreciable increase in cumulative herbicide concentrations to potentially affected soil resources.

4.2.5 Effects to Water Resources and Aquatic Life (Alt. 2)

<u>Direct and Indirect Effects to Water Resources and Aquatic Life (Alt. 2)</u>

Mechanical Controls

As described in the effects to native plant communities section, mechanical treatment types include mowing, pulling, girdling, hand cutting, root stabbing, and similar activities. Some of these methods can result in high levels of soil disturbance on localized areas. Because of this, these methods would be used on appropriate species with relatively low population numbers. This would minimize soil disturbance and associated sediment transport into nearby water resource features. In addition, the Soils report discusses the potential for ground disturbing activities associated with mechanical control methods to temporarily increase the potential for soil erosion. This, in turn, results in increased sediment available for transport into a water resource features such as a stream or lake. A project protocol requires large bare areas to be stabilized after treatment. This reduces the amount of area disturbed and resultant sediment source. In addition, site specific erosion control methods would be used, as needed, to control the movement of detached soil into water resource features. Mowers and other vehicles would not be operated in wetlands. In these ways, the potential for increased sediment transport and subsequent sedimentation related to mechanical treatment of NNIS would be reduced.

Mechanical methods could alter aquatic habitat conditions adjacent to streams and ponds by affecting streambank stability, insect availability, and potential woody debris recruitment into aquatic habitats. Given the invasive species being treated and the small patch size of current infestations, effects on aquatic life and their habitats are likely to be immeasureable.

Chemical Controls

Glyphosate is an herbicide which binds readily with soil particles, which limits its movement in the environment. Studies have indicated that since it binds strongly to soils it is unlikely to enter waters through surface or subsurface runoff. It can reach waters when the soil itself is washed away, but it remains bound to soil particles and unavailable to plants (summarized by Tu et al., 2001). The recommended formulation for this chemical does not contain surfactants, which have the potential to be mobile and pollute surface or groundwater sources and also kill aquatic organisms such as amphibians.

Garlon 3a® is an example of a water soluble salt formulation of the herbicide Triclopyr. This formulation binds well with soils, and therefore is not likely to be mobile in the environment (Tu et al., 2001). Garlon 4® is an example of an ester based formulation of Tricolpyr. It is not water soluble and can persist in the water. Because the ester based formulation of Triclopyr has moderate soil binding, small amounts of Triclopyr could be carried by the first rainstorm is possible for sites near water resources. However, a study in southwest Oregon found that neither leaching nor long-distance overland flow contributed large amounts of Triclopyr into a nearby stream. The study concluded that, when used correctly, the use of Triclopyr posed little risk for non-target organisms or downstream water users (summarized by Tu et al., 2001).

Clopyralid is water-soluble and doesn’t bind with soils or suspended particles in the water column (Tu et al., 2001). Because of this clopyralid has the potential to be highly mobile, although no extensive offsite movement has been documented (Bergstrom, 1991, and summarized by Tu, et al, 2001).

Herbicide application methods would minimize contact of the herbicide with surrounding soil or water and limit the amount applied. Of the proposed methods, foliar spraying of herbicides has the greatest potential to produce drift and some spraying of non-target plants.

State standards require that herbicides not be applied within 250 feet of surface waters without obtaining a special permit. This standard is in place to protect water quality. In addition, when herbicides are proposed for use within a 5-mile distance of a public water supply intake, further permitting is required by the state of New Hampshire. As part of the permitting process, the state of New Hampshire would determine the terms and conditions under which the proposed herbicide use is approved. Conditions may include providing notice of treatment, posting signs, monitoring water quality, adjusting application rates, etc. All state standards would be abided by and all permits would be obtained prior to the start of work.

By selecting appropriate herbicides and applying the herbicide in a way which specifically targets each individual plant, as well as following any additional terms and conditions required by the state of New Hampshire, the risk to water quality should be minimized. The specimen label on Rodeo® indicates that heavy rainfall within 2 hours of application may wash the product off the foliage (Rodeo® Specimen Label, 2002). All label instructions and state regulations will be followed pertaining to application timing related to rainfall events. This mitigation should further minimize the likelihood of the chemical reaching the surface water.

It is unlikely that there would be a measurable effect on the water quality of the streams, lakes or wetlands on WMNF as a result of projects implemented should Alternative 2 be selected. Because of the very small areas to be treated and low levels of use, and project protocols, it is highly unlikely that herbicide would be detected in surface water as a result of these NNIS treatments. Given the requirements for chemical selection and application near water courses and water bodies, it is also highly unlikely that there would be any measurable effect to the growth or survival of aquatic organisms such as invertebrates, fish, and aquatic stages of amphibians.

In addition, the proposed herbicides would be used as directed by label specifications, as a result, no long-term impacts to water resources or water resource features are anticipated.

Biological Controls

Biological control methods would have little potential to directly or indirectly affect water resources or water resource features. The proposed biological control agents have been demonstrated through research and a WMNF pilot project to adversely affect only the targeted NNIS species and other very closely related taxa. There are no associated effects to water features or its aquatic inhabitants.

<u>Cumulative Effects to Water Resources and Aquatic Life (Alt. 2)</u> - The cumulative effects area for water resources is all water resources on the WMNF, including all water resources features such as riparian and wetlands areas. As described earlier, the timeframe for the effect of NNIS spread on water resource features is long term and depends on the rate of spread of NNIS species. The temporal scale of analysis for the effect of chemical control methods on water quality includes 10 years into the future from this decision because actions related to this document could be implemented for that length of time. Physical control methods related to this alternative are unlikely to contribute to cumulative effects due to the limited magnitude and use of Standards and Guidelines related to this activity.

As discussed, physical and chemical control methods proposed as part of Alternative 2 might result in some relatively short-term effects such as increased sediment transport and herbicide residues. These are not expected to add to any water resources issues including water quality in the watersheds where activities are proposed and implemented using Standards and Guidelines within the next 10 years.

As the impacts from the proposed control activities are small and short term, they would contribute little or no incremental effect when combined with impacts of other past, present, and reasonably foreseeable future activities. Existing water quality issues include mercury in lakes from aerial deposition and sedimentation in streams caused by erosion. However, the proposed NNIS control activities from Alternative 2 would not affect sedimentation or mercury levels in streams and lakes. Herbicide use off the forest is expected to increase as NNIS control and roadside vegetation control are implemented through the use of herbicides. Large scale aerial application off the forest is not likely, with treatment areas being limited to roadways and localized occurrences.

The proposed herbicides are expected to degrade quickly in soil or water, within weeks or several months, by natural processes (Table 4-1) All herbicides chosen do not bioaccumulate. As the impacts from these activities are essentially small and short term, they would have little or no incremental effect when combined with the impacts of other past, present, and reasonably foreseeable future activities. Therefore, application of herbicides and use of mechanical methods is not expected to result in any appreciable increase in cumulative herbicide concentrations to potentially affected soil and water resources, including aquatic life.

4.2.6 Effects to Threatened, Endangered and Sensitive Species (Alt. 2)

4.2.6.1 Effects to Federally Listed Animals (Alt. 2)

<u>Direct and Indirect Effects to Federally Listed Animals (Alt. 2)</u> - mechanical treatments would cause no direct effects to these animals, since all are mobile and would easily move away if workers were present. Indirectly, mechanical treatments would not be expected to substantially alter prey habitat. These species move over large home ranges and the scale at which NNIS treatments are likely to occur is so small as to make any changes in habitat insignificant and discountable.

As explained in the Wildlife effects, chemical applications have the potential to affect animals, but the hazard quotients for both acute and chronic exposure scenarios using typical Forest Service application rates did not exceed one for all chemicals proposed in this project. This essentially means adverse effects to these species would be unlikely. In addition, the probability that these species would be affected in any way relies on several unlikely assumptions, including 1) the species occur in the area being treated, and 2) the species pass through the treatment site during the brief window following herbicide application when the chemicals could be absorbed through contact. In many cases, NNIS treatment sites would consist of a few plants or shrubs totaling less than an acre in area. Also, most treatments would involve cut stem or basal bark applications, meaning the shrubs would be cut first and only the stump treated, or only a ring of chemical applied to the base of a stem. Even if foliar treatments were utilized, the chemicals would work quickly and vegetation would quickly wither and die.

Another theoretical scenario could involve one of these species ingesting a prey species that had been exposed to herbicide. Again, this is so unreasonable as to equate to no effect. Snowshoe hare are unlikely to come into contact with chemicals, since NNIS treatments are not expected in their habitat. If wolves or cougars were present on the Forest, exposure to chemicals from ingestion of exposed moose or deer would require not only that the moose or deer feed on a treated plant (unlikely), but also that the wolf or cougar happened to prey on that particular animal. Indiana bats would not likely ingest chemicals through feeding because their prey is nocturnal and would be unlikely to be sprayed during daytime applications.

Use of biological controls would only occur on purple loosestrife. Beetles would have no effect on these species.

Cumulative Effects to Federally Listed Animals (Alt. 2) - as in Alternative 1, since there are no direct or indirect effects, no cumulative effects would occur.

4.2.6.2 Effects to Federally Listed Plants and Regional Forester Sensitive Plant Species (Alt. 2)

The effects to the Forest's one Federally Listed plant, the small whorled pogonia, and the Regional Forester Sensitive plant species have been determined to be the same. Therefore, in the interest of brevity, these two sections are combined and addressed with one set of effects.

Direct and Indirect Effects to Federally Listed Plants and Regional Forester Sensitive Plant Species (Alt. 2) - this alternative employs an integrated pest management approach to NNIS control. Mechanical, biological and chemical methods would be used to control or eradicate NNIS. The method used would depend on the species to be controlled, size of the infestation, site conditions and other measures set forth in the project's protocols.

Mechanical Control

Mechanical control is not considered for use within or directly adjacent to TES/RFSS occurrences on the WMNF according to the project's protocols due to the potential for heavy trampling, up-rooting of plants, and high levels of soil disturbance. Given this, there is no potential for direct or indirect effects to TES/RFSS plants from mechanical control

Chemical Control

Herbicides have the potential to kill all vegetation to which they are applied or come into contact with, including TES/RFSS plants. According to the project's protocols chemical control using only basal bark, cut stem or wand/glove applications would be allowed within or directly adjacent to TES/RFSS occurrences. In this alternative, herbicide would be applied by hand through one of several methods including cut stump, basal bark, and wand or glove application. These methods directly apply herbicide to the target vegetation and because contact with non-target vegetation is extremely unlikely none of these methods would have undesired effects on

TES/RFSS plants. No other herbicide applications including foliar spray would be allowed in proximity to TES/RFSS occurrences.

