PROPOSED ACTIONS: (1) FORESTWIDE NONNATIVE INVASIVE PLANT (NNIP) CONTROL AND (2) INVASIVE WOODY PLANT CONTROL IN MAINTAINED ROADSIDES, UTILITY CORRIDORS AND WILDLIFE OPENINGS

George Washington and Jefferson National Forests

PURPOSE AND NEED FOR THE PROPOSED ACTIONS

Nonnative invasive plants (NNIP) are introduced species that can thrive in areas beyond their natural range. These plants are characteristically adaptable, aggressive, and have a high reproductive capacity. Their vigor combined with a lack of natural enemies often leads to outbreak populations. The Chief of the U.S. Forest Service (USFS) has identified nonnative invasive species as one of the four critical threats to USFS ecosystems (USDA Forest Service Strategic Plan: FY 2007–2012). While not all nonnative species are known to disrupt native ecosystems, of particular concern are those that are successful at invading and rapidly spreading through natural habitats. Based on plot data collected through the Forest Inventory and Analysis (FIA) program, it has been estimated that 10% of the forested acres throughout Virginia are infested with NNIP (USFS Southern Research Station 2009). This amounts to almost 1.7 million acres experiencing the presence of NNIP to some degree across the state. Numerous NNIP have been documented across the George Washington and Jefferson National Forests and many infested sites present an immediate threat to natural communities, rare species sites, and other sites of high public interest. Given the current known distribution of NNIP on the George Washington and Jefferson National Forests, there is a need to implement an integrated program of NNIP control to protect forest resources. Management of NNIP infestations would also help prevent the George Washington and Jefferson National Forests from becoming a source of infestations for surrounding lands, both public and private, and would help slow the spread of NNIP in the central and southern Appalachian region.

Executive Order 13112 requires federal agencies to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts. Numerous federal laws have been passed over the years that pertain to noxious weeds and invasive plants. The purpose and need for this project is consistent with the USFS National Strategy and Implementation Plan for Invasive Species Management (USDA Forest Service 2004) and the Southern Regional Strategy for the Prevention, Control, and Eradication of NNIS (USDA Forest Service 2005). The George Washington and the Jefferson National Forest Revised Land and Resource Management Plans have forest wide direction to minimize the negative effects of NNIP on the landscape. At a local level, the Virginia General Assembly passed legislation during its 2009 session that establishes the state's commitment to addressing the invasive species that threaten the Commonwealth through cooperation and coordination of government agencies, the business community, conservation organizations, and public citizens. The legislation directs Virginia's Secretaries of Natural Resources and Agriculture and Forestry to "coordinate the development of strategic actions to be taken by the Commonwealth, individual state and federal agencies, private business, and landowners related to invasive species

prevention, early detection and rapid response, control and management, research and risk assessment, and education and outreach."

Specific needs that have been identified include:

- Reduce the risk of NNIP introduction into currently un-infested areas;
- Control NNIP that threaten rare communities and high-interest ecosystems such as botanical areas, research natural areas, TES species habitat, and wilderness;
- Eliminate emerging infestations of NNIP that have the potential to develop into large-scale ecosystem-damaging infestations;
- Control NNIP and woody plants that are impeding tree regeneration or damaging wildlife habitat improvements;
- Prevent the spread of invasive plants on adjacent private and public lands; and
- Be able to respond quickly to new invasive infestations before establishment and rapid spread.

The purpose of the first proposed action is to limit, or where feasible, eliminate, the adverse effects of nonnative invasive plants on native biodiversity and other resources through an integrated use of manual, mechanical and chemical methods.

The purpose of the second proposed action is to meet the management needs of maintaining open conditions in existing wildlife openings, roadsides of open roads and the open portions of utility lines through the use of manual, mechanical and chemical methods to control woody vegetation in addition to nonnative invasive plants. Because of their open conditions, these areas are often exploited by nonnative invasive plants and are therefore priority areas for treatment. Combining treatment of NNIP with treatments for maintaining open conditions will improve efficiency, reduce the number of treatments, enhance the management of these areas and help control NNIP.

PROPOSED ACTION (1): NONNATIVE INVASIVE PLANT CONTROL

The proposed action is to treat known and new nonnative invasive plant infestations across the George Washington and Jefferson National Forests using a combination of mechanical, cultural, and/or chemical control treatment methods. To meet the intent of Executive Order 13112, this proposed action is intended to be adaptive in nature, treating both currently known sites, and allowing for the future treatment of undocumented invasive plant infestations that are rapidly evolving and spreading on the forest.

The treatments are expected to begin in the spring of 2010 and will continue for ten years, with a comprehensive review at the five year interval. Certain areas may need to be treated more than once. Treatments will be subject to available funding and resources each year but our current program of work treats between 1,000-2,000 acres per year. Species to be treated include any nonnative invasive plant species listed on Virginia, West Virginia, or Forest Service invasive plant lists. Lists of websites for these species are in Appendix A.

The definition of nonnative invasive plant species is based on Executive Order 13122 (EO 1999). A species is considered a nonnative invasive species if:

- It is not native to the ecosystem under consideration, and
- Its introduction causes or is likely to cause economic or environmental harm or harm to human health.

Priority NNIP Species for Treatment

Nonnative invasive species vary greatly in their degree of establishment and rate of spread. Populations of some species have been known for years, and have spread considerably since they were first identified. Others are still being found in small infestations. The species that are currently the greatest threat on the Forest have been prioritized for their rate of invasiveness (http://www.dcr.virginia.gov/natural_heritage/documents/invlist.pdf) and for their control priorities. While the proposed action has the potential to treat any nonnative invasive plant species found on the Forest, 27 of these species are anticipated to make up the largest percentage (by acreage) of actual treatments implemented. Of these 27 species, 15 are listed as Highly Invasive by the Virginia Department of Conservation and Recreation, 9 are listed as Moderately Invasive, one is listed as Occasionally Invasive, and two are not listed but, are locally invasive on the Forest. Table 1 is subject to change as new species and locations are found.

Table 1. Priority Species for NNIP Control

SCIENTIFIC NAME	COMMON NAME	INVASIVENESS*	PRIORITY**
Ailanthus altissima	tree of heaven	1	1
Akebia quinata	chocolate vine	2	1
Berberis thunbergii	Japanese barberry	2	1
Celastrus orbiculatus	oriental bittersweet	1	1
Ligustrum spp.	privet	1	1
Lolium arundinaceum	tall fescue	2	1
Lonicera maackii	Amur honeysuckle	2	1
Lonicera morrowii	Morrow's honeysuckle	1	1
Lonicera tatarica	Tartarian honeysuckle	2	1
Lythrum salicaria	purple loosestrife	1	1
Perilla frutescens	beefsteak plant	3	1
Persicaria perfoliatum	mile-a minute	1	1
Polygonum cuspidatum	Japanese knotweed	1	1
Buddleja davidii	butterfly bush	L	2
Carduus nutans	musk thistle	2	2
Cirsium vulgare	bull thistle	2	2
Elaeagnus umbellata	autumn olive	1	2
Lespedeza cuneata	sericea lespedeza	1	2
Paulownia tomentosa	princess tree	2	2
Pueraria montana var. lobata	kudzu	1	2
Rosa multiflora	multiflora rose	1	2
Spiraea japonica	Japanese spiraea	2	2

Alliaria petiolata	garlic mustard	1	3
Centaurea biebersteinii	spotted knapweed	1	3
Lonicera japonica	Japanese honeysuckle	1	3
Microstegium vimineum	Japanese stiltgrass	1	3
Tussilago farfara	coltsfoot	L	3

*** Invasiveness is based on Virginia Department of Conservation and Recreation: 1=Highly Invasive;2=Moderately invasive;3=Occasionally invasive; L=Locally invasive**

**** Priority: 1=high, eradicate wherever found**
2=medium, control source populations and eradicate outliers
3=low, prevent invasion of last areas not invaded; eradicate high priority areas

Priority Areas for Treatment

Control of nonnative invasive plant species is only one of a myriad of issues facing forest managers in any given year. Limitations in budget and personnel demand hard choices, thus a process is needed to ensure that any money and time spent in treating invasive plant infestations is efficient and effective. In addition to priorities for the species, infestations would also be prioritized based on the locations of the infestations.

Rare Species or Communities

The areas with highest priority are areas that contain threatened, endangered, and sensitive species (TES) and/or rare natural community types. Actions taken in these places would be to eliminate NNIP existing infestations and prevent new infestations. Control methods would favor manual treatment, mechanical treatment and fire. If herbicides are used near TES species, precautions would be taken to prevent impacts to these species.

Examples: Special Biological Areas -Whitetop Mountain, native bald plants
Guest River Gorge - Virginia spiraea
TESLR locations – Harrington Roadside, Smooth coneflower
Research Natural Areas – Ramseys Draft, Little Laurel Run

Wilderness

Another high priority area is Wilderness, where limitations on control methods could make treatment difficult. Actions taken in Wilderness would be to eliminate NNIP existing populations before they become extensive and to prevent new infestations. Control methods would entail manual treatments that are not motorized. The use of motorized manual equipment, mechanical equipment or herbicides in Wilderness would require approval by the Regional Forester and the use of these treatments are not part of this proposed action.

