Chapter 3 – Affected Environment & Environmental Effects

3.1 - Introduction

Chapter 3 describes resources of the environment that may be affected by the alternatives presented in Chapter 2, as well as the effects that the alternatives may have on those resources. Affected environment and environmental effects have been combined into one chapter to give the reader a more concise and connected depiction of what the resources are and what may happen to them under the different alternatives. The effects analysis forms the scientific and analytic basis for the comparison of alternative effects that appears at the end of Chapter 2.

3.1.1 - Chapter Organization

Chapter 3 is organized by resource, focusing on those resources that may be affected by the proposed action and its alternatives. Each resource section is organized and presented in the format described below.

Scope of the Analysis – Briefly describes the geographic area(s) for potential effects. Areas may differ for direct, indirect, and cumulative effects. Affected areas may also vary in size depending on the resource, issue, or anticipated activities. This section also describes the time frame(s) over which effects were assessed.

Affected Environment – Describes the current conditions of the resources. This section may also include history, development, past disturbances, natural events, and interactions that have helped shape the current conditions.

Desired Conditions – Describes the desired conditions for the resource in the Forest Plan. Proposed activities are designed to maintain, restore, or move resources toward, these conditions.

Direct and Indirect Effects – Analyzes the amount and intensity of direct and indirect effects by alternative on the resource-related issues and indicators. Direct effects are caused by an action and occur at the same time and place as that action. Indirect effects are caused by an action but occur later in time or farther removed in distance.

Cumulative Effects – Analyzes the cumulative effects to the resource that may result from the incremental impacts of the alternatives when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes the other actions.

Unavoidable Adverse Impacts – Describes adverse impacts that would likely occur as a result of implementing proposed activities. These impacts are typically reduced to acceptable levels through project design features and mitigation measures found in Chapter 2.

Irreversible or Irretrievable Commitment of Resources – Irreversible commitments are permanent or essentially permanent resource uses or losses; they cannot be reversed, except in the extreme long term. Examples include minerals that have been extracted or soil productivity that has been lost. Irretrievable commitments are losses of production or use for a period of time. One example is the use of suited timber land for a logging road. Timber growth on the land is irretrievably lost while the land is a road, but the timber resource is not irreversibly lost because the land could grow trees again if and when the road is returned to productivity.

Consistency with Forest Plan and Other Direction - Finally, each section looks at whether the proposed activities and their potential effects are consistent with management direction found in the Monongahela National Forest Land and Resource Management Plan (Forest Plan 2006), as well as applicable laws, regulations and agency policies related to each resource area. More details about the analyses are documented in individual resource reports in the project file.

3.1.2 - Presence or Absence of Particular Resources

The resources analyzed in Chapter 3 were chosen due to issues or concerns about potential impacts from the alternatives. Conversely, other resources were not addressed because there would be little or no effects from the alternatives, or because effects would be beneficial.

For example, effects to timber and range resources were not analyzed in detail because proposed NNIS treatments would be beneficial to these resources by reducing NNIS effects to timber and forage vegetation. Thus, prime farmland, timberland, or rangeland in or near treatments would be beneficially affected as well. Also, timber projects and range allotments are now routinely monitored for NNIS establishment and spread. Mineral development areas are also monitored.

NNIS treatments are not likely to have any measurable effects on air quality, cultural resources, wetlands, or floodplains due to the general lack of disturbance and low commitment of energy resources proposed. Treatments in wetlands/floodplains would beneficially affect the native vegetation and hydrology. Similarly, treatments in special areas—ecological areas, eligible Wild and Scenic River corridors, Scenic Areas, etc.—would be beneficial to the native vegetation and biodiversity of those areas, but would not alter their undeveloped character.

No economic analysis was provided because there is only one action alternative, so there is no need to show which alternative would be more cost effective. Economic impacts of NNIS are hard to assess, but it is well known that invasive species can negatively affect timber growth and regeneration, range carrying capacity, recreation and scenery, soil stability, and other resources. Funding for proposed activities would generally come from Congressional appropriations but could be supplemented by state and private partnerships or contributions. No environmental justice issues are expected, as proposed activities or alternatives would not have any differential effects on minority or low-income populations.

3.1.3 - Analysis Calculations

In the modeling and analysis included throughout Chapter 3, the numbers for acres of treatment, road miles, etc. are all best estimates based on the latest available information and technology. The analysis conducted for this EA is intended and designed to indicate relative differences between the alternatives, rather than to predict absolute amounts of activities, outputs, or effects.

3.2 - Terrestrial Ecosystems

3.2.1 - Scope of the Analysis

This section addresses effects to terrestrial ecosystems including community composition and structure and ecological reserves.

Spatial Boundary

For direct, indirect, and cumulative effects, the spatial boundary of the analysis is the proclamation and purchase unit boundary of the Monongahela National Forest (MNF) (see Figure 1.1 in the EA). This boundary includes all activities proposed in all alternatives, and it also includes the major ecosystem groups that will be affected by the activities. Therefore, it is an appropriate boundary for analyzing effects of the activities. The proclamation and purchase unit boundary includes approximately 920,000 acres of National Forest System (NFS) land and approximately 780,000 acres of private, state, and other federal land.

Temporal Boundary

The temporal boundary for direct, indirect, and cumulative effects is ten years. Initial site-specific control activities are expected to be completed within that time frame. Although follow-up control and control of additional sites may occur beyond ten years, a review of the NEPA documentation is expected to be conducted at that time, and any effects beyond the scope of those considered here can be disclosed at that time.

3.2.2 - Affected Environment

Ecological Setting

The Monongahela National Forest is located in the central Appalachian Mountains, which is one of the major regional concentrations of native biological diversity in the eastern United States (The Nature Conservancy 2003). The Forest spans portions of two ecological sections, the Northern Ridge and Valley and the Allegheny Mountains, which is one of the factors responsible for the high biodiversity found on the MNF. Variations in elevation, topography, geology, soils, and climate produce a wide range of ecological communities that support a great diversity of plant and animal species.

Within the MNF, the Northern Ridge and Valley section is characterized by long, parallel ridges and intervening river valleys. This section lies in the rain shadow of the Allegheny Mountains and has an abundance of submesic and xeric communities dominated by oaks and pines. It also has considerable amounts of limestone geology. The combination of shallow, limestone-derived soils and a dry climate produce unique communities that harbor many rare plant species.

The portion of the Allegheny Mountains section within the MNF is composed of several subsections. Although there is some variation among subsections, topography generally consists of steep-sided mountains and plateaus with narrow, dendritic stream valleys. The climate is moist, and mesic hardwood forests dominate the lower slopes and coves. Northern hardwood forests and spruce forests dominate the upper slopes, mountain tops, and high-elevation coves and valleys. This section contains scattered small, high-elevation wetlands. These wetlands do not cover much total area, but they contain a high proportion of the rare plant and animal species found in the section.

Non-native invasive plants continue to spread on the Forest. Several rare plant communities are imminently threatened by expanding infestations. Many other important ecosystems and large areas of contiguous federal ownership remain largely un-invaded, but threats to these ecosystems are increasing due to new spot infestations and continued spread along transportation corridors or other pathways. A complete inventory of invasive plants on the Forest does not exist, so it is not possible to quantify the extent of existing invasions accurately. In 2003 the Forest estimated that over 30,000 acres of openings were infested, but this was a gross estimate that assumed all openings were infested with at least one invasive plant.