Weather conditions can affect the potential for herbicides to affect non-target plants. Heavy rainfall may wash herbicides off treated plants and carry them in surface runoff to non-target plants. Further, weather conditions can also affect the effectiveness of herbicides. Some cut stem treatments are more effective on a hot humid day than on cool cloudy one. No herbicide applications would take place 24 hours prior to or during a rain event.

Applying herbicides during the growing season can kill or injure non-target plants if the application method is not highly selective. Therefore only highly selective control techniques would be utilized in the presence of rare plant occurrences. Additionally, the effectiveness of the herbicide in killing the target species is also affected by the season of application. Cut stem application to woody species is most effective when applied in the late summer through late autumn when energy reserves are being drawn from the stems and branches to the root system.

All herbicide applicators would be licensed or supervised by licensed pesticide applicators. All licensed applicators would have both federal and the appropriate state-issued pesticide certifications and/or licenses. At all NNIS sites where herbicide treatment is to occur, applicators would be required to be able to visually distinguish the target NNIS from TES/RFSS plants. As specified in the project's protocols all annual proposed treatments would be reviewed by resource specialists, including the Forest botanist. Pre-project botanical surveys are required and, if necessary, modifications would be utilized to protect rare plants.

Biological Control

In this alternative, biological control would be used to control moderate to large infestations of purple loosestrife only. This species currently occupies only a very small percentage of the infested land on the Forest.

Two beetles are proposed as biological control for purple loosestrife on the WMNF; *Galerucella calmariensis* and *G. pusilla*. These beetles preferentially on purple loosestrife, but also feed on other members of the genus *Lythrum* (both native and non-native), swamp loosestrife (*Decodon verticillatus*, unknown whether it occurs on the WMNF), sandbar willow (*Salix interior*, likely to occur on the WMNF), and several species in the rose family (*Rosaceae*). Pre-introduction studies of the beetles to be released determined that normal feeding, egg laying, and development of the beetle was confined to purple loosestrife, but some feeding occurred on members of the *Lythraceae* family when no other choice was available (Blossey et al. 1994). A post-release study in Michigan which further tested 40 species in 14 previously untested families supported the pre-release study, but did note some transient feeding on selected non-targets (Kaufman and Landis 2000). Minor damage was observed on five members of the *Rosaceae* family (*Fragaria x. ananassa, Filipendula rubra, Rosa setigera, Alchemilla mollis, and Rubus idaeus*) (Kaufman and Landis 2000). Of these five only *Rubus idaeus* occurs on the WMNF. Another study noted feeding by the beetles for very brief periods on red osier dogwood (*Cornus sericea*) and speckled alder (*Alnus incana*), which also occur on the WMNF. None of these non-target species were substantially impacted by this feeding during the study periods. (Albright et al.) Damage to all non-target species has been shown in additional studies to be minor (Tewksberry 2004, Schooler et al. 2003, Illinois Natural History Survey 1999). This minor feeding is unlikely to result in a decline of any non-target species. Potential negative impacts to non-target plants caused by the *Galerucella* beetles is far outweighed by the positive benefits of reducing purple loosestrife on the White Mountain National Forest.

The biological control agents proposed for release in this alternative have been very carefully selected, studied, and screened by the Animal Plant Health Inspection Service (APHIS). These insects, which are already present on the Forest, have no potential to impact any listed TES/RFSS plant occurring on the WMNF.

There are no current or historic documented occurrences of the TES/RFSS plant species within any known mapped NNIS infestation on the WMNF (NHNHB 2006, MNAP 2006, USFS 2006), therefore no direct or indirect effect would be caused to known mapped TES/RFSS plant occurrences through the implementation of Alternative 2. None of the 183 currently mapped infestations of NNIS on the WMNF, nor any of the nearly 2,000 mapped occurrences in the White Mountain region are located within or directly adjacent to populations of rare plants. Although the Proposed Action would take place in areas of suitable habitat for a number of rare plant species, it is highly unlikely that any future infestation of NNIS discovered on the WMNF would be in close proximity to known or as yet undiscovered populations of TES/RFSS plants. The main reason for this current mutual exclusivity is nearly all WMNF TES/RFSS occupy intact functioning habitats while the vast majority (if not all) mapped NNIS locations occur in disturbed or degraded environments such as roadsides, openings, edges, and stream/river shores. Implementation of Alternative 2 would decrease the potential for new infestations to impact TES/RFSS populations by rapidly reducing the number of existing infestations, and thereby the number potential seed sources to initiate new infestations.

The application of the treatment protocols to all projects would eliminate the effects of control actions on TES/RFSS individuals and occurrences. Treatment protocols require that all current and future NNIS treatment sites be surveyed for TES/RFSS plants prior to project implementation by a qualified individual. If any TES/RFSS plants are discovered during the pre-project survey, treatment protocols further require that control actions would be limited to either cut stem application of herbicide or biological controls, and that the Forest botanist be on site during all control actions. Mechanical control methods are not allowed in areas of TES/RFSS plant populations due to the potential for heavy trampling, up-rooting of plants, and high levels of soil disturbance. In cut stem applications, the herbicide is applied by hand directly to the freshly cut stem of the target NNIS individual. There is little possibility of any effect to non-target vegetation, which is why this is one of the required methods when conducting control activities within or directly adjacent to rare plant locations. Cut stem application of herbicide is the most effective, target specific control technique available and would cause no effect to surrounding rare plants. Biological control (only to be used on moderate to large populations of purple loosestrife) is effectively target specific. Studies of non-target feeding by the *Galerucella* beetles reveal no feeding on any TES/RFSS species found on the WMNF. Therefore, no effects to TES are expected.

Cumulative Effects to Federally Listed Plants and Regional Forester Sensitive Plant Species (Alt. 2) - There is only a minor amount of NNIS control activity taking place outside the WMNF within the analysis area. There are nearly 2,000 documented NNIS infestations within the White Mountain region and likely many more remain undocumented. It is anticipated that given increased development in the region that an increase in ground disturbing activity would also take place in the White Mountain region. These activities create significant suitable habitat for NNIS to colonize. These uncontrolled NNIS infestations serve as a seed and propagule source for the entire analysis area. NNIS infestations occurring off the WMNF would continue to spread at their current locations and disperse themselves via wind, birds, and animals (including humans and associated activities) to new locations both on and off the WMNF. The resulting cumulative effect would be an increase in NNIS on and off the WMNF. Alternative 2 would provide the necessary response capacity to eliminate new infestations on the WMNF as they arise, thereby protecting TES plant occurrences on the Forest. Therefore, the implementation of Alternative 2 would cause no cumulative effect to TES plants occurring on the WMNF.

4.2.6.3 Effects to Regional Foresters Sensitive Animals (Alt. 2)

Direct, Indirect and Cumulative Effects to Eastern Small Footed Bat (Alt. 2) – see Alt. 1.

Direct and Indirect Effects to Northern Bog Lemming (Alt. 2) - mechanical control treatments are unlikely to harm northern bog lemmings, which would easily avoid any disturbance caused by these activities. Treatments that involve digging roots could potentially damage underground burrows or nests, but this possibility is so remote as to be unreasonable. Only small shrubs and plants would be pulled or dug and the chance that they would be located atop a bog lemming burrow is small.

Chemical treatments would have no effect on bog lemmings. It would be virtually impossible for a bog lemming to make contact with the chemical. Most treatments would involve cutting the stem of the target plant, removing the leafy portion, and injecting or ‘painting’ the chemical on the cut surface or around the stem diameter. Even if a foliar spray were used, bog lemmings would disperse prior to spraying activity. It is possible that bog lemmings might return after spraying occurred and make contact with treated plant material, but there would still be no effect. Evaluations of the three chemicals proposed for use in this project show even small mammals sprayed directly did not approach the threshold for toxicity, nor were those thresholds met when small mammals ingested contaminated water or insects.

No effect would result from application of purple loosestrife biological controls.

Cumulative Effects to Northern Bog Lemming (Alt. 2) - compared to timber harvest and recreational use, NNIS treatment would be a minor additional disturbance. Over time, implementation of this alternative would be expected to maintain local habitat quality through suppression and control of NNIS infestations.

Direct and Indirect Effects to American Peregrine Falcon (Alt. 2) - mechanical treatments would not impact peregrine falcons, since no NNIS are known from cliffs.

Because chemical applications have caused negative impacts to peregrines in the past, risk evaluations for the three herbicides proposed for use in this project were reviewed (SERA 2003a, SERA 2003b, SERA 2004 and accompanying worksheets). Although there was no evaluation for a predatory bird consuming contaminated birds, two other scenarios are useful to consider. One involved predatory birds consuming contaminated small mammals. The other evaluated a small bird consuming contaminated insects. Both scenarios assumed the prey items were sprayed directly with herbicide, which is an unreasonable assumption for peregrine falcon prey species. Even so, the toxicity threshold was not reached, indicating no adverse impacts would be expected.

Biological control methods for purple loosestrife would have no effect on peregrine falcons.

In Alternative 2, many NNIS infestations would be treated, helping to maintain current prey habitat conditions and population levels. No change to peregrine falcon populations would be expected in this alternative.

<u>Cumulative Effects to American Peregrine Falcon (Alt. 2)</u> - rock climbing activity and human disturbance would still be the biggest factors influencing peregrine falcon success. NNIS control treatments would have indirect effects as stated above. Overall, peregrine falcon populations are expected to remain stable over the next 10 years.

<u>Direct and Indirect Effects to Common Loon (Alt. 2)</u> - there are currently no known NNIS in loon habitat, so there would be no immediate impact of any kind. Assuming NNIS infestations colonized loon habitat in the future, all treatments potentially could have beneficial impacts by maintaining suitable habitat conditions.

Mechanical treatments in loon habitats could involve cutting or digging up species near waterbody edges. This should have minimal negative effect on loons as the activity would be small in scope and create little disturbance.

Loons would not be directly impacted by any chemical application, as they would not be in the area when work would occur. Indirectly, minute amounts of chemicals might enter the water, but would be quickly dispersed with no effect. Risk evaluations on the three chemicals proposed for use in this project showed toxicity thresholds were not reached even in the case of an accidental spill into the water or in scenarios involving chronic cases of fish-eating birds eating contaminated fish.