Example: Wilderness - James River Face, high disturbance from repeated wildfire areas

Travel Corridors and High Use Areas

Travel corridors and high use areas (recreation and administrative sites) are another class of priority areas. Humans act as vectors for plant propagules in a variety of ways through clothing, boots, pets, vehicles, firewood, and dumping of vegetation. Travel corridors include roads for vehicles, trails, and streams. Streams may facilitate NNIP movement through human action or by

carrying propagules downstream. Actions taken along travel corridors and high use areas would be to prevent the spread of NNIP. Control methods would include manual treatment, mechanical treatment and herbicide. Any herbicide used in proximity to streams or open bodies of water would be approved for aquatic use.

Examples: Roads – Rt. 60 Oronoco, Rt. 781 Cave Mt. Lake and Parkers Gap – kudzu,
Rt. 59, Great North Mountain - Japanese knotweed
Streams – Jennings Creek, Middle Creek, North Creek – butterfly bush

Disturbed and Open Condition Areas

Disturbed areas or areas maintained in an open condition are another priority and include a variety of places where the vegetation has been altered or the soil exposed. These sites can arise through natural processes, such as landslides, ice storms, wind-caused blow-down, insects and diseases, wildfires, or through human activities, such as trails, roads, wildlife openings, pastures, hayfields, utility corridors, timber harvest and prescribed burning. Actions taken in these areas would be to eliminate existing NNIP infestations and prevent new infestations. For the past several years, we have included the need to treat any existing NNIP infestations wherever we have proposed ground-disturbing activities, such as timber sales, and have included monitoring for NNIPs following project implementation. However, some of our older timber harvest areas and prescribed burn areas contain NNIP infestations that need attention. Control methods would favor prevention of NNIP establishment or spread through treating areas with NNIP before management activities take place, prompt revegetation of disturbed areas (unless this conflicts with desired natural processes), and elimination of NNIP infestations using manual or mechanical treatment, herbicide, or fire.

Other areas have been prioritized in the following table but the consideration of the NNIP species and other resources are also a factor in determining priorities.

Table 2. Priority Areas for NNIP Control

Priority	Area
A	Threatened, Endangered or Sensitive Plant Species
A	Rare Communities/Special Biological Areas
A	Research Natural Areas
A	Wilderness and Wilderness Study Areas (manual treatments only)
A	Roadsides
A	Trails and Trailheads
A	Stream Corridors
A	Any area in which ground or vegetation disturbing management has occurred and there is an existing population of a Priority 1 species (refer to Table 1)
B	Any area in which ground or vegetation disturbing management is

	planned and there is an existing population of Priority 1, 2 or 3 species (refer to Table 1)
B	Any area in which ground or vegetation disturbing management has occurred and there is an existing population of a Priority 2 species (refer to Table 1)
B	Any area with a new infestation of a Priority 2 species (refer to Table 1)
C	Any area in which ground or vegetation disturbing management has occurred and there is an existing population of a Priority 3 species (refer to Table 1)

Table 3 shows these priority areas along with their approximate acres on the George Washington and Jefferson National Forests and an estimate of the acres that may potentially need treatment over the ten year period.

Table 3. Potential Extent of Treatment Areas

Treatment Area		Acres Analyzed*		Potential Treatment
		Acres	% infested	Acres*
Wilderness Areas		100,434	2	2,009
National Scenic Areas		7,695	5	385
Rare Species or Communities	Research Natural Areas	3,900	2	78
	Special Biological Areas	62,300	2	1246
Travel Corridors or High Use Areas	Forest Roads – 100’ corridor each side	114,570	10	11,457
	Trails – 50’ corridor each side	53,285	5	2664
	Recreation sites and administrative sites	89,500	15	13,425
	Riparian areas –100’ corridor each side	56,727	5	2836
Open or Disturbed Areas	Wildlife openings	2,400	25	600
	Pastures, hay fields	7,492	25	1873
	Utility corridors – 100’ corridor each side of right-of-way	16,742	15	2,511
	Wildfire areas	13,047	5	652
	Prescribed burn areas	110,796	5	5540
	Past timber harvest areas (0-40 age class)	167,000	5	8,350
TOTAL		805,888		53,626

*Actual treatment acres are difficult to determine even at the known sites since the density of infestation varies at each site. The % estimate is a gross estimate.

Methods of Treatment

Proposed Manual Methods (pulling, grubbing, cutting, and digging): Manual methods would be the principle method for controlling or eradicating small spot infestations, typically less than 0.10 acres) when the method is effective and efficient. Manual methods may be used in conjunction with herbicide application in some locations. Examples of manual methods include, but are not limited to: shovels, saws, axes, loppers, hoes, weed-wrenches, string trimmers, chain saws, brush saws, aquatic harvesters, and push mowers.

Proposed Mechanical Methods (mowing, tree/brush shearing, uprooting, seeding, disking, and plowing): Mechanical methods would employ the use of tractors or other heavy equipment such as dozers and backhoes. Other equipment could include mowers, bush hogs, and forestry brush cutters/mulchers. Normally, this method would be applied to larger, relatively open areas suitable for equipment access. These areas are usually grown up fields, pastures, roadsides, and other open lands. Mowing or shearing may be used in conjunction with herbicide application. Plowing or disking would be used to restore heavily infested areas or to help establish desirable vegetation before infestation begins.

Proposed Cultural Methods (controlled fire, mulch): Cultural methods may include the use of fire, mulch, or other inhibiting techniques such as weed cloths and plastic sheeting. Fire would be used in accordance with approved burn plans.

Proposed Chemical Methods (herbicide): The objectives of herbicide use would be to control NNIP infestations where manual, mechanical or cultural means would be cost-prohibitive or result in excessive soil disturbance or other resource damage. All herbicides would be used according to manufacturer's label direction for rates, concentrations, exposure times, and application methods. Applications will be done under the supervision of a certified applicator. Herbicides would be directly applied to the target plants. Techniques that could be used include direct foliar applications using hand-held systems, backpack sprayers, hand-held brushes, basal bark and stem treatments using spraying or painting (wiping) methods, cut surface treatments (spraying or wiping), and woody stem injections. No herbicides would be applied aerially. Only formulations approved for aquatic-use would be applied in or within 30 feet of lakes, wetlands, perennial or intermittent springs, and streams, in accordance with label directions and Forest Plan standards.

Proposed Herbicides

Specific herbicides that could be used in the project area are listed below. Detailed descriptions of these chemicals, including comprehensive risk assessments for each, can be found at:

http://www.fs.fed.us/foresthealth/pesticide/risk.shtml
http://www.regulations.gov/search/Regs/home.html#home

Clopyralid is a selective herbicide that controls broadleaf herbs, primarily composites, legumes, and smartweeds (a perennial plant that forms dense colonies in shallow water). This chemical acts as a growth regulator and is typically applied as a direct foliar application. With selectivity to legumes, this chemical is particularly useful in the control of kudzu, mimosa, and lespedeza. Commercial brand-names include, but are not limited to Transline™.

Dicamba is a somewhat selective herbicide that controls most annual and perennial broadleaf herbs and some woody species. Care must be taken as it can damage or kill hardwood and pine seedlings, but has little to no effect on grasses. This chemical acts as a growth regulator and is typically applied as a direct foliar application. It is known to be effective on autumn olive. Commercial brand-names include, but are not limited to Vanquish™ and Overdrive™.

Glyphosate is a non-selective, broad spectrum herbicide that can be used to control many grasses, forbs, vines, shrubs, and tree species. Specific formulations of Glyphosate have been labeled for aquatic application. Formulations labeled for aquatic sites can be effective on both emergent aquatics and shoreline vegetation. This chemical is a growth inhibitor that can be applied through direct foliar application, stem injection, and cut-surface application. It has been proven effective on a wide variety of nonnative invasive plant species. Commercial brand-names include, but are not limited to Accord™, Roundup™, and Rodeo™.

Hexazinone is a photosynthetic inhibitor selective to most hardwood tree species, shrubs and some grasses. Most southern yellow pines are resistant. It has been proven effective on lespedeza and privet. Commercial brand-names include, but are not limited to Velpar™ and Pronone™.

Imazapic is a selective herbicide that is used primarily in and around populations of native, warm season grasses. Warm season grasses, many wildflower species, and legumes are resistant, while many cool season grasses (including nonnative species of fescue) and broadleaf weeds are susceptible. Commercial brand-names include, but are not limited to Plateau™.

Imazapyr is a selective herbicide that is used primarily in the control of hardwood trees and some species of grasses. This chemical is a plant protein production inhibitor that can be absorbed either through roots or foliage, or injected directly into the stem, and works systemically throughout the target plant. It has been proven effective in the control of tree of heaven, princess tree, mimosa, autumn olive, privet, and multiflora rose. Use in combination with Triclopyr or Glyphosate can increase target specificity. Commercial brand-names include, but are not limited to Arsenal™ and Chopper™.