The Forest currently pursues several prevention and treatment strategies for NNIS. They include a) public outreach, b) use of straw rather than hay for mulch, c) required cleaning of logging equipment prior to use on NFS lands, d) prevention measures applied to maintenance activities, e) monitoring, f) use of weed-free seed, g) inclusion of prevention measures in special use permits, and h) borrow pit inspections.

Ecological Reserves

Conservation planners use the term “minimum dynamic area” to describe the minimum size necessary for an ecological reserve to absorb natural disturbances and still maintain representative natural amounts of ecological communities and development stages over the long term (Haney et al. 2000). The MNF relies on the MDA reserve concept as a strategy for providing future old growth and preserving native biodiversity under natural regimes of disturbance and re-growth (USDA Forest Service 2006a). This is achieved through Forest Plan allocations of land to a number of management prescriptions that emphasize passive management. Taken together, these management prescription allocations in many areas coalesce to form large blocks of land where vegetative composition and structure is shaped primarily by natural processes. On the MNF, blocks that are larger than 10,000 acres are considered large enough to perform MDA reserve functions.

Ten areas on the Forest currently meet the 10,000-acre MDA threshold. These areas range from about 11,000 acres to nearly 100,000 acres and are located in the northern, central, and southwestern parts of the Forest (see Forest Plan EIS and accompanying map package for more detail [USDA Forest Service 2006a]). The total area contained in these reserves is approximately 390,000 acres. This total area comprises about 43 percent of all NFS land and about 23 percent of all land within the Forest boundary. The reserves are disproportionately located in the higher elevation areas of the Forest, and are largely dominated by northern hardwood forest, mixed mesophytic/cove forest, and spruce forest.

Most MDA reserves on the Forest are not heavily impacted by invasive species. However, high priority invasive species such as garlic mustard and Japanese stiltgrass have begun to establish around the edges of some reserves, such as the reserves associated with the Otter Creek wilderness, Cranberry wilderness, Dolly Sods wilderness, Seneca Creek backcountry, East Fork Greenbrier backcountry, and the spruce forest on top of Cheat Mountain. An exception is the MDA reserve formed by the Seneca Rocks portion of the Spruce Knob-Seneca Rocks National Recreation Area, which includes the Smoke Hole canyon and much of North Fork Mountain. Due to nutrient-rich soils, a patchwork land ownership pattern, and a long history of intensive use of adjoining private land, this MDA reserve is fairly heavily invaded by Japanese stiltgrass, garlic mustard, tree of heaven, bush honeysuckles, autumn olive, and a host of lower priority invasive plants. Invasions in this reserve tend to be heaviest in and around grazing allotments, roads, and river floodplains, but several rare limestone glade and barren communities also are threatened by the invasions.

Desired Conditions

While the Forest Plan does not contain desired conditions that specifically mention MDA reserves, the concept is included in the Forest Integrated Desired Conditions (USDA Forest Service 2006b, p. II-6). Desired conditions that address the MDA reserve concept include:

- Integrity of ecosystems and watersheds that have a viable combination of all the diverse elements and processes needed to sustain systems and to perform desired functions
- Ecosystems that are dynamic in nature and resilient to disturbances
- Vegetation forms a diverse network of habitats and connective corridors for wildlife, and provides snags, coarse woody material, and soil organic matter

Other Forest Plan direction related to ecological communities deals with rare communities. The Forest Integrated Desired Conditions (USDA Forest Service 2006b, p. II-6) includes an emphasis on maintaining rare plant communities. The Forest-wide desired conditions for vegetation call for protection of rare communities through the designation of botanical areas and through the protection of habitats for Regional Forester's Sensitive Species.

3.2.3 - Environmental Consequences

Direct and Indirect Effects - Plant Community Structure and Composition

Alternative 1 - No Action

The No Action alternative would not implement any new management activities, so the direct and indirect effects outlined above would not occur. Invasive plant prevention and control efforts associated with other projects and activities would continue, but the Forest would not implement a coordinated, Forest-wide effort to reduce the adverse effects of invasive plants in high priority ecosystems. Invasive plants likely would continue to spread across the Forest, impacts to high-value ecological communities likely would increase, and rare plants in infested areas could be harmed or extirpated by competition from invasive plants. The negative effects to non-target plants from treatments described above also would not occur.

Alternative 2 - Proposed Action

The most obvious and desirable effect of invasive plant control efforts on community composition and structure would be the reduction or elimination of the invasive plant component from the target communities. The proposed action includes approximately 5,094 acres of control efforts, with an unspecified amount of additional control possible under programmatic provisions for treating additional sites in the future. Although complete eradication may not be possible in some locations, control efforts are expected to reduce the distribution and abundance of the target plants to the point that they cause minimal adverse impacts to the ecosystems of interest. Small outlier populations of invasive plants likely would be eliminated, which would slow or stop the spread of target species into some currently uninfested areas.

Indirectly, the removal of invasive plants could lead to a decrease in competition with desirable native plants through reduction of allelopathic effects and resource competition. Competitive and allelopathic effects have been documented well for garlic mustard (Prati and Bossdorf 2004, Meekins and McCarthy 1999, Roberts and Anderson 2001, Rodgers et al. 2008, Wolfe et al. 2008, Stinson et al. 2006) and more generally for other invasive plants (Yurkonis et al. 2005, Vila and Weiner 2004). Reduction of invasive plants may increase diversity of desirable native plants, as has been demonstrated for spring ephemerals after the control of garlic mustard (Carlson and Gorchov 2004).

These positive direct and indirect effects would work toward achieving the protection of high-quality communities, including habitat for threatened, endangered, and sensitive species; botanical areas; candidate research natural areas; and unique ecological communities. Of the 5,094 acres of proposed site-specific treatment, 4,092 acres would be conducted in locations that confer some degree of protection on these high-quality communities.

Certain control methods may have negative impacts on community composition and structure due to non-target effects on native plants. Although all control methods have some potential to affect non-target plants, broadcast foliar application of herbicide would be the method most likely to have this effect because generally it is not possible to avoid native vegetation that is intermingled with the invasive vegetation. For the 5,094 acres of identified site-specific control, foliar application of herbicides to low-growing vegetation could occur on any of the sites. However, 4,960 acres of this treatment would be “spot” treatment, meaning broadcast application would occur only on scattered patches of invasive plants within this acreage. The proportion of this spot treatment acreage that would actually be covered by herbicide has not been quantified. The remaining 134 acres are heavily infested and would be subject to continuous or nearly continuous treatment with a high likelihood of impacting any non-target plants that may be present. Most of the continuous treatment acreage consists of roadsides and wildlife openings that are dominated by weedy native and non-native plants, so the non-target plants to be impacted likely would be of low conservation value.