Biological controls would have no negative effects on loons.

<u>Cumulative Effects to Common Loon (Alt. 2)</u> - assumptions regarding recreation use would be the same as in Alternative 1. Because purple loosestrife and common reed produce large amounts of wind-dispersed seed, they can rapidly infest a large area. However, in Alternative 2, NNIS treatment of infested sites would reduce the risk that loon habitats would be impacted in the future.

Direct and Indirect Effects to Wood Turtle (Alt. 2) – all of the treatments would increase human disturbance to local wood turtles if they were present. This is expected to be a minor effect, since wood turtle monitoring (which involves holding the wood turtle to examine its shell) does not appear to have affected population numbers or continued occupancy of suitable habitat (D. Busso, pers. com.).

All treatments in wood turtle habitat would likely improve habitat conditions because habitat is limited and wood turtles are not very mobile. Unlike other species, they do not migrate or have large home ranges, so even small habitat changes can have noticeable effects. NNIS treatments could effectively conserve suitable habitat for this species on the Forest.

Aside from the disturbance factor, mechanical treatment would have little impact to wood turtles. They are large enough to be seen and avoided when using hand tools. In theory, a nest could be harmed by digging NNIS plants, but it is an unlikely scenario because digging would be a rare method in wood turtle habitat and the nest would have to be immediately adjacent to the NNIS.

Risk evaluations were not completed for reptiles, but there would be no direct effect from chemical application, since wood turtles would be easily avoided. Indirectly, reptiles are probably closest to birds in their physiological response. In all scenarios using birds consuming contaminated vegetation, toxicity thresholds were not reached except in the case of triclopyr at the upper end of the hazard quotient range (SERA 2003b and accompanying worksheets). However, this is a somewhat unrealistic scenario. In most cases, vegetation would be cut first and chemicals only applied to the cut stem or around the perimeter of the stem. The leafy vegetation that wood turtles would eat would be unaffected. Even in the situation where foliar applications are used, treated vegetation dies fairly rapidly and would be unattractive to a wood turtle in a short time. Given that wood turtles would not likely be in the same area during the application and would take some time to return afterwards, the likelihood of their eating the treated vegetation and being affected is very small.

Biological control treatments would have no negative impacts on wood turtles.

Cumulative Effects to Wood Turtle (Alt. 2) – the past and future threats described in Alternative 1 would apply to Alternative 2 as well. In this case, though, NNIS control treatments would help to mitigate loss elsewhere. Over time, it is likely that wood turtle habitat outside the Forest would become infested and there are no known plans to treat these sites. If left untreated, the population outside the Forest may still decline, but suitable habitat would be maintained within the Forest's boundary.

Direct and Indirect Effects to Boulder Beach Tiger Beetle (Alt. 2) – all NNIS control treatments in suitable habitat would have beneficial effects, especially in locations where species occurrences have been previously recorded. Mechanical and biological control treatment effects would be similar as those described for wood turtles. Effects of chemical applications have not been tested on this species. The standard insect used for evaluating toxic effects from pesticides is the honeybee. For all chemicals proposed in this project, the threshold for toxicity was not reached, even when chemicals were directly sprayed on the individuals and 100 percent absorption occurred. Because beetles' hard shells are expected to protect them better than honeybees from direct spray, anticipated effects would be even less.

Cumulative Effects to Boulder Beach Tiger Beetle (Alt. 2) – cumulative effects would be similar to those described for wood turtle. Assuming NNIS occurrences are not treated off the Forest, it is likely that much of the tiger beetle habitat outside the WMNF would be reduced in quality over time. Since much of the known population appears to be located off the Forest, population viability may decline, although maintaining habitat quality on the Forest would help keep WMNF numbers stable.

Direct and Indirect Effects to Warpaint Emerald (Alt. 2) – suitable habitats do not currently contain NNIS occurrences. In the future, if NNIS infestations occur, mechanical treatments would likely have little risk of negative effect because adults would easily move out of the way of activity. Even so, with only one known occurrence, it is unlikely the species would be present in many cases. Although there potentially is the risk that a worker could inadvertently step on eggs or larvae, this would be a remote possibility.

Chemical treatments would have no effects on warpaint emeralds. Dragonflies are extremely agile and would easily avoid chemical application. Nonetheless, risk evaluations for all three chemicals proposed in this project were evaluated (SERA 2003a, SERA 2003b, SERA 2004 and accompanying worksheets), using honeybees as a representative insect species. In no case was the toxicity threshold reached

There would be no effect from release of biological controls.

Cumulative Effects to Warpaint Emerald (Alt. 2) – assumptions for cumulative effects analysis would be similar to those described in Alternative 1, therefore, cumulative effects would be the same as the direct and indirect effects described above for this alternative.

4.3 Alternative 3 (Mechanical and Biological Treatments) – this alternative is the same as Alternative 2 with the exception of not using chemical treatment methods.

4.3.1 Effects to Non-Native Invasive Plants (Alt. 3)

Direct and Indirect Effects to NNIS Plants (Alt. 3) - under this alternative, small infestations of woody and some herbaceous NNIS species would be effectively controlled or eradicated via mechanical removal. Mechanical treatments are generally much more labor-intensive than chemical applications, so it is assumed under Alternative 3 that fewer acres would be treated. Large infestations of purple loosestrife would be treated using biological control organisms and extremely small infestations of this species would be removed mechanically. Moderate to large infestations of all species would go effectively untreated and remain on the Forest serving as a source of propagules for new infestations. These new infestations may spread into areas currently un-infested on the Forest. A limited number of species would go entirely untreated due to a lack of successful biological or mechanical treatment protocol. These species include Japanese knotweed and common reed.

Cumulative Effects to NNIS Plants (Alt. 3) - The treatment protocols presented in Alternative 3 would be expected to initially result in a slight decrease in the number of acres infested by NNIS on the Forest. This slight decrease would be a result of the eradication of a number of small infestations of primarily woody NNIS via mechanical means. Large infestations of most species and all infestations of some currently widespread species would go untreated and may spread into currently un-infested areas of the Forest and surrounding northern New Hampshire and western Maine.

4.3.2 Effects to Native Plant Communities (Alt. 3)

Direct and Indirect Effects to Native Plant Communities (Alt. 3) - Alternative 3 is the same as Alternative 2, with the exception that chemical control techniques would not be utilized. Thus, none of the risks to non-target plants or native plant communities from chemicals described under Alternative 2 are applicable. The effects to native plant communities and non-target plants from mechanical and biological control techniques would remain.

Under this alternative, small infestations of woody and some herbaceous NNIS species would be effectively controlled or eradicated via mechanical removal. Large infestations of purple loosestrife would be treated using biological control organisms and extremely small infestations of this species would be removed mechanically. Moderate to large infestations of all species would go effectively untreated and remain on the Forest serving as a source of propagules for new infestations. A limited number of species would go entirely untreated due to a lack of successful biological or mechanical treatment protocol. These species include Japanese knotweed and common reed. The infestations of NNIS remaining untreated on the Forest and the new infestations created by them would spread causing a decline in the abundance, diversity and viability of native plant communities and/or individual non-target species occurring on the WMNF.

Cumulative Effects to Native Plant Communities (Alt. 3) -Because Alternative 3 is the same as Alternative 2 with the exception of chemical control techniques, the cumulative effects to native plant communities would be similar. Large infestations of most species and all infestations of some currently widespread species would go untreated and may spread into currently un-infested areas of the Forest and surrounding northern New Hampshire and western Maine. This continued existence and spread to new locations would cause a decline in the abundance, diversity and viability of native plant communities and/or individual non-target species occurring both on the WMNF and in the surrounding landscape of northern New Hampshire and western Maine.

4.3.3 Effects to Wildlife (Alt. 3)

Direct and Indirect Effects to Mammals (Alt. 3) - since there is no apparent effect to mammals from chemical control treatments, direct and indirect effects of Alternative 3 are essentially the same as described for Alternative 2.

Cumulative Effects to Mammals (Alt. 3) - cumulative effects would be similar to those described in Alternative 2. Over time, if NNIS infestations spread at the current rate, it may be more difficult for WMNF staff to control NNIS occurrences. Mechanical treatments are generally much more labor-intensive than chemical applications, so it is assumed under Alternative 3 that fewer acres would be treated. Therefore, assuming budgets remain steady, habitat decline may happen at a slightly faster rate than in Alternative 2.

Direct and Indirect Effects to Birds (Alt. 3) - since there is no measurable effect to birds from chemical control treatments, direct and indirect effects of Alternative 3 are essentially the same as described for Alternative 2.

Cumulative Effects to Birds (Alt. 3) - cumulative effects are similar to those described in Alternative 2. However, because chemical control is not an option and mechanical treatments are more labor-intensive and less effective, the amount of acres impacted by NNIS effects would be higher in Alternative 3.

Direct and Indirect Effects to Amphibians (Alt. 3) - effects would be similar to those described in Alternative 2. Although risks from chemical exposure are small in Alternative 2, they would be removed completely in Alternative 3.

Cumulative Effects to Amphibians (Alt. 3) - cumulative effects would be similar to those described in Alternative 2. As with mammals and birds, without the option of more effective chemical methods, habitat quality may be somewhat reduced in this alternative compared to Alternative 2.

Direct and Indirect Effects to Invertebrates (Alt. 3) - there would be no effects to honeybees from implementing Alternative 3. Bees are agile and could easily be avoided in mechanical treatments. Benefits from maintaining native pollen sources would be the same as described in Alternative 2.

Cumulative Effects to Invertebrates (Alt. 3) - cumulative effects would be the same as those described in Alternative 2.

4.3.4 Effects to Soils (Alt. 3)

Direct and Indirect effects to Soils (Alt 3) - the direct and indirect effects to soils from the use of physical and biological control methods would be the same as Alternative 2. However, the nonuse of chemical control to remove NNIS infestations would leave some infestations too big or ineffective to use mechanical or biological control intact. These NNIS infestations could adversely impact soils by removing nutrients and increasing soil erosion (Olson 1999).

Cumulative Effects to Soils (Alt. 3) - the cumulative effects analysis area for NNIS is the White Mountain National Forest. This area was chosen because the effects of herbicides to soils should be limited to only the White Mountain National Forest The temporal scale of analysis is 10 years previous and 10 years into the future from this decision. Ten years in the past coincides with the point in time at which non-native invasive species management became a higher priority on the Forest and 10 years into the future is the anticipated length of time for which a decision based on this analysis would be relevant. Physical and biological control methods proposed in Alternative 3 are the same as Alternative 2 so the cumulative effects would be the same as Alternative 2.