Metsulfuron methyl is a systemic herbicide that is selective to woody species, broadleaf weed species, and many annual grasses. It has been proven to be effective in the control of lespedeza, Japanese honeysuckle, kudzu, and multiflora rose. Commercial brand-names include, but are not limited to Escort™.

Triclopyr is a selective herbicide that controls many species of herbaceous and woody broadleaf weeds, but has little to no effect on grasses. This chemical acts as a growth regulator and can be applied as a direct foliar application, stem injection, or cut-surface treatments. Specific formulations of Triclopyr have been labeled for aquatic application. Formulations labeled for aquatic sites can be effective on both emergent aquatics and shoreline vegetation. It has been proven effective on a wide variety on nonnative invasive plant species. Commercial brand-names include, but are not limited to Garlon 3A™, Garlon 4™, and Pathfinder II™.

2,4-D is a selective herbicide that controls invasive broadleaf herbaceous plants and woody seedlings, but does not harm certain monocots (including grasses). Commercial brand-names include, but are not limited to Frontline ™.

Fluazifop-P-Butyl is a monocot specific post-emergent herbicide primarily affecting grasses, sedges, and lilies. Commercial brand-names include, but are not limited to Fusilade ™.

Fenoxaprop-ethyl is a selective herbicide primarily used to control grasses. Commercial brand-names include, but are not limited to Acclaim ™.

Fosamine ammonium is a brush control agent that is diluted with water and applied as a foliar spray. It controls many woody species by inhibiting bud growth and treated plants will not leaf out or grow the season after treatment. Commercial brand-names include, but are not limited to Krenite)™.

Proposed Treatments for Priority Nonnative Invasive Plant Species

Detailed information on 27 NNIP species and associated treatment methods are provided in Appendix B. A summary of the proposed methods for each species is shown in the Table 4.

Table 4: Proposed Treatment Methods for Priority Nonnative Invasive Plant Species on the George Washington and Jefferson National Forests (not including manual treatments)

Scientific Name (common name)	Clopyralid	Dicamba	Glyphosate	Hexazinone	Imazapic	Imazapyr	Metsulfuron methyl	Triclopyr	2,4-D	Fluazifop-P-butyl	Fenoxaprop-ammonium	Fosamine	Mechanical	Cultural
Ailanthus altissima (tree of heaven)			X			X	X	X	X			X	X	
Akebia quinata (chocolate vine)			X					X	X				X	
Alliaria petiolata (garlic mustard)			X					X	X			X		X
Berberis thunbergii (Japanese barberry)									X			X	X	
Buddleja davidii (butterfly bush)			X					X	X				X	
Carduus nutans (musk thistle)			X					X	X				X	
Celastrus orbiculatus (Oriental bittersweet)			X					X	X				X	X
Centaurea biebersteinii (spotted knapweed)	X								X				X	
Cirsium vulgare (bull thistle)		X	X					X	X				X	
Eleagnus umbellata (autumn olive)		X	X			X		X	X			X	X	
Lespedeza cuneata (sericea lespedeza)	X		X	X			X	X	X				X	X
Ligustrum sp. (privet)			X			X	X	X	X			X		X
Lolium arundinaceum (tall fescue)			X		X	X				X				X
Lonicera japonica (Japanese honeysuckle)			X				X	X	X			X	X	X
Lonicera maackii (Amur honeysuckle)						X		X	X			X	X	X
Lonicera morrowii (Morrow's honeysuckle)						X		X	X			X	X	X
Lonicera tatarica (Tartarian honeysuckle)						X		X	X			X	X	X
Lythrum salicaria (purple loosestrife)			X					X	X				X	X
Microstegium vimineum (Japanese stiltgrass)			X							X				X
Paulownia tomentosa (princess tree)			X			X		X	X			X	X	
Perilla frutescens (beefsteak plant)			X						X				X	
Persicaria perfoliatum (mile-a-minute)			X						X				X	
Polygonum cuspidatum (Japanese knotweed)			X					X	X				X	X
Pueraria montana var. lobata (kudzu)	X		X				X	X	X				X	X
Rosa multiflora (multiflora rose)			X			X	X	X	X			X	X	X
Spiraea japonica (Japanese spiraea)			X					X	X			X	X	X
Tussilago farfara (coltsfoot)			X						X				X	

Design Criteria (from the George Washington and Jefferson Forest Plans):

Any action taken will be consistent with both Forest Plans, the decision document, and will comply with applicable laws and regulations such as the Endangered Species Act and the Archaeological Resources Protection Act, and herbicide labeling. Additional measures to be implemented for herbicide use include:

- The method and timing of herbicide are chosen to achieve project objectives while minimizing effects on non-targeted vegetation and other environmental elements. Selective treatment is preferred over broadcast treatment.
- No class B, C, or D chemicals may be used without approval of the Regional Forester. (Table 2-6 Jefferson Forest Plan, none are proposed here)
- Vegetable oil is used as the herbicide carrier when available and compatible with the proposed application.
- No herbicide will be ground applied within 60 feet of any known threatened, endangered, proposed or sensitive plant (PETS) except where a nonnative invasive species is affecting federally listed or sensitive species.
- No herbicide will be ground-applied within 30 horizontal feet of lakes, wetlands, and perennial or intermittent springs and streams. No herbicide will be applied within 100 horizontal feet of any public or domestic water source. Selective treatments (which require added site-specific analysis and use of aquatic–labeled pesticides) may occur within these buffers only to prevent significant environmental damage such as nonnative invasive plant infestations.
- With the exception of utility corridor and road rights-of-way, no herbicide is broadcast within 100 feet of a private land and 300 feet of a private residence, unless there is private owner permission.
- No soil-active herbicide is applied within 30 feet of the drip line of reserved vegetation or within 30 feet of the drip line of vegetation adjacent to the treated area.
- Aquifers and public water sources are identified and protected.
- Application equipment, empty herbicide containers, clothes worn during treatment, and skin are not cleaned in open water or wells. Mixing and cleaning water must come from a public water supply and be transported in separate labeled containers.
- Herbicide mixing, loading, or cleaning areas in the field are not located within 200 feet of private land, riparian corridors, open water or wells, or other sensitive areas.
- No herbicide will be broadcast on rock outcrops or sinkholes. No soil-active herbicide with a half-life longer than 3 months will be broadcast on slopes over 45 percent, erodible soils, or aquifer recharge zones. Such areas will be clearly marked before treatment so applicators can easily see and avoid them.

- Herbicides are applied at the lowest rate effective in meeting project objectives and according to guidelines for protecting human and wildlife health. Application rate and work time must not exceed typical levels (Table 3-11, George Washington Forest Plan).
- Weather is monitored and the project is suspended if temperature, humidity, or wind becomes unfavorable as shown in Table 2-7 of the Jefferson Forest Plan.

Treatment of Future Infestations

The project proposal is also intended to be adaptive in nature and allow the use of integrated methods for the future treatment of invasive plant infestations. Nonnative invasive species infestations are uncertain and dynamic; even the most complete inventory will never cover the actual infested area and will quickly be out of date. During the life of this project, invasive plants are likely to be introduced to new locations by vehicles, heavy equipment, livestock, wildlife, recreationists, and all the usual vectors of spread, and will be detected through monitoring. It is also likely that additional species of invasive plants not identified may be discovered on the Forest over the term of the project. Treatment options may vary according to the particular invasive species, the size and configuration of the infestation, site location, and site conditions. Prior to any treatments of future infestations, the proposed treatment would be reviewed by forest resource specialists in the areas of wildlife biology, botany, aquatics, soils, recreation, and heritage resources. A site-specific implementation checklist of required reviews (see Appendix C), documentation of any additional site-specific mitigation measures, and consideration of potential cumulative effects would be used to ensure that potential environmental impacts are within the scope of the impacts disclosed from the environmental analysis completed for this project proposal. Any new treatment method or new herbicide would require a separate environmental analysis and decision.

Monitoring

Weed infestations are rarely eradicated, or even controlled, with a single treatment. Follow-up monitoring to evaluate the success of the treatments will be necessary to successfully implement the control program. It is anticipated that many infested sites will require multiple treatments over several years to gain the desired level of control. Monitoring will be a necessary component in determining the frequency and type of successive treatments, as well as the effects on non-target species and other resources.