Use of selective herbicides would reduce the negative impact by targeting either grasses or broadleaf plants, which would leave the other group unaffected. Grass-specific or semi-specific herbicides (imazapic, sethoxydim) are proposed as the first choice herbicides for Japanese stiltgrass and many of the other invasive grasses. Broadleaf-specific herbicides (triclopyr, metsulfuron methyl, clopyralid) are proposed as the first choice for many of the woody and broadleaf herbaceous invasive plants. However, the broad-spectrum herbicide glyphosate is proposed as the first choice for control of garlic mustard, reed canary grass, and several other species. For garlic mustard, application would be timed such that most native plants are dormant, which would minimize non-target effects. Carlson and Gorchov (2004) demonstrated that carefully timed control of garlic mustard using glyphosate actually led to an increase in native herbaceous vegetation diversity, and that non-target impacts were largely limited to non-native winter annuals. For reed canary grass, applications cannot be conducted during the dormant season, so a greater potential for non-target effects exists. However, control of reed canary grass would be limited to disturbed roadsides and wildlife openings that are dominated by weedy vegetation.

Mowing also has the potential to harm or kill non-target plants that are intermingled with the invasive plants. Mowing is not proposed as a stand-alone treatment on any of the site-specific areas, but it could be used as a possible alternate control method on up to 220 acres. Of this total, 196 acres would contain spot control of invasive plant patches, and 24 acres would be continuous mowing. Most of the mowing would occur in and near the Blue Rock Geological Area in the Smoke Hole Canyon.

Cumulative Effects - Plant Community Structure and Composition

Alternative 1 - No Action

Because the No Action alternative would have no direct or indirect effects on plant community structure and composition, it would not contribute to any cumulative effects of other projects involving invasive plant control, herbicide application, or mowing.

Alternative 2 - Proposed Action

The direct and indirect effects of this project on community composition would add to the effects of past, current, and future activities that cause similar changes in community composition. The two activities most likely to have such effects are projects that involve mitigation measures to control the spread of invasive plants and projects that use mowing or foliar spraying of herbicides to control undesirable vegetation. Invasive plant control efforts would have positive effects similar to those noted above in the direct and indirect effects section, whereas mowing and foliar spraying of herbicides could have negative effects on non-target plants similar to those outlined above. In this cumulative effects analysis, invasive plant control activities are analyzed in their entirety for their potential positive effects in controlling invasive plants, and negative effects are analyzed for the parts of the activities that include foliar spraying. Therefore, some of the acreage discussed in the paragraph for invasive plant control activities is double-counted in the paragraph on foliar spraying.

On NFS land, control of invasive plants has only recently begun to be incorporated into the design of timber harvests and other projects. Proposed timber projects that may be implemented in the foreseeable future and include an invasive plant control component are the Hogback timber project in Tucker County, which would include up to 66 acres of invasive plant control, and the Lower Williams project in Webster County, which would include approximately 21 acres of invasive plant control. Ongoing and foreseeable range management activities also include control of invasive plants on several allotments totaling 991 acres. We are not aware of any specific invasive plant control efforts being conducted on other land ownerships within the proclamation and purchase unit boundary, although it is likely that some private landowners attempt to control multiflora rose, bush honeysuckles, and autumn olive in pastures. The Forest-wide Invasive Plant Management project proposes almost 5,094 acres of invasive plant control at specific sites, plus unspecified additional acreage at sites to be identified in the future. Therefore, this project would be responsible for the bulk of the cumulative effects of invasive plant control efforts on the Forest in the foreseeable future. On a Forest-wide basis, the total quantifiable cumulative invasive plants control (6,172 acres) would cover only about 0.4 percent of the land within the proclamation and purchase unit boundary. This probably is an underestimate of the actual total due to unknown amounts of private control activity and the unknown amounts of future control that the programmatic portion of this project would authorize on NFS lands. However, even in the unlikely event that the actual total amount of control is several times higher than this estimate, it would still cover a very small proportion of the land within the proclamation and purchase unit boundary. The total extent of existing infestations is not known, so the true cumulative impact on invasive plant infestations cannot be quantified.

The foliar spraying of herbicides to control undesirable vegetation (including both nonnative invasive and undesirable native vegetation) is also a relatively recent endeavor on the Forest. Two current timber projects include up to 1,188 acres of foliar spray, primarily to control undesirable native vegetation, such as ferns and grasses that compete with future crop trees. These projects are the Hogback project (598 acres of foliar spray), which is expected to be implemented in 2009, and the Little Beech Mountain project in Randolph County (590 acres of foliar spray), which was implemented in 2008. In addition to timber projects, one wildlife habitat improvement project expected to be implemented in the near future may use foliar spraying of herbicide to control undesirable vegetation. Wildlife openings and savannas to be developed in conjunction with the Lower Williams project would apply herbicide on up to 62 acres. Range allotment management would involve up to 445 acres of foliar spraying. It is possible that private landowners within the proclamation and purchase unit boundary also would conduct foliar herbicide spraying as part of forest management activities, but available information does not permit estimation of the amount. The Forest-wide Invasive Plant Management project would add up to 5,094 acres, for a cumulative foreseeable Forest-wide total of 6,789 acres of foliar herbicide application. Thus the Forest-wide Invasive Plant Management project would account for approximately 75 percent of the measurable cumulative effects of foliar herbicide application on the Forest. The cumulative total amount of foliar application would cover about 0.7 percent of NFS land and about 0.4 percent of all land in the proclamation and purchase unit boundary. Therefore, the cumulative effects of foliar herbicide application are not expected to cause a measurable decrease in the abundance or diversity of common non-target native plants.

Mowing is used across the Forest to maintain wildlife openings, road shoulders, and administrative sites. Pastures may also be mowed periodically to control encroaching woody vegetation. Most of the sites that are mowed have been maintained for many years, and maintenance is expected to continue on most of these sites for the foreseeable future. Thus, these sites constitute past, present, and reasonably foreseeable future activities. Open lands on all ownerships within the proclamation and purchase unit boundary cover approximately 93,000 acres (USDA Forest Service 2006, p. 3-116 and 3-118). Although a small proportion of the open areas are natural and are not maintained, a large majority of the acreage consists of pastures and other maintained sites that are mowed at least periodically. The 220 acres of mowing proposed by the Forest-wide Invasive Plants Management project constitutes a very small proportion of the total area potentially subject to mowing (0.2 percent). Therefore, this project is unlikely to make a measurable contribution to the cumulative effects of mowing on plant community composition.

Direct and Indirect Effects - Ecological Reserves

Alternative 1 - No Action

The No Action alternative would not implement any new management activities, so the direct and indirect effects outlined above would not occur. Invasive plant prevention and control efforts associated with other projects and activities would continue, but the Forest would not implement a coordinated, Forest-wide effort to reduce the adverse effects of invasive plants in MDA reserves. Invasive plants likely would continue to spread into reserves, potentially reducing their value as repositories for native biodiversity.

Alternative 2 - Proposed Action

The Proposed Action includes trailhead sanitation and other invasive plant control activities near or within each of the MDA reserves on the Forest. These control activities would reduce the density and distribution of existing infestations of high priority invasive plants within the reserves. The activities likely would also reduce the rate of spread of new infestations into the reserves. The programmatic component of the proposed action would allow for control of infestations identified in the future, which would provide the flexibility to respond to new infestations before they progress beyond practical control. This flexibility would increase the likelihood that ecologically damaging infestations could be excluded from the reserves.