4.3.5 Effects to Water Resources and Aquatic Life (Alt. 3)

Direct and Indirect Effects to Water Resources and Aquatic Life (Alt. 3) - because chemical control methods would not be used under this alternative, greater use of mechanical control methods may be needed to achieve satisfactory control of some NNIS infestations. However, as stated in the effects to native plant communities, "Moderate to large infestations of all species would go effectively untreated and remain on the Forest serving as a source for new infestations. A limited number of species would go entirely untreated due to a lack of successful biological or mechanical treatment protocol."

Because of the greater use of mechanical control methods there would be an increased potential for sedimentation of waters depending on the location of the treatment sites. However, the protocols discussed in this report ensure that water resources and associated features such as wetland and aquatic habitats would not be not substantially exposed to sedimentation.

Mechanical methods could alter aquatic habitat conditions adjacent to streams and ponds by affecting streambank stability, insect availability, and potential woody debris recruitment into aquatic habitats. Even with potentially greater use of mechanical methods in this alternative, effects on aquatic life and their habitats are likely to be immeasureable due to the invasive species being treated and the small patch size of current infestations.

Cumulative Effects to Water Resources and Aquatic Life (Alt. 3) - The cumulative effects area for water resources is all water resources on the WMNF, including all water resources features such as riparian and wetlands areas. The timeframe is long term for the effect of NNIS spread on water resource features and depends on the rate of spread of NNIS species. Biological and physical control methods related to this alternative are unlikely to contribute to cumulative effects due to the limited magnitude and use of Standards and Guidelines related to this activity.

As described in the effects to native plant communities, NNIS populations for all species would continue to increase in the WMNF since mechanical and biological methods are not adequate to control all NNIS species on the Forest. In addition, locations outside the Forest may not be treated for NNIS, resulting in a larger seed pool and potential for transport on the Forest. This combination with less effective treatments on the WMNF, could result in large mono-species NNIS populations in wetland and riparian areas. This effect could increase with time, until a limiting factor such as elevation or other site characteristics limit the spread of NNIS. The effects of not treating invasives species on aquatic life is not well understood at this time. However, impacts could include changes to water chemistry, nitrogen cycling (Fickbohm and Shu, 2006), hydrologic functions (Mitsch and Gosselink, 2000), and streambank/shoreline characteristics over the long term.

4.3.6 Effects to Threatened, Endangered and Sensitive Species (Alt. 3)

4.3.6.1 Effects to Federally Listed Animals (Alt. 3)

Direct and Indirect Effects to Federally Listed Threatened and Endangered Animals (Alt. 3) - Alterative 3 is the same as Alternative 2 except no chemical treatments would be used. Effects would similar to those described in Alternative 2 for mechanical and biological treatments.

Cumulative Effects to Federally Listed Threatened and Endangered Animals (Alt. 3) - there would be no cumulative effects, since no direct or indirect effects would occur.

4.3.6.2 Effects to Federally Listed Plants (Alt. 3)

Direct and Indirect Effects to Federally Listed Plants (Alt. 3) - Alternative 3 is the same as Alternative 2, with the exception that chemical control techniques will not be utilized. Furthermore, per project's protocols (Section 2.2.2) mechanical control methods are not considered within or in close proximity to TES occurrences. Therefore, only biological control would be considered in the effects analysis for Alternative 3. The analysis and resulting effects for biological control are identical to those written for Alternative 2.

Under this alternative, if a population of small whorled pogonia were discovered to be infested with a NNIS no action would be taken to control the NNIS unless the NNIS were a moderate to large infestation of purple loosestrife. Purple loosestrife does not infest the habitat occupied by small whorled pogonia, therefore any infestation impacting small whorled pogonia would remain uncontrolled. This would be an indirect effect leading to increased competition for light, nutrients, water, and space.

Cumulative Effects to Federally Listed Plants (Alt. 3) - because Alternative 3 is the same as Alternative 2 with the exception of chemical control techniques the cumulative effects to TES/RFSS are similar. Furthermore, per Project Design Criteria mechanical control methods are not considered within or in close proximity to TES/RFSS occurrences. Therefore, only biological control would be considered in the effects analysis for Alternative 3. The analysis and resulting effects for biological control are identical to those written for Alternative 2.

Under Alternative 3, only moderate to large infestations of purple loosestrife would be controlled within or in close proximity to TES/RFSS plant occurrences. Purple loosestrife does not infest the habitat occupied by small whorled pogonia. Therefore all NNIS that may impact this species would remain uncontrolled and would continue to spread at their current locations and disperse themselves via wind, birds, and animals (including humans and associated activities) to new locations both on and off the WMNF. Over time it is reasonable to conclude that the uncontrolled spread of NNIS on the WMNF would begin to affect small whorled pogonia populations both on and off WMNF ownership. The cumulative effect of this would be the spread of these species to new locations leading to increased competition for light, nutrients, water, and space.

Direct and Indirect Effects to Federally Listed Animals (Alt. 3) -Alterative 3 is the same as Alternative 2 except no chemical treatments would be used. Effects would similar to those described in Alternative 2.

Cumulative Effects to Federally Listed Animals (Alt. 3) - there would be no cumulative effects, since no direct or indirect effects would occur.

4.3.6.3 Effects to Regional Foresters Sensitive Animals (Alt. 3)

Direct, Indirect and Cumulative Effects to Eastern Small Footed Bat (Alt. 3) – see Alt. 1.

Direct and Indirect Effects to Northern Bog Lemming, American Peregrine Falcon, and Warpaint Emerald (Alt. 3) - effects would be the same as those described in Alternative 2 for mechanical and biological treatments.

Cumulative Effects to Northern Bog Lemming, American Peregrine Falcon, and Warpaint Emerald (Alt. 3) - cumulative effects would be the same as those described in Alternative 2.

Direct and Indirect Effects to Common Loon (Alt. 3) - effects would be similar to those described in Alternative 2. However, without the use of chemical treatment methods, it would be more labor intensive to control some sites. Larger patches of common reed would be difficult to treat mechanically without causing additional disturbance because of longer implementation times and repeated entries.

Cumulative Effects to Common Loon (Alt. 3) - effects would be similar to those described in Alternative 2.

Direct and Indirect Effects to Wood Turtle (Alt. 3) - effects from Alternative 3 are similar to those described in Alternative 2. However, known NNIS sites in wood turtle habitat would be more effectively treated with chemicals than with mechanical controls. It is possible that mechanical control alone may help suppress these sites, but without chemical options, it would be difficult to eradicate the NNIS completely, so habitat quality may be somewhat reduced in this alternative.

Cumulative Effects to Wood Turtle (Alt. 3) - cumulative effects would be similar to those described in Alternative 2, but as explained above, lack of chemical control options would limit the amount of NNIS work that could be effectively accomplished. Mechanical and biological control options would help maintain suitable habitat conditions, but potentially could require more labor and time, reducing somewhat the probability that habitat quality would be maintained. Because of the concern over wood turtle viability in general, it is likely that this habitat would be a high priority for treatment, so differences in treatment methods should be minor.

Direct and Indirect Effects to Boulder Beach Tiger Beetle (Alt. 3) - effects from Alternative 3 would be similar to those described for Alternative 2. As with wood turtles, it is possible that lack of chemical control options would lead to some reduced habitat quality.

Cumulative Effects to Boulder Beach Tiger Beetle (Alt. 3) - cumulative effects would be similar to those described for Alternative 2.

4.3.6.4 Effects to Regional Forester Sensitive Plant Species (Alt. 3)

Direct and Indirect Effects to Regional Forester Sensitive Plant Species (Alt. 3) - Alternative 3 is the same as Alternative 2, with the exception that chemical control techniques would not be utilized. Furthermore, per the treatment protocols mechanical control methods are not considered within or in close proximity to RFSS occurrences. Therefore, only biological control would be considered in the effects analysis for Alternative 3. The analysis and resulting effects (or lack there of) for biological control are identical to those written for Alternative 2.

Under this alternative, if a RFSS plant occurrence were discovered to be infested with a NNIS no action would be taken to control the NNIS unless the NNIS were a moderate to large infestation of purple loosestrife. All other infestations would remain uncontrolled leading to increased competition for light, nutrients, water, and space or displacement by NNIS, ultimately resulting in the potential decline in viability or loss of RFSS occurrences on the WMNF.

Effects to Butternut under Alternative 3 are similar to those presented in Alternative 1. Project design criteria prohibits mechanical control methods within or in close proximity to RFSS occurrences. Biological control is only available for purple loosestrife which does not infest butternut habitat. Therefore, no control of NNIS would be performed at occurrences of butternut. Currently, this species exists largely as adult trees and regeneration is scarce, even without the added competition from NNIS at existing sites. The additional stresses caused by the spread of and competition from NNIS could further jeopardize the local viability of this species.

Cumulative Effects to Regional Forester Sensitive Plant Species (Alt. 3) - because Alternative 3 is the same as Alternative 2 with the exception of chemical control techniques, the cumulative effects to RFSS are similar. Furthermore, per the treatment protocols mechanical control methods are not considered within or in close proximity to RFSS occurrences. Therefore, only biological control would be considered in the effects analysis for Alternative 3. The analysis and resulting effects (or lack there of) for biological control are identical to those written for Alternative 2.

Under Alternative 3, only moderate to large infestations of purple loosestrife would be controlled within or in close proximity to RFSS plant occurrences. All other NNIS infestations would remain uncontrolled and would continue to spread at their current locations and disperse themselves via wind, birds, and animals (including humans and associated activities) to new locations both on and off the WMNF. Over time it is reasonable to conclude that the uncontrolled spread of NNIS on the WMNF would begin to affect RFSS species both on and off WMNF ownership. The spread of these species to new locations would lead to increased competition for light, nutrients, water, and space or displacement by NNIS. The end result would be a potential decline in viability or loss of RFSS occurrences from the WMNF, northern New Hampshire and western Maine.

In the case of Butternut, cumulative effects would are similar to those for the other RFSS as presented for this alternative, however the outcome for butternut due to its current scarcity and lack of regeneration the spread and impact of NNIS on this species within the analysis area could jeopardize the local viability of this species.