Other Management Actions

Prevention of NNIP infestations remains the foremost priority for addressing this issue. The GWJ currently pursues several prevention strategies for NNIPs. For example, the Forest uses various media outlets to encourage visitors to take preventative measures such as cleaning bicycles, vehicles, horses, trailers, etc. prior to recreational visits to the Forest; not bringing livestock forage onto the Forest; using only locally-procured firewood; and other measures as deemed appropriate. Weed-free forage and mulch (hay) currently is not available in the local area. Therefore, the Forest generally requires that straw be substituted for hay wherever mulch is used. Straw is less likely than hay to contain NNIPs because of the more intensive cultivation under which it is produced. Permits for organized equestrian use on the Forest encourage users

not to bring hay on to the National Forest whenever practical. Cleaning of logging equipment prior to use on National Forest land is national and regional policy. When necessary, special use permits require prevention measures such as seed testing, prohibiting use of hay for mulch, and cleaning of construction and maintenance equipment. For the past several years, we have included the need to treat any existing NNIP infestations wherever we have proposed ground-disturbing activities, such as timber sales, and have included monitoring for NNIPs following project implementation. The environmental analyses and decisions made for future ground-disturbing activities will include prevention, treatment and monitoring of nonnative invasive plant species.

PROPOSED ACTION (2): INVASIVE WOODY PLANT CONTROL IN MAINTAINED ROADSIDES, UTILITY CORRIDOR AND WILDLIFE OPENINGS

Roadsides, utility corridors and wildlife openings are typically maintained in grass, forb or shrub vegetation and can provide large, contiguous pathways for NNIP spread or encroachment of unwanted woody plant species. The proposed action for maintaining these areas includes the previously described action to control nonnative invasive plants, but also includes control of some woody vegetation that could include native species, such as black locust.

In addition to problems with NNIP, it is also important to manage vegetation immediately adjacent to open roads for driver safety. Tall woody vegetation growing in the road right-of-way (ROW) creates visibility and safety problems for motorists utilizing these roads. A road closed-in with woody vegetation does not allow for sunshine to help keep the road ROW free from ice and water. This in turn increases road service maintenance needs. So we are also proposing chemical treatment of unwanted woody vegetation in the right-of-way of open roads on the Forests. Mowing and brushing (historical maintenance techniques) keep the vegetation down but these methods do not kill the roots of many species. Over time the root system gets larger while maintaining the above ground vegetation. With each mowing or brushing, the woody vegetation is cut down but sprouting actually increases because of the larger root system that remains after cutting. Chemical control is needed to control this woody vegetation. Treatment would occur annually on about 872 miles of road, for a total treatment area of about 2,600 acres (about 12 feet on either side of the road).

Wildlife openings provide important habitat for the many species that need open, grassy or shrubby habitat at some point in their life history. Mowing, brushing and chemical control are important to maintain the open conditions. Mowing and brushing are standard practices to maintain these areas and along with fire, would continue to be the primary method of maintenance. Woody vegetation, particularly autumn olive (*Elaeagnus umbellata*) and tree-of-heaven (*Ailanthus altissima*), are encroaching into areas maintained in grasses and forbs for wildlife forage. In addition to these NNIP, black locust and other native shrubs can become established in the openings and reduce the ability to mow. Since chemical control of the unwanted vegetation may be necessary for NNIP control, we are also proposing chemical control of native unwanted vegetation within wildlife openings. Treatment would occur sporadically as needed in an individual area. Any of the 2,400 acres of maintained openings could be treated with chemicals in a given year.

Utility corridors need to be managed to provide for safety and reliability of the utility. This generally means maintaining a grass/forb or shrub community without trees. The use of herbicides can enhance the growth of desirable species that maintain the needs of the utility, reduce long-term maintenance needs and produce open canopy habitat for wildlife species. Treatment with herbicides is proposed as needed across the 3,414 acres of utility rights-of-way across both Forests.

Areas to Be Treated and Methods of Treatment

The areas to be treated, methods of treatment, and standard management practices are as described in the previous section for the first proposed action. Herbicides used to control woody vegetation in road and utility rights-of-way and wildlife openings would include fosamine ammonium, glyphosate, and triclopyr. One additional method of treatment for these areas is the use of broadcast spraying with a boom sprayer attached to a vehicle.

DECISIONS TO BE MADE

The Forest Supervisor of the George Washington and Jefferson National Forests is the Responsible Official for the decision to be made for both proposed actions. The decision-maker will answer the following questions based on the environmental analysis:

- Whether the proposed action would result in significant environmental effects that would require the preparation of an Environmental Impact Statement, or if there is a finding of no significant impact.
- If significant impacts are not anticipated, the Forest Supervisor will determine whether the proposed action will proceed as described above, as modified by an alternative, or not at all.
- Mitigation measures and monitoring requirements to be implemented by the Forest Service.
- Whether there needs to be a separate decision for each of the proposed actions or they can be combined in one decision.

REFERENCES

[EO] Executive Order 13112 of February 3, 1999. Federal Register Vol. 64, No. 25. Available at http://www.invasivespecies.gov/

Evans, C.W., Moorhead, D.J., Bargeron, C.T. and G.K. Douce. 2006. Invasive Plant Responses to Silvicultural Practices in the South. The University of Georgia Bugwood Network, Tifton, GA. BW-2006-03.

Miller, J.H. 2003. Nonnative Invasive Plants of Southern Forests: A Field Guide for Identification and Control. USDA Forest Service, Southern Research Station, Asheville, NC. General Technical Report SRS-62.

SE-EPPC. 2004. Southeast Exotic Pest Plant Council Invasive Plant Manual. http://www.invasive.org/eastern/eppc/

USDA Forest Service. 2004. National Strategy and Implementation Plan for Invasive Species Management. FS-805. Available at http://www.fs.fed.us/invasivespecies/documents/Final_National_Strategy_100804.pdf

USDA Forest Service. 2005. Forest Service southern regional framework for nonnative invasive plant species.

USDA Forest Service 2007. USDA Forest Service Strategic Plan: FY 2007-2012. 32 p. Available at http://www.fs.fed.us/plan/

USDA Forest Service. 2007. Four Threats – Quick Facts. http://www.fs.fed.us/projects/fourthreats/facts/invasive-species.shtml.

USDA Forest Service. 2007. Forest Health Protection Website: Herbicide Risk Assessments. http://www.fs.fed.us/foresthealth/pesticide/risk.shtml

USDA Forest Service, Southern Research Station 2009. Southern Research Station Forest Inventory and Analysis Data Center – Nonnative Invasive Plant data tool. Available at http://srsfia2.fs.fed.us/nonnative_invasive/Southern_Nonnative_Invasives.htm

APPENDIX A. NNIP List Websites

Virginia:

http://www.dcr.virginia.gov/natural_heritage/documents/invlist.pdf

http://plants.usda.gov/java/noxious?rptType=State&statefips=51

West Virginia:

http://www.wvdnr.gov/Wildlife/DirtyDozen.shtm

http://plants.usda.gov/java/noxious?rptType=State&statefips=54

Forest Service:

http://www.na.fs.fed.us/fhp/invasive_plants/weeds/index.shtm

http://www.fs.fed.us/invasivespecies/speciesprofiles/index.shtml#plants

http://www.fs.fed.us/r8/resources/ecosystems/nnis/list.php?p=1.1.3.4

APPENDIX B. Ecology and Treatment Methodology for the Species of Greatest Threat
Information drawn extensively from Evans et al. 2006, SE-EPPC 2004, and Miller 2003. (See references section).

***Ailanthus altissima* (tree of heaven)**
Ecology: This deciduous tree is originally from China and was introduced to the United States in the late 1700's as an ornamental species. Tree of heaven can grow up to 80 feet in height and spreads rapidly by root sprouts forming dense colonies. This species is a prolific seeder capable of producing upwards of 300,000 winged seeds per plant that are readily transported long distances both by wind and water. Tree of heaven is extremely tolerant of poor soil and drought conditions and readily invades roadsides, forest openings, and other disturbed areas. This species re-sprouts vigorously after being cut or burned and is also alleopathic, enhancing its ability to displace other species and rapidly invade disturbed areas.
Proposed treatment methods: Cutting, girdling, and hand-pulling will provide some control of this species, however, it re-sprouts aggressively and will require continuous follow-up treatments. Mechanical methods are best used in conjunction with chemical treatments. Tree of heaven readily re-sprouts after fire, thus prescribed fire is not considered to be a viable control option for this species. For large trees apply stem injections of triclopyr, glyphosate, or imazapyr, or fell the trees and treat cut stumps immediately with the same herbicides. Treatment for saplings and seedlings could include mechanical removal with a weed wrench or hand-pulling, and/or application of triclopyr to young bark. Direct foliar applications to seedlings and re-sprouts imazapyr, glyphosate, or triclopyr, or metasulfuron-methyl could also be used.