Cumulative Effects - Ecological Reserves

Alternative 1 - No Action

Because the No Action alternative would have no direct or indirect effects on ecological reserves, it would not contribute to any cumulative effects of other projects involving invasive plant control within reserves.

Alternative 2 - Proposed Action

The proposed action would contribute to the cumulative effects of other past, present, and reasonably foreseeable future activities that provide control of invasive plants in or near MDA reserves. The only such activity that would involve control of invasive plants in MDA reserves is the management of range allotments in the Spruce Knob-Seneca Rocks National Recreation

Area. This project could lead to control of invasive plants on up to 445 acres within the MDA reserve that occupies the Smoke Hole canyon and North Fork Mountain. The two projects in combination would lead to greater control of invasive plants in this MDA than either project by itself. However, this reserve is heavily infested with a number of high priority invasive plants, so the cumulative effect of these two projects would still only accomplish targeted control over specific small areas. Cumulative effects across the rest of the Forest would be the same as the direct and indirect effects noted above.

Unavoidable Adverse Impacts

The No Action alternative would not have any direct or indirect effects on terrestrial ecosystems; therefore it would not have any unavoidable adverse impacts to them.

The Proposed Action would unavoidably kill non-native plants on 134 acres that would be subject to continuous broadcast spraying or continuous mowing. Some non-target species may be harmed or killed as well by this activity. However, impacts to non-target species would be minimized by applying mitigation measures described in Chapter 2 of this EA.

Irreversible or Irretrievable Commitment of Resources

The No Action alternative would not have any direct or indirect effects on terrestrial ecosystems; therefore it would not involve any irreversible or irretrievable commitment of resources.

The Proposed Action would irretrievably kill non-target native and non-native plants on 134 acres that would be subject to continuous broadcast spraying or continuous mowing. The loss of these plants would not be irreversible because the areas could be re-colonized after treatment ends.

3.2.4 - Consistency with the Forest Plan

The No Action alternative would be consistent with Forest Plan direction for terrestrial ecosystems because it would take no action and have no potential to affect these features.

The Proposed Action would be consistent with Forest Plan direction for terrestrial ecosystems. By focusing on control efforts that benefit rare plant communities, it would be consistent with direction to avoid management actions in rare communities unless such action is necessary for maintenance or restoration of the community (guideline VE14, p. II-19). The Proposed Action also would be consistent with Forest Plan direction requiring invasive plant management strategies to identify treatment methods and monitoring and reporting requirements (guideline VE24, p. II-20).

3.2.5 - Consistency with Laws, Regulations, and Handbooks

The primary federal direction that relates to management of non-native invasive species by federal agencies is Executive Order 13112 (February 3, 1999). The provisions of this order that are relevant to this project stipulate that federal agencies use their programs and authorities to prevent the spread of invasive species, control invasive species in a cost-effective and environmentally sound manner, and refrain from funding, authorizing, or carrying out activities that are likely to promote the spread of invasive species.

The No Action would not implement any activities or have any direct or indirect effects with respect to invasive species. Therefore, Alternative 1 would not take any actions that are inconsistent with EO 13112. However, by not pursuing a proactive control strategy, Alternative 1 would hinder or delay the Forest's efforts to use its programs and authorities to prevent the spread of invasive species.

The Proposed Action would provide a comprehensive framework for controlling invasive plants, prioritized to emphasize control efforts that would maximize environmental benefits with limited funds and personnel. Any necessary seeding, mulching, or earth disturbance would include prevention measures and follow-up monitoring to ensure that activities do not establish invasive plants with the potential to disrupt local ecosystems. These control and monitoring provisions make the Proposed Action consistent with EO 13112.

3.3 - Threatened, Endangered, and Sensitive Plants

3.3.1 - Scope of the Analysis

This analysis addresses effects to plant species that are federally listed as threatened or endangered, and also those plant species that are listed as Regional Forester's Sensitive Species (RFSS) on the Monongahela National Forest. Threatened, endangered, and sensitive plants are collectively referred to as TES plants.

Spatial Boundary

The spatial boundary for direct, indirect, and cumulative effects on TES plants is the proclamation and purchase unit boundary. This boundary contains all proposed project activities and is the boundary within which all direct and indirect effects will occur. This is also the boundary to which the National Forest Management Act viability requirement applies.

Temporal Boundary

The temporal boundary for direct, indirect, and cumulative effects is ten years. Initial site-specific control activities are expected to be completed within that time frame. Although follow-up control and control of additional sites may occur beyond ten years, a review of the NEPA documentation is expected to be conducted at that time, and any effects beyond the scope of those considered here can be disclosed at that time.

3.3.2 - Affected Environment

Four federally-listed threatened and endangered plant species are known to occur on the Monongahela National Forest: running buffalo clover (*Trifolium stoloniferum*), shale barren rockcress (*Arabis serotina*), Virginia spirea (*Spiraea virginiana*), and small whorled pogonia (*Isotria medeoloides*). Fifty-four plant species are listed as RFSS on the Monongahela National Forest. Because this is a Forest-wide project, all four threatened and endangered plant species and all 54 RFSS are presumed to occur within the project analysis boundary (i.e., proclamation and purchase unit boundary). Field surveys were conducted in specific activity areas with the potential for TES plant habitat and the potential for non-target impacts. Heavily disturbed sites (e.g., roadsides, maintained wildlife openings) were checked for the potential presence of TES habitat, but complete surveys were not conducted unless potential TES habitat existed.

Threatened and Endangered Plants

Based on field surveys of proposed activity areas and existing records, only one of the four threatened and endangered species (running buffalo clover) is known to occur within the proposed site-specific treatment areas.

Virginia Spiraea

Virginia spiraea is a clonal shrub found on damp, rocky banks of large, high-gradient streams.

This species may also be found at the flood-scoured mouths of side streams, rocky isles, seasonally flooded side channels, and in shrub thickets between river channels and adjacent forest (USFWS 1992a). The only known location of this species on the Forest is along the Greenbrier River near the Greenbrier County town of Anthony. This location is not near any of the proposed site-specific treatment areas. However, several proposed treatment sites are near large streams that could provide potential habitat.

Running Buffalo Clover

Potential habitat for running buffalo clover typically exists in lightly disturbed forests and woodlands on soils derived from circumneutral geologic features (NatureServe 2008, USFWS 2007). The Monongahela National Forest is a stronghold for running buffalo clover, with the largest and highest quality populations range-wide occurring on the Forest (USFWS 2007). Most of the Forest's populations are associated with minor soil disturbance features such as old skid trails and lightly used roads.

Running buffalo clover is known to occur at two of the proposed site-specific treatment locations. The Brushy Run mine road site in Pendleton County has two known subpopulations along an old road bed through the site. These subpopulations contain an estimated 10-20 rooted crowns. The entire site is considered potential habitat for running buffalo clover. Although the site has been surveyed and no other subpopulations were found, the potential for occurrence of other subpopulations cannot be ruled out. Running buffalo clover also is known to occur at the proposed treatment site near Bickle Knob. The botany survey at this location found two small subpopulations containing approximately 15 rooted crowns. This entire site also is considered potential habitat.