4.4 Environmental Justice – after reviewing the design of the proposed project in relation to low-income or minority populations, either of the action alternatives would not adversely impact these populations. The potential benefit to maintaining and restoring ecosystem health in these alternatives should help preserve and protect the Forest resources which could potentially provide some economic benefit to the lower income populations and Native Americans using the Forest.

In the no-action alternative (Alt. 1), the potential damage to Forest ecosystems resulting from the uncontrolled spread of invasive plants could place some of the resources that low-income and Native Americans derive benefit from at risk. Either directly or indirectly, many people in the categories derive benefit from resources such as timber, forest products and well being from healthy Forest ecosystems. Under Alternative 1, these benefits could be at risk in some areas of heavy invasive plant infestations over the long term.

5.0 List of Preparers and Persons Contacted

As mentioned in Section 1.5, Public Involvement, the proposal for this project was mailed to an extensive list of 1,786 contacts including federal, state, and town agencies and offices, public organizations, and individuals who had expressed interest in receiving these documents. Paper copies of this document will be mailed to individuals that responded during the initial scoping period and those that have requested paper copies. Electronic copies of this document will be posted to the White Mountain National Forest web site at :
http://www.fs.fed.us/r9/forests/white_mountain/projects/projects/index.php

The Forest Service contacted the following individuals in the course of preparing this analysis:

New England Wild Flower Society – William Brumback, Conservation Director
New Hampshire Natural Heritage Bureau – Lionel Chute, Bureau Administrator
Maine Natural Areas Program, Don Cameron, State Botanist

Interdisciplinary Team Members:
Thomas Giles – Planning Analyst, ID Team Leader
Leighlan Prout - Forest Biologist, TES Program Leader
Chris Mattrick – Forest Botanist
Andy Colter - Forest Ecologist/Soil Scientist
Livia Crowley – Forest Hydrologist
Mark Prout – Forest Fisheries Biologist
Karl Roenke - Forest Archeologist

6.0 Literature Citations and References

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Note: in preparing this analysis, members of the interdisciplinary team prepared specialist's reports to include a Biological Evaluation. These documents are part of the project record and are available upon request.

Appendix A – Table of Known NNIS Plant Locations on the White Mountain National Forest*

DISTRICT	COMMON_NAME	INFESTED_ACRES	LONG DEC DEG	LAT DEC DEG	LONGITUDE DMS	LATITUDE DMS
ANDROSCOGGIN RANGER DISTRICT	Asian bittersweet	0.01	-70.82836000013	44.32021802549	70° 49' 42.10" W	44° 19' 12.78" N
ANDROSCOGGIN RANGER DISTRICT	Asian bittersweet	0.01	-70.80376096971	44.33734587686	70° 48' 13.54" W	44° 20' 14.45" N
ANDROSCOGGIN RANGER DISTRICT	Asiatic honeysuckle	0.35	-71.46896524993	44.41784973722	71° 28' 8.27" W	44° 25' 4.26" N
ANDROSCOGGIN RANGER DISTRICT	Asiatic honeysuckle	0.01	-71.46896524993	44.41784973722	71° 28' 8.27" W	44° 25' 4.26" N
ANDROSCOGGIN RANGER DISTRICT	Asiatic honeysuckle	0.01	-71.23944770069	44.20451705132	71° 14' 22.01" W	44° 12' 16.26" N
ANDROSCOGGIN RANGER DISTRICT	Asiatic honeysuckle	0.01	-71.21690068557	44.32262726851	71° 13' 0.84" W	44° 19' 21.46" N
ANDROSCOGGIN RANGER DISTRICT	Asiatic honeysuckle	0.01	-71.18815948053	44.35700237368	71° 11' 17.37" W	44° 21' 25.21" N
ANDROSCOGGIN RANGER DISTRICT	Asiatic honeysuckle	0.01	-70.80287821277	44.33399029198	70° 48' 10.36" W	44° 20' 2.37" N
ANDROSCOGGIN RANGER DISTRICT	bishop's goutweed	0.01	-71.36499555877	44.60544370808	71° 21' 53.98" W	44° 36' 19.60" N
ANDROSCOGGIN RANGER DISTRICT	bishop's goutweed	0.01	-71.36253546072	44.60369374159	71° 21' 45.13" W	44° 36' 13.30" N
ANDROSCOGGIN RANGER DISTRICT	bishop's goutweed	0.01	-71.25322832065	44.25670600627	71° 15' 11.62" W	44° 15' 24.14" N
ANDROSCOGGIN RANGER DISTRICT	bishop's goutweed	0.01	-70.97604009328	44.33030842042	70° 58' 33.74" W	44° 19' 49.11" N
ANDROSCOGGIN RANGER DISTRICT	black locust	0.01	-71.25229813790	44.24176641339	71° 15' 8.27" W	44° 14' 30.36" N
ANDROSCOGGIN RANGER DISTRICT	black locust	0.17	-70.93291748404	44.39862269369	70° 55' 58.50" W	44° 23' 55.04" N
ANDROSCOGGIN RANGER DISTRICT	black locust	0.01	-70.91032654616	44.37771362776	70° 54' 37.18" W	44° 22' 39.77" N
ANDROSCOGGIN RANGER DISTRICT	brownray knapweed	0.0001	-71.35564646431	44.30314828237	71° 21' 20.33" W	44° 18' 11.33" N
ANDROSCOGGIN RANGER DISTRICT	climbing nightshade	0.01	-71.21700913563	44.32362352793	71° 13' 1.23" W	44° 19' 25.04" N
ANDROSCOGGIN RANGER DISTRICT	coltsfoot	0.01	-71.47211579479	44.46967803685	71° 28' 19.62" W	44° 28' 10.84" N
ANDROSCOGGIN RANGER DISTRICT	coltsfoot	0.01	-71.36280546072	44.60098384763	71° 21' 46.10" W	44° 36' 3.54" N
ANDROSCOGGIN RANGER DISTRICT	coltsfoot	0.01	-71.36253546072	44.60369374159	71° 21' 45.13" W	44° 36' 13.30" N
ANDROSCOGGIN RANGER DISTRICT	coltsfoot	0.02	-71.34955391224	44.46117240523	71° 20' 58.39" W	44° 27' 40.22" N
ANDROSCOGGIN RANGER DISTRICT	coltsfoot	0.02	-71.34109005021	44.45215356783	71° 20' 27.92" W	44° 27' 7.75" N
ANDROSCOGGIN RANGER DISTRICT	coltsfoot	0.02	-71.33485242992	44.58672640286	71° 20' 5.47" W	44° 35' 12.22" N
ANDROSCOGGIN RANGER DISTRICT	coltsfoot	0.01	-71.33128025143	44.49550961007	71° 19' 52.61" W	44° 29' 43.83" N
ANDROSCOGGIN RANGER DISTRICT	coltsfoot	0.01	-71.31762968269	44.49111008737	71° 19' 3.47" W	44° 29' 28.00" N
ANDROSCOGGIN RANGER DISTRICT	coltsfoot	0.01	-71.30610984335	44.47278516024	71° 18' 22.00" W	44° 28' 22.03" N
ANDROSCOGGIN RANGER DISTRICT	coltsfoot	0.01	-71.18465057596	44.35960241108	71° 11' 4.74" W	44° 21' 34.57" N
ANDROSCOGGIN RANGER DISTRICT	coltsfoot	0.01	-71.08062804304	44.29562043772	71° 4' 50.26" W	44° 17' 44.23" N
ANDROSCOGGIN RANGER DISTRICT	common barberry	0.03	-70.84378261029	44.33117999506	70° 50' 37.62" W	44° 19' 52.25" N
ANDROSCOGGIN RANGER DISTRICT	common reed	0.01	-71.35152399197	44.46733033156	71° 21' 5.49" W	44° 28' 2.39" N
ANDROSCOGGIN RANGER DISTRICT	Japanese barberry	1	-71.46896524993	44.41784973722	71° 28' 8.27" W	44° 25' 4.26" N
ANDROSCOGGIN RANGER DISTRICT	Japanese barberry	0.01	-70.85286489384	44.26825861409	70° 51' 10.31" W	44° 16' 5.73" N
ANDROSCOGGIN RANGER DISTRICT	Japanese knotweed	0.1	-71.36843968045	44.32492466176	71° 22' 6.38" W	44° 19' 29.73" N
ANDROSCOGGIN RANGER DISTRICT	Japanese knotweed	0.01	-71.36525552457	44.60455371897	71° 21' 54.92" W	44° 36' 16.39" N