***Alliaria petiolata* (garlic mustard)**
Ecology: This cool season biennial forb was first introduced from Europe in the 1800s.
The basal rosettes of leaves persist over the winter and the erect stems are among the first plants to flower in the spring. A single plant can produce hundreds of seeds which are dispersed up to a few yards around the parent plant. Due to its prolific growth, garlic mustard displaces many native spring wildflowers such as spring beauty (*Claytonia virginica*), wild ginger (*Asarum canadense*), bloodroot (*Sanguinaria canadensis*), Dutchman's breeches (*Dicentra canadensis*), toothworts (*Dentaria* species) and trilliums (*Trillium* species) that occur in the same habitat.
Proposed treatment methods: Because the seeds of garlic can remain viable in the soil for five years or more, effective management requires a long term commitment. The goal is to prevent seed production until the stored seed is exhausted. Hand removal of plants is possible for light infestations and when desirable native species co-occur. Care must be taken to remove the plant with its entire root system because new plants can sprout from root fragments. This is best achieved when the soil is moist, by grasping low and firmly on the plant and tugging gently until the main root loosens from the soil and the entire plant pulls out. Pulled plants should be removed from site if at all possible, especially if flowers are present. For larger infestations of garlic mustard, or when hand-pulling is not practical, flowering stems can be cut at ground level or within several inches of the ground, to prevent seed production. If stems are cut too high, the plant may produce additional flowers at leaf axils. Once seedpods are present, but before the seeds have matured or scattered, the stalks can be clipped, bagged and removed from the site to help prevent continued buildup of seed stores. This can be done through much of the summer. For very heavy infestations, where the risk to desirable plant species is minimal, application of the systemic herbicide glyphosate is also effective. Herbicide may be applied at any time of year,

including winter (to kill overwintering rosettes), as long as the temperature is above 50 degrees F. and rain is not expected for about 8 hours. Fire has been used to control garlic mustard in some large natural settings but, because burning opens the understory, it can encourage germination of stored seeds and promote growth of emerging garlic mustard seedlings. For this reason, burns must be conducted for three to five consecutive years. Regardless of the control method employed, annual monitoring is necessary for a period of at least five years to ensure that seed stores of garlic mustard have been exhausted.

***Akebia quinata* (chocolate vine)**

Ecology: Fiveleaf akebia is a vigorous vine that grows as a groundcover and climbs shrubs and trees by twining. Once established, its dense growth crowds out native plants. Fiveleaf akebia is found in 16 states in the eastern U.S. and has been reported to be invasive in Kentucky, Maryland, New Jersey, Pennsylvania, Virginia and the District of Columbia. Akebia is shade and drought tolerant and can invade many types of habitats, preferring lighter, well drained soils and sunny to partially shaded environs. Fiveleaf akebia was brought to the United States in 1845 as an ornamental which eventually escaped from cultivation and has since become naturalized in warmer climates. Akebia spreads primarily by vegetative means and is capable of growing twenty to forty feet in a single growing season. In the mid-Atlantic region, fruits are not always produced. Seeds of akebia may be dispersed by birds. Long distance spread of akebia is largely through human activities.

Proposed treatment options: Control options must be determined on a site-by-site basis. Manual, mechanical and chemical control methods are all effective for control of *Akebia*. Employing a combination of methods often yields the best results and may reduce potential impacts to native plants, animals and people. The method you select depends on the extent and type of infestation, the amount of native vegetation on the site, and the time, labor and other resources available to you. For small or scattered infestations manual and mechanical methods may suffice. Systemic herbicides such as triclopyr and glyphosate or a combination of manual, mechanical and chemical are probably more effective and practical for large infestations. Whenever possible and especially for vines climbing up trees or buildings, a combination of cutting followed by application of concentrated systemic herbicide to rooted, living cut surfaces is likely to be the most effective approach. For large infestations of ivy spanning extensive areas of ground, a foliar herbicide may be the best choice to minimize soil disturbance that could lead to reinfestation.

***Berberis thunbergii* (Japanese barberry)**

Ecology: Japanese barberry forms dense stands in natural habitats including canopy forests, open woodlands, wetlands, pastures, and meadows and alters soil pH, nitrogen levels, and biological activity in the soil. Once established, barberry displaces native plants and reduces wildlife habitat and forage. White-tailed deer apparently avoid browsing barberry, preferring to feed on native plants, giving barberry a competitive advantage. In New Jersey, Japanese barberry has been found to raise soil pH (i.e., make it more basic) and reduce the depth of the litter layer in forests. Japanese barberry has been reported to be invasive in twenty states and the District of Columbia. Due to its ornamental interest, barberry is still widely propagated and sold by nurseries for landscaping purposes in many parts of the U.S. Barberry is shade tolerant, drought resistant, and adaptable to a variety of open and wooded habitats, wetlands and disturbed areas. It prefers to grow in full sun to part shade but will flower and fruit even in heavy shade. Japanese barberry was introduced to the U.S. and New England as an ornamental plant in 1875 in the form

of seeds sent from Russia to the Arnold Arboretum in Boston, Massachusetts. In 1896, barberry shrubs grown from these seeds were planted at the New York Botanic Garden. Japanese barberry was later promoted as a substitute for common barberry (Berberis vulgaris) which was planted by settlers for hedgerows, dye and jam, and later found to be a host for the black stem grain rust. Because Japanese barberry has been cultivated for ornamental purposes for many years, a number of cultivars exist. Japanese barberry spreads by seed and by vegetative expansion. Barberry produces large numbers of seeds which have a high germination rate, estimated as high as 90%. Barberry seed is transported to new locations with the help of birds (e.g., turkey and ruffed grouse) and small mammals which eat it. Birds frequently disperse seed while perched on powerlines or on trees at forest edges. Vegetative spread is through branches touching the ground that can root to form new plants and root fragments remaining in the soil that can sprout to form new plants. Japanese barberry may be confused with American barberry (Berberis canadensis), the only native species of barberry in North America, and common or European barberry (Berberis vulgaris) an introduced, sometimes invasive plant.
Proposed treatment options: Do not plant Japanese barberry. Because it is a prolific seed-producer with a high germination rate, prevention of seed production should be a management priority. Barberry can resprout from root fragments remaining in soil so thorough removal of root portions is important. Because Japanese barberry leafs out early, it is easy to identify and begin removal efforts in early spring. Small plants can be pulled by hand, using thick gloves to avoid injury from the spines. The root system is shallow making it easy to pull plants from the ground, and it is important to get the entire root system. The key is to pull when the soil is damp and loose. Young plants can be dug up individually using a hoe or shovel. Hand pulling and using a shovel to remove plants up to about 3 ft high is effective if the root system is loosened up around the primary tap root first before digging out the whole plant. Mechanical removal using a hoe or Weed Wrench ® can be very effective and may pose the least threat to non-target species and the general environment at the site. Tools like the Weed Wrench ® are helpful for uprooting larger or older shrubs. Shrubs can also be mowed or cut repeatedly. If time does not allow for complete removal of barberry plants at a site, mowing or cutting in late summer prior to seed production is advisable. Manual control works well but may need to be combined with chemical control in large or persistent infestions. No biological control organisms are available for this plant. Treatments using the systemic herbicides glyphosate and triclopyr have been effective in managing Japanese barberry infestations that are too large for hand pulling. Application early in the season before native vegetation has matured may minimize non-target impacts. However, application in late summer during fruiting may be most effective. Triclopyr or glyphosphate may be used on cut stumps or as basal bark applications

***Buddleja davidii* (butterfly bush)**
Ecology: has been planted in landscapes to attract butterflies, bees, moths and birds. It can escape from plantings and become invasive in a variety of habitats such as surface mined lands, coastal forest edges, roadsides, abandoned railroads, rural dumps, stream and river banks to displace native plants.
Proposed treatment options: Manual, hand pick seedlings or dig out where possible. Big plants may be difficult to dig out. Chemical: cut plants and treat stumps with any of several readily available general use herbicides such as triclopyr or glyphosate.

***Carduus nutans* (musk thistle)**

Ecology: An aggressive, biennial herb from western Europe. Musk thistle grows from sea level to about 8,000 ft elevation, in neutral to acidic soils. It invades open natural areas, meadows, prairies, grassy bald, disturbed areas, old pastures, roadsides, waste places, ditch banks, old fields, and hay fields. It spreads rapidly in areas subjected to frequent natural disturbance events such as landslides and flooding but does not grow well in excessively wet, dry or shady conditions. The invasive nature of this aggressive plant can lead to severe degradation of native grasslands and meadows because grazing animals focus on native vegetation giving the thistles a competitive advantage.
Proposed treatment options: Manual, hand pulling is most effective on small populations and can be done throughout the year, but is most effective prior to the development of seeds. Flowers and seed-heads should be bagged and disposed of in a landfill to prevent or minimize seed dispersal. Minimizing disturbance to the soil during removal activities will help reduce the chance of germination of seeds stored in the soil. Chemical control can be achieved using any of several readily available general use herbicides such as glyphosate or triclopyr. Treatments should be applied during the rosette stage or prior to flowering. Glyphosate is a non-selective systemic (i.e., moves through the plant) herbicide that can kill non-target plants that are only partially contacted by spray. Triclopyr is selective to broadleaf species and is a better choice if native grasses are present.