Potential habitat for running buffalo clover may exist at the following proposed treatment sites (see site maps in EA Appendix A):

- Shaver's Mountain wildlife openings (Forest Road 229 east of Otter Creek wilderness, Randolph County, see Map 3)
- Blue Rock Geological Area (Smoke Hole Canyon, Grant County, see Map 5)
- Pretty Ridge (west of Brushy Run, Pendleton County, see Map 5)
- Forest Road 112 (east of Spruce Knob near Simoda, Pendleton County, see Map 6)
- Cunningham Knob allotment (near Sinks of Gandy, Randolph County, see Map 7)
- Chestnut Ridge sites near Forest Road 1560 (west side of Cheat Mountain, Randolph County, see Map 9)
- Forest Road 92A (west side of Cheat Mountain, Randolph County, see Map 9)
- Buzzard Ridge (southeast of Slaty Fork, Pocahontas County, see Map 11).

Surveys were completed at each of these sites during the summer of 2008, except for the Blue Rock site, which was surveyed during the summer of 2005. No running buffalo clover was found. However, the potential for occurrence cannot be completely ruled out due to the possibility that a small subpopulation may have been overlooked.

Small Whorled Pogonia

Habitat preferences for small whorled pogonia are poorly known, but could include a variety of forested habitats. The available literature indicates occurrence in mixed deciduous and pine-hardwood habitats of a variety of ages, often near partial canopy openings (USFWS 1992b). Because the known distribution of small whorled pogonia on the Forest is so limited, the likelihood of occurrence for this species at any of the proposed treatment sites is considered to be very low. However, due to uncertainty about specific habitat requirements in this part of the species' range, potential occurrence cannot be completely ruled out at any of the wooded sites.

Shale barren Rockcress

Shale barren rockcress is a federally endangered biennial herb found mainly on shale barrens of eastern counties of West Virginia and western Virginia (USFWS 1991). A shale barren is a steep shale slope with a very sparse growth of scrubby pines, oaks, shrubs, and herbaceous plants that are adapted to the very warm, dry microclimate. Shale barrens on the Forest are limited to a few small sites in Greenbrier County. Shale barren rockcress is known to occur near the proposed treatment site at the White's Draft Botanical Area. The actual treatment location at this site does not include the shale barren habitat. Shale barren rockcress is unlikely to occur at other treatment sites due to lack of shale barren habitat.

Regional Forester's Sensitive Plants

The 54 plant species on the RFSS list cover a wide variety of habitats. Because the Proposed Action is Forest-wide, has a programmatic component, and could include treatments in many different types of habitats, the potential for occurrence in or near treatment sites cannot be completely ruled out for any of the 54 RFSS plants. Some species may be less likely to occur than others, but for the purposes of this analysis, all RFSS plants are considered to have the potential to occur in a treatment site. Based on field surveys and existing records, 14 of the 54 RFSS plants are known to occur within or adjacent to specific treatment sites (Table PL-1).

The 54 RFSS plant species can be categorized into six groups based on typical habitat (Tables PL-2 through PL-7). These habitat groupings can be used to assess likelihood of occurrence and potential for effects on various species at specific sites. The six habitat groups are wetland/riparian, rocky habitat, shale barrens, limestone glades and barrens, mesic hardwood forest, and xeric oak-pine forest. One species, Canada yew (*Taxus canadensis*), is included in the wetland/riparian group, but also occurs in high-elevation spruce forest. No other RFSS plants typically occur in spruce forest, so a separate habitat group was not created for this one species. The rocky habitat, shale barren, and limestone glades and barrens species overlap somewhat in their habitat preferences. Likewise, habitat preferences for some of the wetland/riparian species and mesic hardwood forest species overlap. These species were assigned to the group that best represents typical habitat on the Monongahela National Forest.

Table PL-1. RFSS Plants Known to Occur In or Adjacent to Proposed Non-native Invasive Plant Treatment Sites on the Monongahela National Forest

Scientific Name	Common Name	Site(s)
Agrostis mertensii	Arctic bentgrass	Cheat Mountain near Stonecoal Run
Allium allegheniense	Allegheny onion	Ramshorn
Astragalus neglectus	Cooper's milkvetch	Blue Rock Geological Area
Delphinium exaltatum	Tall larkspur	Blue Rock Geological Area
Heuchera alba	White alumroot	Cave Mtn. near Brushy Run, Shock Run, Ramshorn
Ilex collina	Long-stalked holly	Blister Run, Glade Run, Dogway Fork
Monarda fistulosa var. *brevis*	Smokehole bergamot	Blue Rock, Big Bend
Paronychia virginica var. *virginica*	Yellow nailwort	Blue Rock, Big Bend
Rhamnus lanceolata ssp. *lanceolata*	Lance-leaved buckthorn	Blue Rock
Scutellaria saxatilis	Rock skullcap	Ramshorn, Shock Run
Taenidia montana	Virginia mountain pimpernel	Big bend, Shock Run
Taxus canadensis	Canada yew	Blister Run
Trifolium virginicum	Kate's Mountain clover	Big bend, White's Draft
Viola appalachiensis	Appalachian blue violet*	Forest Road 229 wildlife openings, Five Lick wildlife openings, Stuart Park.

**Identification not confirmed – survey was conducted after the flowering period.*

Table PL-2. Wetland and Riparian Habitat RFSS plants on the Monongahela National Forest

Scientific Name	Common Name	Habitat Comments
Agrostis mertensii	Arctic bentgrass	Wetland/riparian at high elevations (Strausbaugh and Core 1977)
Baptisia australis var. *australis*	Blue wild indigo	Primarily early successional wetlands (NatureServe 2002)
Cypripedium reginae	Showy lady's slipper	Variety of wetland and riparian habitats; part to full sun (NatureServe 2008)
Euphorbia purpurea	Darlington's spurge	Open or closed canopy (NatureServe 2008)
Hasteola suaveolens	Sweet-scented Indian plantain	Riverbanks and disturbed wetlands (Strausbaugh and Core 1977)
Hypericum mitchellianum	Blue Ridge St. John's wort	Riverbanks and disturbed wetlands (Strausbaugh and Core 1977, NatureServe 2002)
Ilex collina	Long-stalked holly	Open or closed canopy wetlands (NatureServe 2002)
Juncus filiformis	Thread rush	Open canopy (NatureServe 2002)
Marshallia grandiflora	Large-flowered Barbara's buttons	Flood-scoured river banks in full sun (NatureServe 2008)
Menyanthes trifoliata	Bog buckbean	Bogs and marshy areas (Strausbaugh and Core 1977)
Pedicularis lanceolata	Swamp lousewort	May prefer circumneutral soil (Strausbaugh and Core 1977)
Poa paludigena	Bog bluegrass	Sun to partial shade (Center for Plant Conservation 2006)
Polemonium vanbruntiae	Jacob's ladder	Swamps, bogs, riparian zones (Deller 2002)
Potamogeton tennesseensis	Tennessee pondweed	Streams, ponds, and river shallows (NatureServe 2008)
Taxus canadensis	Canada yew	Cool, moist, climax conditions in boreal conifer forests (Sullivan 1993); also bogs and riparian areas on the MNF (USDA Forest Service unpublished data)
Vitis rupestris	Sand grape	River banks and washes (NatureServe 2008)
Woodwardia areolata	Netted chain fern	Swamps and wet woods (Strausbaugh and Core 1977)