Appendix A – Table of Known NNIS Plant Locations on the White Mountain National Forest*						
DISTRICT	COMMON_NAME	INFESTED_ACRES	LONG DEC DEG	LAT DEC DEG	LONGITUDE DMS	LATITUDE DMS
ANDROSCOGGIN RANGER DISTRICT	Japanese knotweed	0.01	-71.36525552457	44.60455371897	71° 21' 54.92" W	44° 36' 16.39" N
ANDROSCOGGIN RANGER DISTRICT	Japanese knotweed	0.01	-71.36525552457	44.60455371897	71° 21' 54.92" W	44° 36' 16.39" N
ANDROSCOGGIN RANGER DISTRICT	Japanese knotweed	0.01	-71.25219793598	44.22085678547	71° 15' 7.91" W	44° 13' 15.08" N
ANDROSCOGGIN RANGER DISTRICT	Japanese knotweed	0.01	-71.19503940990	44.34738270161	71° 11' 42.14" W	44° 20' 50.58" N
ANDROSCOGGIN RANGER DISTRICT	Japanese knotweed	0.01	-71.06497080740	44.30506142500	71° 3' 53.89" W	44° 18' 18.22" N
ANDROSCOGGIN RANGER DISTRICT	Japanese knotweed	0.13	-70.96590913246	44.39552440435	70° 57' 57.27" W	44° 23' 43.89" N
ANDROSCOGGIN RANGER DISTRICT	Japanese knotweed	0.36	-70.91038833844	44.37764713698	70° 54' 37.40" W	44° 22' 39.53" N
ANDROSCOGGIN RANGER DISTRICT	Japanese knotweed	1.27	-70.79393679906	44.30437072428	70° 47' 38.17" W	44° 18' 15.73" N
ANDROSCOGGIN RANGER DISTRICT	oriental bittersweet	0.2	-71.46896524993	44.41784973722	71° 28' 8.27" W	44° 25' 4.26" N
ANDROSCOGGIN RANGER DISTRICT	purple loosestrife	0.18	-71.25334821811	44.24756631001	71° 15' 12.05" W	44° 14' 51.24" N
ANDROSCOGGIN RANGER DISTRICT	winged burning bush	0.01	-71.36253546072	44.60369374159	71° 21' 45.13" W	44° 36' 13.30" N
PEMIGEWASSET RANGER DISTRICT	Asiatic honeysuckle	0.01	-71.95686996111	43.95965729787	71° 57' 24.73" W	43° 57' 34.77" N
PEMIGEWASSET RANGER DISTRICT	Asiatic honeysuckle	0.04	-71.87779531679	44.11272019346	71° 52' 40.06" W	44° 6' 45.79" N
PEMIGEWASSET RANGER DISTRICT	Asiatic honeysuckle	0.27	-71.87628027214	43.83960211667	71° 52' 34.61" W	43° 50' 22.57" N
PEMIGEWASSET RANGER DISTRICT	Asiatic honeysuckle	0.01	-71.79270690742	44.07046178881	71° 47' 33.74" W	44° 4' 13.66" N
PEMIGEWASSET RANGER DISTRICT	Asiatic honeysuckle	0.21	-71.70184832616	44.03867912256	71° 42' 6.65" W	44° 2' 19.24" N
PEMIGEWASSET RANGER DISTRICT	Asiatic honeysuckle	0.04	-71.64543206961	44.21847419895	71° 38' 43.56" W	44° 13' 6.51" N
PEMIGEWASSET RANGER DISTRICT	Asiatic honeysuckle	0.03	-71.62846290740	44.25601379534	71° 37' 42.47" W	44° 15' 21.65" N
PEMIGEWASSET RANGER DISTRICT	Asiatic honeysuckle	0.28	-71.62771767211	44.25612237833	71° 37' 39.78" W	44° 15' 22.04" N
PEMIGEWASSET RANGER DISTRICT	Asiatic honeysuckle	0.01	-71.61846010179	44.24272163264	71° 37' 6.46" W	44° 14' 33.80" N
PEMIGEWASSET RANGER DISTRICT	Asiatic honeysuckle	0.13	-71.58233348874	43.86960252408	71° 34' 56.40" W	43° 52' 10.57" N
PEMIGEWASSET RANGER DISTRICT	autumn olive	0.15	-71.87625589143	43.83956686417	71° 52' 34.52" W	43° 50' 22.44" N
PEMIGEWASSET RANGER DISTRICT	bishop's goutweed	0.01	-71.90613190956	44.11451465784	71° 54' 22.07" W	44° 6' 52.25" N
PEMIGEWASSET RANGER DISTRICT	bishop's goutweed	0.02	-71.85419056764	44.10130508401	71° 51' 15.09" W	44° 6' 4.70" N
PEMIGEWASSET RANGER DISTRICT	bishop's goutweed	0.01	-71.37510932439	44.07510838019	71° 22' 30.39" W	44° 4' 30.39" N
PEMIGEWASSET RANGER DISTRICT	black locust	0.01	-71.95686996111	43.95965729787	71° 57' 24.73" W	43° 57' 34.77" N
PEMIGEWASSET RANGER DISTRICT	black locust	0.01	-71.87156474603	44.11706348006	71° 52' 17.63" W	44° 7' 1.43" N
PEMIGEWASSET RANGER DISTRICT	black locust	0.9	-71.85250630209	43.80745067103	71° 51' 9.02" W	43° 48' 26.82" N
PEMIGEWASSET RANGER DISTRICT	black locust	0.66	-71.85250630209	43.80745067103	71° 51' 9.02" W	43° 48' 26.82" N
PEMIGEWASSET RANGER DISTRICT	black locust	0.01	-71.85250630209	43.80745067103	71° 51' 9.02" W	43° 48' 26.82" N
PEMIGEWASSET RANGER DISTRICT	black locust	0.01	-71.52204100235	43.96491906470	71° 31' 19.35" W	43° 57' 53.71" N
PEMIGEWASSET RANGER DISTRICT	black locust	0.1	-71.45595371600	44.30697297887	71° 27' 21.43" W	44° 18' 25.10" N
PEMIGEWASSET RANGER DISTRICT	brownray knapweed	0.11	-71.68073993301	44.19885564048	71° 40' 50.66" W	44° 11' 55.88" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.01	-71.92248331410	44.12136407015	71° 55' 20.94" W	44° 7' 16.91" N

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DISTRICT	COMMON_NAME	INFESTED_ACRES	LONG DEC DEG	LAT DEC DEG	LONGITUDE DMS	LATITUDE DMS
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.01	-71.92227236613	44.12146448535	71° 55' 20.18" W	44° 7' 17.27" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.01	-71.91395082440	44.06036558731	71° 54' 50.22" W	44° 3' 37.32" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.5	-71.90978765252	44.05831242434	71° 54' 35.24" W	44° 3' 29.92" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.01	-71.90854197392	44.11533464229	71° 54' 30.75" W	44° 6' 55.20" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.03	-71.89689829753	44.12197043028	71° 53' 48.83" W	44° 7' 19.09" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.01	-71.89291929813	44.11905801160	71° 53' 34.51" W	44° 7' 8.61" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.12	-71.87142072641	44.10517339131	71° 52' 17.11" W	44° 6' 18.62" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.04	-71.85336120194	44.05542373545	71° 51' 12.10" W	44° 3' 19.53" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.06	-71.85130044495	44.09793514935	71° 51' 4.68" W	44° 5' 52.57" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.04	-71.84844483075	44.06838187877	71° 50' 54.40" W	44° 4' 6.17" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.01	-71.84703028270	44.09518520644	71° 50' 49.31" W	44° 5' 42.67" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.01	-71.84621032078	44.09759518804	71° 50' 46.36" W	44° 5' 51.34" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.01	-71.84587063618	44.11222490309	71° 50' 45.13" W	44° 6' 44.01" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	1.59	-71.83863265246	44.08440934381	71° 50' 19.08" W	44° 5' 3.87" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.3	-71.83574958910	44.07427562421	71° 50' 8.70" W	44° 4' 27.39" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.01	-71.83319002533	44.09595526387	71° 49' 59.48" W	44° 5' 45.44" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.01	-71.83170966665	44.08185552749	71° 49' 54.15" W	44° 4' 54.68" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.01	-71.81574723933	44.12153362827	71° 48' 56.69" W	44° 7' 17.52" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.01	-71.81328012621	44.11668495237	71° 48' 47.81" W	44° 7' 0.07" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.07	-71.79700036959	43.85562534678	71° 47' 49.20" W	43° 51' 20.25" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.1	-71.75902623585	43.99110748686	71° 45' 32.49" W	43° 59' 27.99" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.01	-71.75547506083	43.87261968041	71° 45' 19.71" W	43° 52' 21.43" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.01	-71.74963612004	43.99700739616	71° 44' 58.69" W	43° 59' 49.23" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.01	-71.74943610852	43.99921736919	71° 44' 57.97" W	43° 59' 57.18" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.03	-71.73216517338	43.93696859023	71° 43' 55.79" W	43° 56' 13.09" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.01	-71.73146558604	44.02136493110	71° 43' 53.28" W	44° 1' 16.91" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.02	-71.65538659958	44.23912291495	71° 39' 19.39" W	44° 14' 20.84" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.01	-71.58340252969	43.99412822393	71° 35' 0.25" W	43° 59' 38.86" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.06	-71.57999155624	43.88294037617	71° 34' 47.97" W	43° 52' 58.59" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.14	-71.53668253473	44.25452945999	71° 32' 12.06" W	44° 15' 16.31" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.01	-71.51560999592	43.85122133235	71° 30' 56.20" W	43° 51' 4.40" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.01	-71.51448001940	43.85609125049	71° 30' 52.13" W	43° 51' 21.93" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.01	-71.48196274045	44.17920561971	71° 28' 55.07" W	44° 10' 45.14" N
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.02	-71.47903036757	44.22696005859	71° 28' 44.51" W	44° 13' 37.06" N