***Celastrus orbiculatus* (oriental bittersweet)**
Ecology: This woody vine was introduced from Asia in the 1800's as an ornamental species. Oriental bittersweet can climb upwards of 60 feet forming thickets in tree canopies and sometimes girdling or completely covering smaller trees. It produces clusters of attractive fruits that are eaten by birds and other wildlife species and are collected by people for decorative wreaths, resulting in widespread seed dispersal. Oriental bittersweet poses a serious threat to native plant communities due to its high reproductive rate, long range dispersal, ability to root sucker, and rapid growth rate. Climbing oriental bittersweet vines severely damage native vegetation by constricting and girdling stems. Vines can shade, suppress, and ultimately kill native vegetation.
Proposed treatment methods: Cut climbing or trailing vines as close to the root collar as possible to control small populations. Cutting will prevent seed production and strangulation of surrounding woody vegetation, however Oriental bittersweet will aggressively re-sprout unless cut so frequently that its root stores are exhausted. Digging or pulling can also be effective for small populations. Fire is not considered to be a control option for this species due to its ability to rapidly re-sprout from underground roots. Chemical control can be achieved using direct foliar application of glyphosate or tryclopyr. For stems too tall for foliar application, basal bark treatments of tryclopyr are effective. Large stems can also be cut at the base and treated with a solution of glyphosate or tryclopyr to prevent re-sprouting.

***Centaurea biebersteinii* (spotted knapweed)**
Ecology: From Eurasia; introduced in 1890's as a contaminant in alfalfa or hay seed. Spotted knapweed is found at elevations up to and over 10,000 feet and in precipitation zones receiving 8 to 80 inches of rain annually. It is most common in sunny habitats with well-drained or gravelly soils. It grows on heavily disturbed sites, roadsides, agricultural field margins, undisturbed dry prairies, oak and pine barrens, rangeland, lake dunes, and sandy ridges. It releases a toxin into the soil that hinders or prevents the growth of neighboring species. This promotes its domination,

reduces plant diversity and limits forage and crop production. As spotted knapweed populations rise and other plant species are excluded, surface runoff and sedimentation often increases. Water holding capacity of soil decreases as taproots replace the network of native plant root systems.
Proposed treatment methods: Mechanical: hand-pull small infestations prior to seed set. Use gloves to prevent skin irritation. Remove entire crown and taproot to prevent re-growth. Chemical: spotted knapweed can be effectively controlled using any of several readily available general use herbicides such as clopyralid or picloram. Picloram will control spotted knapweed for three to five years. Clopyralid should be applied during bolt or bud growth stage. Biological control - two species of seed head flies, Urophora affinis and U. quadrifasciata, are well established on spotted knapweed. The larvae of these species reduce seed production by as much as 50% by feeding on spotted knapweed seed heads and causing the plant to form galls. Three moth species (Agapeta zoegana, Pelochrista medullana, and Pterolonche inspersa) and a weevil (Cyphocleonus achates) that feed on spotted knapweed roots have also been released. Biological control agents may be more effective when combined with other control methods such as herbicides, grazing, and revegetation with desirable, competitive plants. Other methods: Long-term grazing by sheep and goats has been found to control spotted knapweed. Burning, cultivation, and fertilization typically are not effective on spotted knapweed unless combined with other methods of control.

***Cirsium vulgare* (bull thistle)**
Ecology: Introduced from Europe, western Asia, and North Africa. Bull thistle is a widespread weed that can grow in a wide range of environments but is most troublesome in recently or repeatedly disturbed areas such as pastures, overgrazed rangelands, recently burned forests, forest clear-cuts, and along roads, ditches, and fences. It is found on dry and wet soils, but is most common on soils with intermediate moisture. Although bull thistle is a problem predominantly in disturbed areas, it also can be found in natural areas. The basal rosette may grow to over 3 feet in diameter before bolting. Once established, bull thistle out-competes native plant species for space, water, and nutrients.
Proposed treatment methods: Manual: mow to prevent seeding. Chemical: can be effectively controlled using any of several readily available general use herbicides such as glyphosate, triclopyr, or dicamba. Biocontrol: the seed-feeding fly, Urophora stylata Fabricius, has been selected and released for biological control of bull thistle.

***Eleagnus umbellata* (autumn olive)**
Ecology: This deciduous shrub was introduced from China and Japan in the 1800's and was widely and actively promoted by many state and federal agencies for erosion control, mine reclamation, and wildlife habitat, and was also widely marketed as an ornamental prior to being recognized as a threat to native ecosystems. Autumn olive is a prolific producer of fruit and can produce over 30,000 seeds per plant per year that are readily consumed by birds and small mammals. This species is also a nitrogen fixer and thus is able to colonize nutrient poor sites giving it an advantage in areas with infertile soils. Autumn olive re-sprouts vigorously after being cut or burned and can form dense thickets that can rapidly displace native vegetation if left unchecked.
Proposed treatment methods: Cutting, girdling, and hand-pulling will provide some control of this species, however, it re-sprouts aggressively and will require continuous follow-up

treatments. Mechanical methods are best used in conjunction with chemical treatments. Autumn olive readily re-sprouts after fire, thus prescribed fire is not considered to be a viable control option for this species. Large stems can be pulled with a weed wrench or cut and treated with imazapyr or glyphosate directly on the cut-surface. Other chemical control options include applying direct foliar application of dicamba, imazapyr, or triclopyr, or for stems too tall for foliar application, basal bark treatments of tryclopyr.

***Lespedeza cuneata* (sericea lespedeza)**

Ecology: Sericea lespedeza was introduced from Japan in 1896 to be tested as an agricultural crop. Since that time it has been used as livestock forage, erosion control, in wildlife plots, and to improve eroded soil. This species thrives in a wide range of soil moisture conditions, tolerating some flooding and also showing resistance to drought. Because if its ability to fix nitrogen, it can rapidly invade nutrient poor sites forming dense thickets. Sericea lespedeza sprouts rapidly from the root crown and is promoted by fire making it an aggressive invader of open areas. Seeds can remain viable in the seedbank for decades making eradication extremely difficult.

Proposed treatment methods: Hand pulling may be used for small plants or in loose soil, however, pulling of mature plants is impractical due to lespedeza's extensive perennial root system. Mowing plants before blooming for two or three consecutive years may reduce the vigor of lespedeza stands and control further spread. Plants should be cut as low to the ground as possible. Prescribed fire is not a control option for this species and will only promote its spread. Chemical control can be achieved through a variety of options. Direct foliar applications of clopyralid, glyphosate, hexazinone, or triclopyr or metsulfuron-methyl have all been shown to be effective in controlling this plant.

***Ligustrum sp.* (privet)**

Ecology: Several species of privet native to Asia, Europe, and North Africa have been introduced to the United States, primarily as a hedge in landscaping. They are difficult to distinguish and include common privet (*L. vulgare*), Chinese privet (*L. sinense*), and Japanese privet (*L. japonicum*). All easily escape cultivation to invade adjacent areas and since the fruits are eaten by birds, seeds can be spread to great distances. Privet is an aggressive invasive often forming dense thickets particularly in bottomlands, riparian areas, and along fencerows. Privet is an aggressive sprouter after damage and spreads both through seed dispersal and abundant root sprouts.

Proposed treatment methods: Mowing or cutting can be effective for small populations or environmentally sensitive areas where herbicides cannot be used. Repeated mowing or cutting will provide some control to the spread of privet, but will not eradicate it. Stems should be cut at least once per growing season as close to ground level as possible.

Privet is effectively controlled by manual removal of young seedlings. Plants should be pulled as soon as they are large enough to grasp but before they produce seeds. Seedlings are best pulled after a rain when the soil is loose. Larger stems can be removed using a weed wrench or similar uprooting tools. The entire root must be removed since broken fragments may re-sprout. Privet responds by sprouting after fire damage, but repeated fire has been shown to afford some control for this species. Mechanical methods are most effective when used in conjunction with the following chemical treatments. Apply direct foliar treatments of glyphosate, imazapyr, or metsulfuron-methyl during the dormant season . For stems too tall for foliar application apply

basal bark treatments of tryclopyr. Cut-surface or stem injection treatments of glyphosate or triclopyr are also effective on larger stems.

***Lolium arundinaceum* (tall fescue)**
Ecology: This grass species was introduced from Europe in the mid 1800's for use as a turf and forage grass. It has been widely established across the United States (and world) where various cultivars are still used extensively for turf, forage, and erosion control. Tall fescue is a cool season grass that is tolerant of a wide range of ecological conditions and is capable of forming dense stands along roadsides or in fields or any other open and disturbed areas.
Proposed treatment methods: Frequent mowing as close to the ground as possible will slow the spread of tall fescue, but will not eliminate it from the site. Prescribed burning in the early spring of successive years will inhibit fescue growth and usually promotes desirable native warm season grasses and legumes. To eradicate fescue from a site, a combination of burning and chemical treatments is needed. Apply imazapic or glyphosate as a foliar spray, or a foliar application of imazapyr in the early growing season for the best control.