Table PL-3. Rocky Habitat RFSS Plants on the Monongahela National Forest

Scientific Name	Common Name	Habitat Comments
Allium allegheniense	Allegheny onion	Outcrops in oak-pine forests (Bartgis, pers. comm. 2006)
Arabis patens	Spreading rockcress	Moist, rocky woods; limestone (NatureServe 2008)
Cornus rugosa	Roundleaf dogwood	Rocky areas within forests (NatureServe 2002)
Gymnocarpium appalachianum	Appalachian oak fern	Rocky woods (NatureServe 2008)
Heuchera alba	White alumroot	Most likely in dry, rocky microsites within forests (NatureServe 2008)
Juncus trifidus	Highland rush	Rock crevices (Gleason and Cronquist 1991)
Paronychia argyrocoma	Silver nailwort	Sandstone barrens (Schori undated)
Paronychia virginica var. *virginica*	Yellow nailwort	Cliffs and outcrops (Strausbaugh and Core 1977)
Oryzopsis canadensis	Canada mountain rice grass	Sandstone barrens (Strausbaugh and Core 1977)
Pycnanthemum beadlei	Beadle's mountainmint	Open canopy over rocks (NatureServe 2002)
Scutellaria saxatilis	Rock skullcap	Rocky areas within forests (Dolan 2004). On the MNF, also known from shaded cut banks and shoulders of infrequently used forest roads.
Syntrichia ammonsiana	Ammon's tortula	Nutrient rich outcrops in crevices or seepage deposits (NatureServe 2008)
Taenidia montana	Virginia mountain pimpernel	Shale barrens and rocky woods (NatureServe 2008)
Trichomanes boschianum	Appalachian bristle fern	Dripping rocks (Strausbaugh and Core 1977)
Trichostema setaceum	Narrow-leaved blue-curls	Shale and sandstone barrens (NatureServe 2002)
Trifolium virginicum	Kate's Mountain clover	Shale barrens and other rocky habitats (NatureServe 2008)

Table PL-4. Shale Barren RFSS Plants on the Monongahela National Forest

Scientific Name	Common Name	Habitat Comments
Allium oxyphilum	Lillydale onion	Mainly on shale barrens (NatureServe 2008)
Eriogonum allenii	Yellow buckwheat	Barest, most sterile shale barren sites (Strausbaugh and Core 1977)
Liatris turgida	Turgid gay feather	In West Virginia, known from shale barrens (NatureServe 2008)
Phlox buckleyi	Sword-leaved phlox	Open woodlands around shale barrens; also road corridors (Norris and Sullivan 2002)

Table PL-5. Limestone Glades and Barrens RFSS Plants on the Monongahela Forest

Scientific Name	Common Name	Habitat Comments
Astragalus neglectus	Cooper's milkvetch	Dry, calcareous soils; open canopy (NatureServe 2008)
Delphinium exaltatum	Tall larkspur	Open canopy and dry, rocky, calcareous soil (NatureServe 2008)
Hexalectris spicata	Crested coralroot	Dry to dry-mesic circumneutral forests (NatureServe 2002)

Scientific Name	Common Name	Habitat Comments
Monarda fistulosa var. *brevis*	Smokehole bergamot	Endemic to limestone glades of the South Branch valley and adjacent areas in Virginia (NatureServe 2008)
Ophioglossum engelmannii	Limestone adder's tongue	Limestone barrens and woodlands (Ohio DNR 1982)
Paxistima canbyi	Canby's mountain lover	Limestone cliffs and bluffs (NatureServe 2008)
Rhamnus lanceolata ssp. *Lanceolata*	Lance-leaved buckthorn	Limestone glades and woodlands; also known from shale barrens (WV Natural Heritage Program unpublished data)
Silene virginica var. *robusta*	Robust fire pink	Endemic to limestone woodlands and riparian areas in the Smoke Hole area (NatureServe 2008)

Table PL- 6. Mesic Hardwood Forest RFSS Plants on the Monongahela National Forest

Scientific Name	Common Name	Habitat Comments
Botrychium lanceolatum var. *angustisegmentum*	Lance-leaf grapefern	Moist, shady woods and swamp margins (Gleason and Cronquist 1991)
Botrychium oneidense	Blunt-lobed grapefern	Moist forests and swamps (Chadde and Kudray 2003)
Corallorhiza bentleyi	Bentley's coral root	Habitat preferences poorly understood
Cypripedium parviflorum var. *parviflorum*	Small yellow lady's slipper	Moist to wet sites in late-successional forests (NatureServe 2002)
Juglans cinerea	Butternut	Moist, fertile soils; also drier sites on limestone soils (Schultz 2003)
Triphora trianthophora	Nodding pogonia	Deep leaf litter or humus (Ramstetter undated)
Viola appalachiensis	Appalachian blue violet	Riparian areas and mesic forests, often in moderately disturbed areas (Strausbaugh and Core 1977, NatureServe 2008)

Table PL-7. Xeric Oak-Pine Forest RFSS Plants on the Monongahela National Forest

Scientific Name	Common Name	Habitat Comments
Cetraria arenaria	Foliose lichen	
Gaylussacia brachycera	Box huckleberry	Woodlands with acidic, sandy soil (NatureServe 2008)

Desired Conditions

The Forest Plan addresses TES species at several places in the Forest-wide direction.
The Forest Integrated Desired Conditions (USDA Forest Service 2006b, p. II-6) call for maintaining habitats that support populations of TES species. Desired conditions for vegetation (p. II-17) emphasize protection and enhancement of rare plants and their habitats. Desired conditions for threatened and endangered species (p. II-22) call for managing habitats to maintain or enhance populations consistent with recovery plans, and for keeping adverse effects at levels that do not threaten population persistence.

3.3.3 - Environmental Consequences

Threatened and Endangered Plants

Direct and Indirect Effects

Alternative 1 - No Action
The No Action Alternative would not implement any new activities; therefore, it would not directly affect Virginia spiraea, running buffalo clover, small whorled pogonia, or shale barren rockcress. Continued spread of invasive plants at the known sites that support running buffalo clover and shale barren rockcress could have long-term adverse effects on these species, but such effects cannot be quantified presently.