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DISTRICT	COMMON_NAME	INFESTED_ACRES	LONG DEC DEG	LAT DEC DEG	LONGITUDE DMS	LATITUDE DMS
PEMIGEWASSET RANGER DISTRICT	coltsfoot	0.01	-71.47166822273	44.28317757826	71° 28' 18.01" W	44° 16' 59.44" N
PEMIGEWASSET RANGER DISTRICT	common barberry	0.01	-71.60852974694	43.93576548993	71° 36' 30.71" W	43° 56' 8.76" N
PEMIGEWASSET RANGER DISTRICT	common buckthorn	0.06	-71.89526679427	44.12139678214	71° 53' 42.96" W	44° 7' 17.03" N
PEMIGEWASSET RANGER DISTRICT	common reed	0.03	-71.69036615572	43.86638479133	71° 41' 25.32" W	43° 51' 58.99" N
PEMIGEWASSET RANGER DISTRICT	common reed	0.02	-71.68720359750	43.86694012192	71° 41' 13.93" W	43° 52' 0.98" N
PEMIGEWASSET RANGER DISTRICT	common reed	0.06	-71.60503906024	44.23406600491	71° 36' 18.14" W	44° 14' 2.64" N
PEMIGEWASSET RANGER DISTRICT	garlic mustard	0.79	-71.82055683172	44.11586130595	71° 49' 14.00" W	44° 6' 57.10" N
PEMIGEWASSET RANGER DISTRICT	glossy buckthorn	0.02	-71.66474292632	44.24486097927	71° 39' 53.07" W	44° 14' 41.50" N
PEMIGEWASSET RANGER DISTRICT	Japanese barberry	0.05	-71.89511406437	44.12137336367	71° 53' 42.41" W	44° 7' 16.94" N
PEMIGEWASSET RANGER DISTRICT	Japanese barberry	0.02	-71.84170478302	44.07696279723	71° 50' 30.14" W	44° 4' 37.07" N
PEMIGEWASSET RANGER DISTRICT	Japanese barberry	0.01	-71.82380506492	44.09057956883	71° 49' 25.70" W	44° 5' 26.09" N
PEMIGEWASSET RANGER DISTRICT	Japanese barberry	0.01	-71.73609013374	43.86664998536	71° 44' 9.92" W	43° 51' 59.94" N
PEMIGEWASSET RANGER DISTRICT	Japanese barberry	0.3	-71.70185803756	44.03864742825	71° 42' 6.69" W	44° 2' 19.13" N
PEMIGEWASSET RANGER DISTRICT	Japanese barberry	0.01	-71.69705391976	43.90194058669	71° 41' 49.39" W	43° 54' 6.99" N
PEMIGEWASSET RANGER DISTRICT	Japanese barberry	0.01	-71.69269373223	43.86824007687	71° 41' 33.70" W	43° 52' 5.66" N
PEMIGEWASSET RANGER DISTRICT	Japanese barberry	0.02	-71.67715300246	44.22299898623	71° 40' 37.75" W	44° 13' 22.80" N
PEMIGEWASSET RANGER DISTRICT	Japanese barberry	0.02	-71.56817178174	43.90048737217	71° 34' 5.42" W	43° 54' 1.75" N
PEMIGEWASSET RANGER DISTRICT	Japanese knotweed	0.01	-71.81884006970	44.11088503505	71° 49' 7.82" W	44° 6' 39.19" N
PEMIGEWASSET RANGER DISTRICT	Japanese knotweed	0.01	-71.75478616298	43.99256746379	71° 45' 17.23" W	43° 59' 33.24" N
PEMIGEWASSET RANGER DISTRICT	Japanese knotweed	0.02	-71.74313755665	44.00610106135	71° 44' 35.30" W	44° 0' 21.96" N
PEMIGEWASSET RANGER DISTRICT	Japanese knotweed	0.01	-71.74019728159	43.83115387954	71° 44' 24.71" W	43° 49' 52.15" N
PEMIGEWASSET RANGER DISTRICT	Japanese knotweed	0.3	-71.74019728159	43.83115387954	71° 44' 24.71" W	43° 49' 52.15" N
PEMIGEWASSET RANGER DISTRICT	Japanese knotweed	0.01	-71.69977453816	43.94309864193	71° 41' 59.19" W	43° 56' 35.16" N
PEMIGEWASSET RANGER DISTRICT	Japanese knotweed	0.01	-71.67661520468	44.03044713972	71° 40' 35.81" W	44° 1' 49.61" N
PEMIGEWASSET RANGER DISTRICT	Japanese knotweed	0.04	-71.67585513769	44.02903717284	71° 40' 33.08" W	44° 1' 44.53" N
PEMIGEWASSET RANGER DISTRICT	Japanese knotweed	0.01	-71.63241401626	44.25553701250	71° 37' 56.69" W	44° 15' 19.93" N
PEMIGEWASSET RANGER DISTRICT	Norway maple	0.01	-71.95686996111	43.95965729787	71° 57' 24.73" W	43° 57' 34.77" N
PEMIGEWASSET RANGER DISTRICT	oriental bittersweet	0.01	-71.82380506492	44.09057956883	71° 49' 25.70" W	44° 5' 26.09" N
PEMIGEWASSET RANGER DISTRICT	purple loosestrife	0.25	-71.64845470324	44.03910713449	71° 38' 54.44" W	44° 2' 20.79" N
PEMIGEWASSET RANGER DISTRICT	purple loosestrife	0.01	-71.63819372810	43.99881787805	71° 38' 17.50" W	43° 59' 55.74" N
PEMIGEWASSET RANGER DISTRICT	purple loosestrife	0.01	-71.52422106961	43.96529907247	71° 31' 27.20" W	43° 57' 55.08" N
PEMIGEWASSET RANGER DISTRICT	purple loosestrife	0.01	-71.52374104520	43.96475906338	71° 31' 25.47" W	43° 57' 53.13" N
PEMIGEWASSET RANGER DISTRICT	purple loosestrife	0.01	-71.49428324043	44.19608523035	71° 29' 39.42" W	44° 11' 45.91" N
PEMIGEWASSET RANGER DISTRICT	purple loosestrife	0.06	-71.48879318556	44.20082519954	71° 29' 19.66" W	44° 12' 2.97" N

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DISTRICT	COMMON_NAME	INFESTED_ACRES	LONG DEC DEG	LAT DEC DEG	LONGITUDE DMS	LATITUDE DMS
PEMIGEWASSET RANGER DISTRICT	purple loosestrife	0.01	-71.47112755761	44.30794159032	71° 28' 16.06" W	44° 18' 28.59" N
PEMIGEWASSET RANGER DISTRICT	reed canarygrass	0.01	-71.52581107920	43.96428907452	71° 31' 32.92" W	43° 57' 51.44" N
PEMIGEWASSET RANGER DISTRICT	winged burning bush	0.01	-71.95686996111	43.95965729787	71° 57' 24.73" W	43° 57' 34.77" N
SACO RANGER DISTRICT	Asiatic honeysuckle	0.01	-71.31020723421	44.00870000160	71° 18' 36.75" W	44° 0' 31.32" N
SACO RANGER DISTRICT	Asiatic honeysuckle	0.01	-71.27643783160	44.04679297841	71° 16' 35.18" W	44° 2' 48.45" N
SACO RANGER DISTRICT	Asiatic honeysuckle	10	-71.13324442340	43.97983087192	71° 7' 59.68" W	43° 58' 47.39" N
SACO RANGER DISTRICT	black locust	0.01	-71.29723742879	44.05499931082	71° 17' 50.05" W	44° 3' 18.00" N
SACO RANGER DISTRICT	black locust	0.01	-71.18390512638	43.99069073862	71° 11' 2.06" W	43° 59' 26.49" N
SACO RANGER DISTRICT	black locust	0.01	-71.00982571540	44.16694716681	71° 0' 35.37" W	44° 10' 1.01" N
SACO RANGER DISTRICT	black locust	0.01	-71.00982571540	44.16694716681	71° 0' 35.37" W	44° 10' 1.01" N
SACO RANGER DISTRICT	coltsfoot	0.01	-71.42394328749	44.00364538298	71° 25' 26.20" W	44° 0' 13.12" N
SACO RANGER DISTRICT	coltsfoot	0.01	-71.30438755276	44.05052931801	71° 18' 15.80" W	44° 3' 1.91" N
SACO RANGER DISTRICT	coltsfoot	0.01	-71.27076685809	44.05106959946	71° 16' 14.76" W	44° 3' 3.85" N
SACO RANGER DISTRICT	coltsfoot	0.01	-71.10953621709	44.15098769220	71° 6' 34.33" W	44° 9' 3.56" N
SACO RANGER DISTRICT	coltsfoot	0.01	-71.10915612847	44.14240783848	71° 6' 32.96" W	44° 8' 32.67" N
SACO RANGER DISTRICT	coltsfoot	0.01	-71.10796616386	44.14519778614	71° 6' 28.68" W	44° 8' 42.71" N
SACO RANGER DISTRICT	coltsfoot	0.01	-71.09322625014	44.16150746910	71° 5' 35.61" W	44° 9' 41.43" N
SACO RANGER DISTRICT	glossy buckthorn	0.01	-71.42621953218	44.01286892068	71° 25' 34.39" W	44° 0' 46.33" N
SACO RANGER DISTRICT	glossy buckthorn	0.01	-71.12457671050	44.18029721947	71° 7' 28.48" W	44° 10' 49.07" N
SACO RANGER DISTRICT	glossy buckthorn	0.01	-71.12457671050	44.18029721947	71° 7' 28.48" W	44° 10' 49.07" N
SACO RANGER DISTRICT	glossy buckthorn	0.02	-71.10707166283	44.13935120570	71° 6' 25.46" W	44° 8' 21.66" N
SACO RANGER DISTRICT	glossy buckthorn	0.01	-71.10203627122	44.15749754234	71° 6' 7.33" W	44° 9' 26.99" N
SACO RANGER DISTRICT	Japanese barberry	0.01	-71.32360975355	44.03782727217	71° 19' 25.00" W	44° 2' 16.18" N
SACO RANGER DISTRICT	Japanese knotweed	0.01	-71.17883508060	43.99083073043	71° 10' 43.81" W	43° 59' 26.99" N
SACO RANGER DISTRICT	Japanese knotweed	0.01	-71.00312729021	44.26740518945	71° 0' 11.26" W	44° 16' 2.66" N
SACO RANGER DISTRICT	Norway maple	0.25	-71.13324442340	43.97983087192	71° 7' 59.68" W	43° 58' 47.39" N
SACO RANGER DISTRICT	oriental bittersweet	0.44	-71.03614576217	44.15574743067	71° 2' 10.12" W	44° 9' 20.69" N
SACO RANGER DISTRICT	oriental bittersweet	0.14	-71.03614576217	44.15574743067	71° 2' 10.12" W	44° 9' 20.69" N
SACO RANGER DISTRICT	oriental bittersweet	0.01	-71.00312729021	44.26740518945	71° 0' 11.26" W	44° 16' 2.66" N
SACO RANGER DISTRICT	purple loosestrife	0.2	-71.40534957899	44.05226841866	71° 24' 19.26" W	44° 3' 8.17" N
SACO RANGER DISTRICT	purple loosestrife	0.01	-71.40534957899	44.05226841866	71° 24' 19.26" W	44° 3' 8.17" N
SACO RANGER DISTRICT	purple loosestrife	0.25	-71.29128746727	44.07089908323	71° 17' 28.63" W	44° 4' 15.24" N
SACO RANGER DISTRICT	purple loosestrife	0.01	-71.29128746727	44.07089908323	71° 17' 28.63" W	44° 4' 15.24" N
SACO RANGER DISTRICT	purple loosestrife	0.01	-71.25339800719	44.22282674571	71° 15' 12.23" W	44° 13' 22.18" N