***Lonicera japonica* (Japanese honeysuckle)**
Ecology: This woody vine was introduced from Japan in the early 1800's as an ornamental and has since been widely planted for erosion control and wildlife (deer) forage. Japanese honeysuckle can climb to heights of over 80 feet, but also forms sprawling mats over shrubs, rocks, and on the ground. It is probably the most commonly encountered invasive plant species in the southeastern states and is adapted to wide range of ecological conditions, occurring in floodplains and dry ridges, and within the full shade of mature forests, to open areas in full sunlight. Japanese honeysuckle spreads rapidly through root-sprouts and fast growing vines that root at the nodes. Seeds are readily dispersed by animals that feed on the numerous fruits. The slender twining vines can girdle shrubs and small trees, and the dense mats rapidly shade out native vegetation resulting in a dramatic reduction in native biodiversity in heavily infested areas.
Proposed treatment methods: For small patches, repeated pulling or digging of entire vines and root systems may be effective. Cut and remove twining vines to prevent them from girdling and killing shrubs and other plants. Mowing large patches of honeysuckle may be useful if repeated regularly (twice a year) but is most effective when combined with herbicide applications to reduce re-sprouting. Prescribed burning removes the above ground vegetation and can sever vines but does not kill the underground rhizomes, which will continue to sprout. Foliar applications of glyphosate, metsulfuron-methyl, or triclopyr will provide control for this species, or for larger vines, cut and treat the cut-surface immediately with glyphosate or triclopyr.

***Lonicera* spp.** (Bush honeysuckles, includes L. *maackii, L. morrowii, and L. tartarica*)
Ecology: In torduced from Asia in the 1700s and 1800s and planted as ornamentals and for wildlife. Often forms dense thickets in open forests, forest edges, abandoned fields, pastures, roadsides, and other open upland habitats. Relatively shade tolerant. Bush honeysuckles colonize by root sprouts and spread by abundant bird- and other animal-dispersed seeds. Seeds are long-lived in the soil.
Proposed treatment methods: Glyphosate applied as a foliar spray from August to October is effective. Or, apply triclopyr as to young bark as a basal spray. For stems too tall for foliar

sprays, cut large stems and immediately treat the stumps with one of the following herbicides: imazapyr or glyphosate.

***Lythrum salicaria* (purple loosestrife)**

Ecology: Native to Eurasia- Great Britain, central and southern Europe, central Russia, Japan, Manchuria China, Southeast Asia, and northern India. Purple loosestrife is capable of invading wetlands such as freshwater wet meadows, tidal and non-tidal marshes, river and stream banks, pond edges, reservoirs, and ditches. It spreads through the vast number of seeds dispersed by wind and water, and vegetatively through underground stems at a rate of about one foot per year. Seed banks can remain viable for twenty years. Purple loosestrife adapts to natural and disturbed wetlands. As it establishes and expands, it can out compete and replace native grasses, sedges, and other flowering plants that provide a higher quality source of nutrition for wildlife. The highly invasive nature of purple loosestrife allows it to form dense, homogeneous stands that restrict native wetland plant species, including some federally endangered orchids, and reduce habitat for waterfowl.

Proposed treatment methods: Manual - small infestations of young purple loosestrife plants may be pulled by hand, preferably before seed set. Older plants can be removed with a shovel. Landfill or burn removed plants. Chemical: purple loosestrife can be effectively controlled using any of several readily available general use herbicides such as glyphosate or triclopyr. These herbicides may be most effective when applied late in the season when plants are preparing for dormancy. However, it may be best to do a mid-summer and a late season treatment to reduce the amount of seed produced. Biological control: for long term control of large infestations biological control is recommended. As of 1997, three insect species from Europe have been approved by the USDA for use as biological control agents. These plant-eating insects include a root-mining weevil (Hylobius transversovittatus), and two leaf feeding beetles (Galerucella calmariensis and Galerucella pusilla). Two flower-feeding beetles (Nanophyes) that feed on various parts of purple loosestrife plants are still under investigation. Galerucella and Hylobius have been released experimentally in natural areas in 16 northern states, from Oregon to New York. Although these beetles have been observed occasionally feeding on native plant species, their potential impact to non-target species is considered to be low.

***Microstegium vimineum* (Japanese stiltgrass)**

Ecology: Nepal grass is native to temperate and tropical Asia and was first identified in the United States at Knoxville, Tennessee in 1919. It apparently spread rapidly from there, and by 1972, it had been identified in 14 eastern states. Microstegium vimineum is an annual, shade tolerant grass that is colonial in nature, rooting from the nodes, and may form dense monotypic stands. Each plant may produce from 100-1,000 seeds that remain viable in the soil for five or more years. Seed dispersal is primarily by animals, flooding, and deposition with fill dirt. This plant spreads rapidly into disturbed areas but can also invade undisturbed areas when seeds "hitch-hike" into pristine area on the fur of animals, car or bicycle tires, hiker's boots, or flooding. On fertile, mesic sites Japanese grass can replace competing ground vegetation within 3-5 years.

Proposed treatment methods: Mowing plants as close to the ground as possible using a weed-eater or similar grass cutting tool can be effective in reducing seed production. Treatments should be made when plants are in flower and before seeds are produced. Treatments made earlier may result in plants producing new seed heads in the axils of lower leaves. Hand-pulling

could be effective for small patches, but is usually not a feasible control option given the extent of infestations. Prescribed fire is also effective in eliminating seasonal growth, but is difficult to implement in the mesic sites where this species often occurs and it quickly re-establishes on disturbed ground from seed. For chemical control apply a foliar treatment of glyphosate in late summer.

***Paulownia tomentosa* (princess tree)**

Ecology: This deciduous tree is native to China and was introduced to the United States as an ornamental in the early 1800's. The showy purple flowers have made it popular as a landscaping tree and the wood of mature trees is also valuable in many overseas markets. Princess tree is an extremely fast grower and can reproduce from seed or from root sprouts. Sprouts can grow to over 15 feet in a single season. Each tree produces numerous clusters of seed pods each with four compartments that contain as many as 2,000 tiny winged seeds. It has been estimated that one tree is capable of producing twenty million seeds that are easily transported in water or wind. Paulownia tolerates drought and low soil fertility, allowing it to invade almost any habitat from rich riparian areas to vacant city lots. It is most often found on roadsides, stream banks, and disturbed areas, and its ability to sprout prolifically allows it to survive fire, cutting, and even bulldozing in construction areas.

Proposed treatment methods: Cutting, girdling, and hand-pulling will provide some control of this species, however, it re-sprouts aggressively and will require continuous follow-up treatments. Mechanical methods are best used in conjunction with chemical treatments. Princess tree readily re-sprouts after fire, thus prescribed fire is not considered to be a viable control option for this species. For large trees stem injections of glyphosate or imazapyr, or fell the trees and treat cut stumps immediately with the same herbicides. Treatment for saplings and seedlings could include mechanical removal with a weed wrench or hand-pulling, and/or application of triclopyr to young bark with a penetrant. Direct foliar applications to seedlings and re-sprouts using imazapyr, glyphosate or triclopyr could also be used.

***Perilla frutescens* (beefsteak plant)**

Ecology: From Asia where it is a traditional crop of China, India, Japan, Korea, Thailand, and other Asian countries. Beefsteak plants are prominent along roadsides, railroad rights-of-way, streams, spring branches, pastures, fields, woodlands and gravel bars. It can grow in rich soils, alluvial soils or dry soils. Often planted as showy ornamentals, beefsteak plants may readily escape cultivation, spreading to disturbed areas where they disrupt native ecosystems. The species has toxic characteristics and very few predators. It is ordinarily avoided by cattle and has been implicated in cattle poisoning. Plants are most toxic if cut and dried for hay late in the summer, during seed production. One reason for beefsteak plants' survival in pastures is that cattle avoid it. Sold as a salad plant for its dark purple foliage, this member of the mint family is extremely invasive by wind-borne seeds.

Proposed treatment methods: Manual - Pull seedlings and small or shallow-rooted plants when soil is moist. Dig out larger plants, including the root systems. To prevent spread of seeds, cut off spent flowers ("deadhead") or cut off seeds or fruits before they ripen, then bag, burn, or send to the landfill. Chemical: beefsteak plant can be effectively controlled using any of several readily available general use herbicides such as glyphosate.

***Polygonum cuspidatum* (Japanese knotweed)**

Ecology: This semi-woody shrub is native to Japan and was introduced to the United States in the 1800's as a landscape plant and for erosion control. It forms dense thickets that can reach heights of 3 to 10 feet and is easily recognizable by its "bamboo-like" stems and large, ovate leaves. Japanese knotweed spreads rapidly from stout rhizomes forming dense clonal stands. Seeds and rhizome fragments are distributed by water in floodplains and transported with fill dirt. Once established, populations are quite persistent and can rapidly out-compete existing vegetation.
Proposed treatment methods: Digging, plowing, or hand-pulling can be effective if care is taken to remove the entire plant including all roots and runners. Any portions of the root system not removed will potentially re-sprout. All plant parts, including mature fruit, should be bagged and disposed to prevent re-establishment. The effects of prescribed fire on this plant are unknown, though the dry, hollow stems of the previous seasons' growth should burn rapidly. Cutting or mowing may prevent seasonal reproduction, but will not provide effective control unless used in combination with chemical treatments. For chemical control apply a foliar treatment of either glyphosate or triclopyr, or cut stems and apply the same herbicides directly to the cut surface.