Alternative 2 - Proposed Action
Virginia Spiraea – The proposed site-specific treatments would not occur near the single known occurrence of Virginia spiraea. Several proposed treatments would occur near large streams that might provide potential habitat, but effects to Virginia spiraea are unlikely due to the nature of the treatments or the low probability that Virginia spiraea actually occurs at the sites. At the State Road 26 crossing of the Shaver's Fork River in Tucker County, control efforts would be concentrated in a small, shaded flood channel that is unlikely to support Virginia spiraea due to lack of sunlight. Surveys at this site did not find Virginia spiraea or any likely habitat. Treatment at the Blue Rock Geological Area would include a small stretch of streamside habitat along the South Branch of the Potomac River that could provide potential habitat. However, surveys in this area did not locate Virginia spiraea. Treatment at the Camp Pocahontas site and the Island Campground site would occur near the East Fork of the Greenbrier River. Treatment at these sites would focus on roadsides, maintained areas, and upland woods edges, and thus would not affect riparian areas that might provide habitat for Virginia spiraea. The Williams River at the Highland Scenic Highway crossing could be potential habitat, but treatment on the Highland Scenic Highway would focus on the road shoulders rather than the riparian habitat under the bridge. Proposed garlic mustard treatment along Forest Roads 102 and 76 would run parallel to the Cranberry River for approximately 9 miles, but treatment would consist of targeted spot treatment within the maintained road corridor and would have little potential to affect potential habitat for Virginia spiraea.

Under the programmatic provisions of the Proposed Action, future treatments could occur in the riparian zones of large rivers. Any such treatments would be preceded by surveys of the potential habitat so that adverse effects to Virginia spiraea could be avoided. Treatments could have beneficial effects on Virginia spiraea if they reduce competition from invasive plants.

Running Buffalo Clover – The known occurrences of running buffalo clover at the Brushy Run mine road and the Bickle Knob site are intermingled in the areas to be treated for garlic mustard. Broadcast foliar application of herbicide would be avoided within 100 feet of these known occurrences. Only carefully targeted spot spraying and hand pulling would be used in these buffers. However, undiscovered patches of running buffalo clover may exist at these sites. Although management personnel would be instructed in running buffalo clover identification, it is possible for clover plants to escape detection. Therefore, it is anticipated that some running buffalo clover plants could be killed at these two sites. Running buffalo clover is not expected to be extirpated at either site due to avoidance of the known subpopulations. Any reduction in population size is expected to be temporary, with recovery occurring after treatment efforts have been completed. At the other eight sites where potential habitat for running buffalo clover exists, the potential for adverse effects is considered very low due to lack of known occurrences.

The proposed treatments could have beneficial effects on running buffalo clover at the Brushy Run mine road and Bickle Knob sites. Treatments would be expected to reduce competition from garlic mustard, which could free up moisture and nutrients for running buffalo clover, as well as eliminate the effects of allelopathic chemicals produced by garlic mustard. Because of these beneficial effects and the expected temporary nature of the negative effects, the long-term indirect effects of the Proposed Action on running buffalo clover at these sites may be positive.

Under the programmatic provisions of the Proposed Action, future treatments could occur in occupied and potential running buffalo clover habitat. Any such treatments would be preceded by surveys of the potential habitat so that adverse effects could be avoided or minimized. Future treatments could have beneficial effects if they reduce competition from invasive plants.

Small Whorled Pogonia – Due to the lack of known occurrences in the wooded sites that are proposed for treatment, effects to small whorled pogonia are considered extremely unlikely. Although surveys can miss occurrences of this species, the species is known to occur on only one site on the Monongahela National Forest, despite thousands of acres of surveys that have been conducted Forest-wide for a variety of projects. Small whorled pogonia is believed to be absent from most of the Forest, and none of the proposed site-specific treatments are located near the one known population.

Under the programmatic provisions of the Proposed Action, future treatments could occur in occupied and potential small whorled pogonia habitat. Garlic mustard is known to occur near the known location of small whorled pogonia, so it is possible that treatment could be proposed near this site in the future. Any such treatments would be preceded by surveys of the potential habitat so that adverse effects could be avoided or minimized. Future treatments could have beneficial effects if they reduce competition from invasive plants.

Shale Barren Rockcress – Although one of the proposed treatment sites is located at a botanical area that is known to support shale barren rockcress, the actual treatment would occur along the roadside and not in the shale barren proper. Therefore, no treatment would occur in immediate proximity to the known occurrence or likely habitat. Adverse effects to shale barren rockcress from the proposed site-specific treatments are considered extremely unlikely. The proposed site-specific treatments could have beneficial effects on shale barren rockcress by preventing the encroachment of invasive plants into shale barren rockcress habitat at the White's Draft Botanical Area.

Under the programmatic provisions of the Proposed Action, future treatments could occur in occupied and potential shale barren rockcress habitat. Any such treatments would be preceded by surveys of the potential habitat so that adverse effects could be avoided or minimized. Future treatments could have beneficial effects if they reduce competition from invasive plants.

Cumulative Effects

Alternative 1 - No Action

Because the No Action alternative would have no direct or indirect effects on these four species of threatened or endangered plants, it would not contribute to the cumulative effects of other activities.

Alternative 2 - Proposed Action

Virginia Spiraea, Small Whorled Pogonia, and Shale Barren Rockcress – Because direct effects on these three species are considered extremely unlikely, the Proposed Action would not contribute to the cumulative effects of other activities on Virginia spiraea, small whorled pogonia, or shale barren rockcress.

Running Buffalo Clover – Because the Proposed Action likely would have direct and indirect effects on running buffalo clover, it could make a measurable contribution to the cumulative effects of other activities on this endangered species.

Past activities that have affected this species on the MNF include timber harvest, road construction and maintenance, and private land access across National Forest land. Most of the effects of past activities cannot be quantified because the activities that affected running buffalo clover mostly occurred prior to the beginning of systematic survey efforts to locate the species on the Forest. Although negative effects almost certainly occurred, especially where clear cutting opened the tree canopy beyond running buffalo clover's tolerances, the net effect of past timber management may have been positive. Many past timber harvests on the MNF were thinning or two-age harvests that left enough residual canopy to allow running buffalo clover to persist, and the skid trails and low standard roads associated with these harvests provided establishment sites for new subpopulations. Research on the Fernow Experimental Forest has demonstrated that such partial harvests cause an initial population decline due to disturbance of the plants, but ultimately lead to a population increase as running buffalo clover expands into the newly disturbed skid trails (Schuler pers. comm. 2008). Road construction, maintenance, and private land access also likely had both positive and negative effects including creation of habitat, maintenance of habitat, and destruction of existing subpopulations.

Ongoing activities that may affect running buffalo clover include timber management research activities on the Fernow Experimental Forest and the use and maintenance of Forest roads that support running buffalo clover. Timber management research at the Fernow is expected to have a net positive effect by providing filtered sunlight and moderate soil disturbance that is favorable to expansion of existing occurrences (Chapman 2005). Current road management activities on the MNF follow Forest Plan direction that requires development of protection measures prior to changing use levels on roads occupied by running buffalo clover. Therefore, ongoing road management tends to maintain existing habitat rather than causing negative impacts.

Many typical management activities that may be conducted on the MNF in the future have the potential to affect running buffalo clover. Such activities include road construction and maintenance, timber harvest, mineral operations, wildlife habitat management, prescribed fire, range management, and recreation management (USDA Forest Service 2006c, US Fish and Wildlife Service 2006). These activities would follow Forest Plan direction that is intended to minimize negative effects and incorporate potentially beneficial habitat management. No specific, currently planned future activities are expected to affect running buffalo clover. Therefore, the location, extent, and magnitude of any effects due to future activities cannot be estimated at this time (i.e., such effects are not considered reasonably foreseeable).