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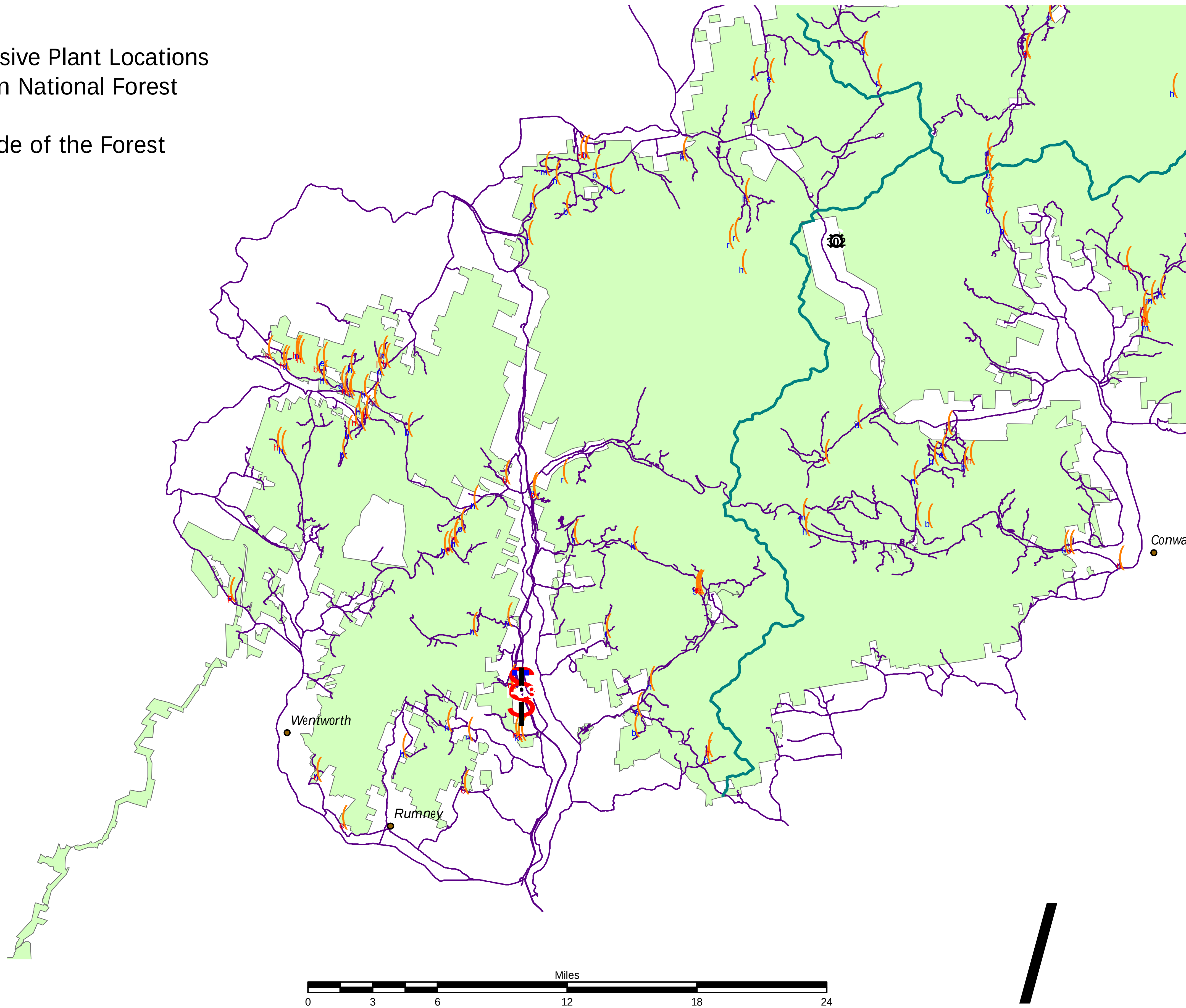
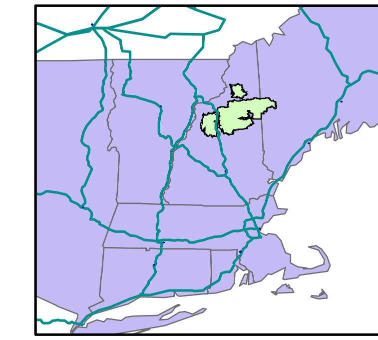
DISTRICT	COMMON_NAME	INFESTED_ACRES	LONG DEC DEG	LAT DEC DEG	LONGITUDE DMS	LATITUDE DMS
SACO RANGER DISTRICT	purple loosestrife	0.06	-71.25218800608	44.22703667251	71° 15' 7.88" W	44° 13' 37.33" N
SACO RANGER DISTRICT	reed canarygrass	1.5	-71.01944736495	44.26917515159	71° 1' 10.01" W	44° 16' 9.03" N
SACO RANGER DISTRICT	spotted knapweed	0.01	-71.32059746976	44.00997988344	71° 19' 14.15" W	44° 0' 35.93" N
SACO RANGER DISTRICT	winged burning bush	0.01	-71.00376725989	44.26716517763	71° 0' 13.56" W	44° 16' 1.79" N

*Disclaimer: The Forest Service uses the most current and complete data available. GIS data and product accuracy may vary. They may be: developed from sources of differing accuracy, accurate only at certain scales, based on modeling or interpretation, or incomplete information while being created or revised, etc. Using GIS products for purposes other than those for which they were created, may yield inaccurate or misleading results. The Forest Service reserves the right to correct, update, modify, or replace GIS products without notification.

Mapped Non-Native Invasive Plant Locations on the White Mountain National Forest

Map 1 of 2 - West Side of the Forest





Legend

- Invasive Plant Locations
- Roads
- National Forest
- district boundary

KEY	Name
a	Asian bittersweet
b	Asiatic honeysuckle
c	autumn olive
d	bishop's goutweed
e	black locust
f	brownray knapweed
g	climbing nightshade
h	coltsfoot
i	common barberry
j	common buckthorn
k	common reed
l	garlic mustard
m	glossy buckthorn
n	Japanese barberry
o	Japanese knotweed
p	Norway maple
q	oriental bittersweet
r	purple loosestrife
s	reed canarygrass
t	spotted knapweed
u	winged burning bush

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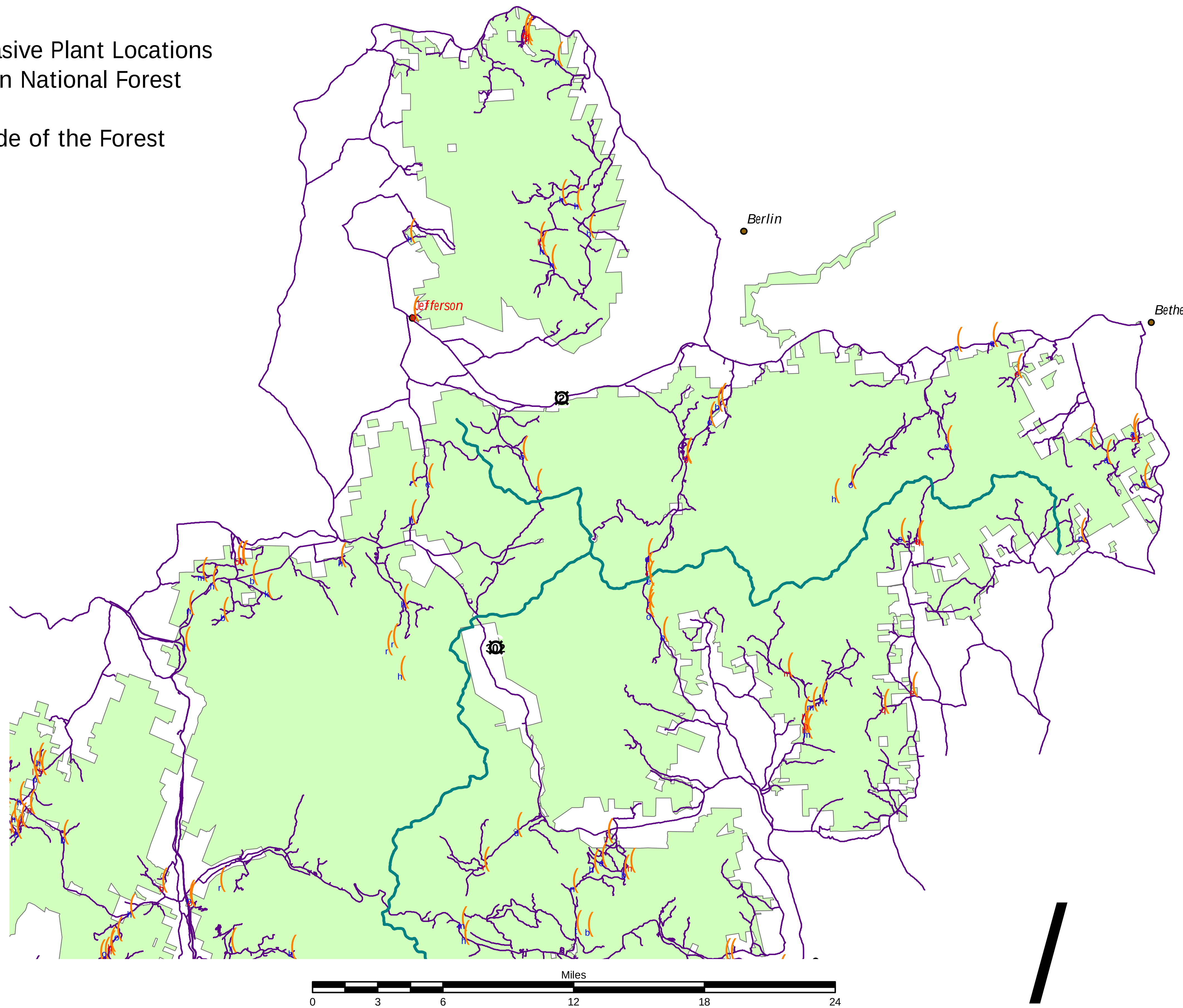
White Mountain National Forest
719 N. Main Street
Laconia, NH 03246
(603) 528-8721

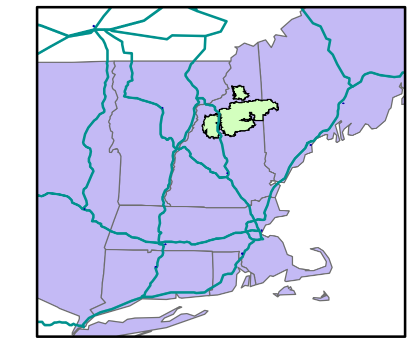
Source: USFS NRIS TERRA as of April 2006

A larger scale version of this map for viewing is available on-line at
http://www.fs.fed.us/r9/forests/white_mountain/projects/projects/assessments/forestwide_nnis/forestwide_nnis.html

Mapped Non-Native Invasive Plant Locations on the White Mountain National Forest

Map 2 of 2 - East Side of the Forest





Legend

- Invasive Plant Locations
- Roads
- National Forest
- district boundary

KEY	Name
a	Asian bittersweet
b	Asiatic honeysuckle
c	autumn olive
d	bishop's goutweed
e	black locust
f	brownray knapweed
g	climbing nightshade
h	coltsfoot
i	common barberry
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