Persicaria perfoliatum **(mile-a-minute)**
Ecology: Mile-a-minute, also called Devil's tear-thumb, was experimentally introduced into Portland, Oregon in 1890, and later to Beltsville, Maryland in 1937 but did not become established at either site. An additional unintentional introduction in the 1930s to a nursery site in York County, Pennsylvania was successful and is the likely source of this invasive plant in the mid-Atlantic and northeastern United States. Seeds of the plant may have been spread with rhododendron stock. Mile-a-minute weed is found in the northeast from Virginia to New York to Ohio and Oregon. It invades open and disturbed areas, such as fields, forest edges, stream banks, wetlands, roadsides and wetlands. Mile-a-minute grows rapidly, scrambling over existing plants, limiting their photosynthess, which can lead to their death.
Proposed treatment methods: Hand pulling and glyphosate. Manual and chemical methods are effective for controlling mile-a-minute. Seedlings and vines are easy to pull by hand as long as gloves and sturdy clothing are worn. However, pulling vines with mature fruits should be avoided as it may help spread seeds. Contact and systemic herbicides are effective in controlling it. Because the foliage has a waxy covering, the herbicide must be mixed with surfactant to help it adhere to the plant. Mile-a-minute is an annual and reproduces by seed—roots do not persist through the winter. Continued presence of mile-a-minute in a location is due to seeds from the previous year, not from plants regrowing from roots. Care should be taken to dispose of pulled or cut materials properly, using the following guidelines, to minimize the potential for further spread by seed. Hand pulling of seedlings is best done before the recurved barbs on the stem and leaves harden. Removal of vines by hand may be conducted throughout the summer. Repeated mowing or trimming of mile-a-minute plants will prevent the plants from flowering and thus reduce or eliminate fruit and seed production. Mile-a-minute spreads by seed. Even small, green seeds can still germinate. Seeds should not be composted, as composting may not kill seeds. Seeds have been known to germinate after long periods in the soil (up to 7 years), so it is important to check and re-check the area frequently to be sure that all the plants have been removed and follow up in later years, or the problem could begin all over again. Minimize movement of the plants. Vegetative material (with no fruits) can be pulled and can be left on-site if possible. Vegetative material can be composted. Cultural methods: maintain vegetative community stability and avoid creating gaps or openings in existing vegetation. Maintaining

broad vegetative buffers along streams and forest edges will help to shade out, reduce the dispersal of fruits by water and prevent establishment. Chemical: glyphosate will control mile-a-minute weed.

***Pueraria montana* var. lobata (kudzu)**

Ecology: This woody vine is native to Japan and China and was introduced into the United States in the late 1800's as an inexpensive livestock forage. The Soil Conservation Service distributed approximately 85 million seedlings starting in 1933 in an effort to control agricultural erosion. Kudzu was listed by USDA as a common weed of the south in 1970 and it is now estimated that kudzu covers over seven million acres in the southeast. This aggressive vine can grow up to a foot per day forming a continuous cover of foliage that chokes out competing native vegetation. Kudzu grows well under a wide range of environmental conditions and can grow in nearly any type of soil, resulting in large-scale alteration of biotic communities. Kudzu has large, tuberous roots that reach depths of up to 5 meters making it extremely difficult to eradicate with any method other than a systemic herbicide.

Proposed treatment methods: Plowing, digging, mowing, and pulling (young plants) all can have some effect on controlling spread of smaller patches, but it is extremely difficult to eradicate without resorting to the use of chemicals. Like the previous mechanical treatments, prescribed fire can reduce above ground biomass, but the plant rapidly re-sprouts from the deep-seated roots and re-establishes rapidly. To treat chemically apply a foliar spray of clopyralid, a foliar spray of glyphosate or triclopyr, or a foliar treatment of metsulfuron-methyl. Treat the bark of larger vines with triclopyr ,or cut stems and immediately treat the cut surface with a glyphosate or triclopyr for additional control.

***Rosa multiflora* (multiflora rose)**

Ecology: Multiflora rose was introduced from Asia in the late 1800's as an ornamental species and was subsequently used for wildlife plantings and windbreaks. In some states, it was even planted as a crash barrier along highways. Plants produce long, arching, vine-like stems that form sprawling clumps and often climb high into the branches of nearby trees. Multiflora rose reproduces by seed and also spreads rapidly from root sprouts and by rooting from the tips of arching branches. Its fruits are eaten by birds and other small animals that then disperse the seeds great distances. Seeds may remain viable in the soil for 10-20 years. Multiflora rose will tolerate a wide range of environmental conditions and once established, grows rapidly forming dense, impenetrable thickets.

Proposed treatment methods: Mowing and cutting can be effective at controlling the spread of small populations or environmentally sensitive areas where herbicides cannot be used, but will not eradicate it. Stems should be cut at least once per growing season and as close to ground level as possible. Hand cutting of established clumps is extremely difficult due to the long arching stems and prolific thorns. Prescribed burning will reduce above ground biomass and seems to have some benefit as a control measure, though more information is needed on long-term effectiveness of this treatment option. The best control is achieved though the use of chemical treatments. For large stems, cut and immediately treat the cut surface with glyphosate or imazapyr. Stems can also be treated with a basal application of triclopyr. Direct foliar applications can also be made using imazapyr, glyphosate, or metsulfuron-methyl.

***Spiraea japonica* (Japanese spiraea)**

Ecology: Japanese spiraea is a perennial shrub native to Japan that was introduced to the United States in the late 1800's as an ornamental species. Spiraea will tolerate a wide range of ecological conditions but is most commonly encountered along streams or roads in moist soils. It grows well in full sun but may endure partial shade. It will grow in almost any disturbed habitat including riparian areas, successional fields, roadsides, power line rights of way, and forest edges. Once established, spiraea grows rapidly forming dense stands that may invade canopy gaps of adjacent woodlands. Each plant produces hundreds of small seeds that can be dispersed by water and deposited along stream banks, or easily transported in fill dirt or by vehicle tires along roadways.
Proposed treatment methods: Mowing, cutting, and hand-pulling are appropriate for small populations or environmentally sensitive areas where herbicides cannot be used. Repeated mowing or cutting may control the spread of Japanese spiraea, but will not eradicate it. Stems should be cut at least once per growing season prior to seed production and as close to ground level as possible. The use of weed wrenches or hand-pulling of seedlings will effectively control small populations. The effects of prescribed fire are not well documented for Japanese spiraea. Related species are top-killed, but re-sprout after fire. Because this species often occurs in riparian areas or other mesic habitats, prescribed fire is probably not an option as a control method. For chemical control apply a foliar solution of glyphosate or triclopyr, or cut stems and immediately treat the cut surface with a solution of the same herbicides.

***Tussilago farfara* (coltsfoot)**
Ecology: A native of Europe, this plant is believed to be brought to this country by early settlers for its medicinal properties. Coltsfoot thrives in low-lying mesic areas including stream banks, moist field or pastures, roadsides, and disturbed areas. It can also be found in drier sites and in poor soils. It is intolerant of shade and is not commonly found in wooded areas, though it has been documented invading forests following fire.
Proposed treatment methods: Small infestations may be controlled by hand pulling to remove the entire plant. Chemical: coltsfoot can be effectively controlled using any of several readily available general use herbicides such as glyphosate. Treat in summer when the leaves of coltsfoot are fully developed.

Appendix C: Implementation Checklist for the Treatment of NNIP Species

NRIS Site ID: _____ Primary Species name: _____
Lat/Long in decimal degrees: N_____ W _____
GIS Acres: _____ (*calculated from GIS*) % of Site Infested: _____

List other NNIP species present at site:

Treatment method (List methods, chemicals to be used, date to be treated, by whom, etc)

Botanist Review: (Describe any special circumstances including the presence of TES species and rare or unique communities. List all recommended mitigations below.)

Wildlife Biologist Review: (Describe any special circumstances including potential impacts to forage and wildlife investments. List all recommended mitigations below.)

Aquatic Biologist Review (only required when treating sites within riparian area): (Describe any special circumstances including the presence of aquatic TES species. List all recommended mitigations below.)

Hydrologist/Soils Review: (Describe any special circumstances regarding potential impacts to water quality. List all recommended mitigations below.)

Archaeologist Review (only required if treatment involves ground disturbance): (Describe any special circumstances regarding historical or cultural significance. List all recommended mitigations below.)

Signatures:

_____	_____	_____
Botanist/Ecologist	Wildlife Biologist	Aquatic Biologist
_____	_____	
Archaeologist	Hydrologist/Soil Scientist	