It is quite likely that past activities on private land within the MNF proclamation and purchase unit boundary have affected running buffalo clover, and it is also likely that private activities will continue to affect this species in the future. Activities such as timber harvest, road construction, mineral development, residential development, agriculture, and grazing are common on private land within the proclamation and purchase unit boundary. Similar to the activities on federal land, such private activities are expected to have both adverse and beneficial effects on running buffalo clover. However, available information does not allow an analysis of extent and magnitude of the effects of private activities. If no federal authorization or funding is involved, private land owners do not have to analyze or disclose the effects of their actions on threatened and endangered plants. Thus information on the effects of private activities on running buffalo clover generally is not available.

The negative direct and indirect effects of the Proposed Action on running buffalo clover are expected to be small and temporary. Therefore, this project is expected to make a very small, short-term contribution to the cumulative negative effects of other activities within the proclamation and purchase unit boundary.

The long-term beneficial effects of this project would contribute to the cumulative beneficial effects of federal and private forest management. Because neither the benefits of this project nor the benefits of the other activities can be estimated accurately, the net cumulative benefit cannot be quantified. This project's contribution to the cumulative benefit is expected to be small because of the relatively small size of the running buffalo clover populations that would be affected.

Effect Determinations for Threatened and Endangered Plants

Virginia Spiraea, Small Whorled Pogonia, and Shale Barren Rockcress

The No Action Alternative would not implement any new activities. Therefore, *the No Action alternative would have no effect on Virginia spiraea, small-whorled pogonia, or shale barren rockcress.*

Potential effects of the Proposed Action on these species are extremely unlikely to occur. Therefore, the potential for effects is discountable, and *the Proposed Action may affect, but is not likely to adversely affect Virginia spiraea, small-whorled pogonia, or shale barren rockcress.*

Running Buffalo Clover

The No Action Alternative would not implement any new activities. Therefore, *the No Action alternative would have no effect on running buffalo clover.*

The Proposed Action likely would affect running buffalo clover at two sites. Although the net long-term effect would be expected to be beneficial, short-term negative effects likely would occur. Therefore*, the Proposed Action may affect, and is likely to adversely affect running buffalo clover*.

Regional Forester's Sensitive Plants

Direct and Indirect Effects for Species Known to Occur at Specific Treatment Sites

Alternative 1 - No Action

The No Action Alternative would not implement any new activities; therefore, it would not directly affect Arctic bentgrass, Cooper's milkvetch, tall larkspur, white alumroot, long-stalked holly, Smoke Hole bergamot, yellow nailwort, lance-leaved buckthorn, rock skullcap, Virginia mountain pimpernel, Canada yew, Kate's Mountain clover, or Appalachian blue violet. However, the beneficial effects noted below for the Proposed Action also would not occur. Indirect negative effects could occur as invasive plants continue to spread and compete with known populations of these sensitive species.

Alternative 2 - Proposed Action

Arctic Bentgrass – The Proposed Action includes a site-specific treatment for reed canary grass near one known location of Arctic bentgrass along the upper Shaver's Fork River. However, the treatment would focus on a road bed that leads away from the river; no treatment would occur in the riparian area where Arctic bentgrass occurs. Therefore, the Proposed Action is unlikely to cause adverse impacts to this known occurrence of Arctic bentgrass. Beneficial impacts could occur if the treatment prevents reed canary grass from invading Arctic bentgrass habitat.

Allegheny Onion – Allegheny onion occurs within the Ramshorn project area in a site that is proposed for treatment of garlic mustard. Eight individual plants were found intermingled with a dense garlic mustard infestation. Design criteria would require spot spraying within 100 feet of the population, but the garlic mustard at this site is so dense that even spot spraying likely would result in overspray of the Allegheny onion site. However, Allegheny onion would be dormant during the most likely treatment seasons for garlic mustard (early spring and late fall). Therefore, Allegheny onion likely would not be exposed to herbicide spraying. As an extra precaution, only broadleaf-specific herbicides would be used within 100 feet of the Allegheny onion occurrence. Allegheny onion is a monocot, so broadleaf specific herbicides would not affect this species. Due to the likely timing of control efforts and the extra precautions to be taken at this site, adverse effects to Allegheny onion are not anticipated.

The proposed action likely would benefit Allegheny onion by reducing the competition from the dense garlic mustard that occurs at the Ramshorn site.

Cooper's Milkvetch – The proposed treatment for Japanese stiltgrass at the Blue Rock Geological Area would occur within 300 feet of two known populations of Cooper's milkvetch. Because of uncertain accuracy of the GIS mapping depicting these populations and the boundary of the nearby treatment area, the treatment has the potential to affect Cooper's milkvetch. Design features for sensitive plants require that these populations be located prior to treatment and that no broadcast foliar application of herbicide occur within a 100-foot buffer around the populations. Only precisely targeted spot applications would be used within this buffer; only hand pulling would be used if herbicide drift cannot be prevented. This design feature would greatly reduce the chance of adverse effects on Cooper's milkvetch, and it is very unlikely that extirpation or appreciable population reductions would occur. If undiscovered Cooper's milkvetch plants occur within areas to be treated by broadcast application, they could be harmed or killed. However, while plants could have been missed by the botanical survey of the site, it is unlikely that Cooper's milkvetch would occur within dense infestations of Japanese stiltgrass. Japanese stiltgrass tends to grow in moist microhabitats (Tu 2000), whereas Cooper's milkvetch is generally found in dry microhabitats (NatureServe 2008). Therefore, the likelihood of inadvertent adverse effects to Cooper's milkvetch is considered low.

The proposed treatment could benefit Cooper's milkvetch if it prevents Japanese stiltgrass from invading Cooper's milkvetch habitat. Any such benefits are expected to be minor because Cooper's milkvetch habitat generally is too dry to support damaging infestations of Japanese stiltgrass.

Tall Larkspur – The proposed treatment of Japanese stiltgrass at the Blue Rock Geological Area would occur within 300 feet of a known population of tall larkspur. Because of uncertain accuracy of GIS mapping in this location, the treatment has the potential to affect this occurrence of tall larkspur. The 100-foot buffer for broadcast spraying near sensitive plants would greatly reduce the chance of adverse effects on tall larkspur, and it is very unlikely that extirpation or appreciable population reductions would occur. If undiscovered larkspur plants occur within dense infestations that need broadcast treatment, the larkspur plants could be harmed or killed. This scenario is considered unlikely because dense infestations of Japanese stiltgrass are unlikely to occur in the dry, rocky habitat preferred by tall larkspur (Tu 2000, NatureServe 2008).

The proposed treatment could benefit tall larkspur if it prevents Japanese stiltgrass from invading occupied habitat. Any such benefits are expected to be minor because tall larkspur habitat generally is too dry to support damaging infestations of Japanese stiltgrass.

White Alumroot – Proposed treatment sites in the Cave Mountain, Ramshorn, and Shock Run areas include nine known occurrences of white alumroot. Tree of heaven would be treated at the Cave Mountain site, and garlic mustard would be treated at the Ramshorn and Shock Run sites. The 100-foot buffer for broadcast spraying near sensitive plants would greatly reduce the chance of adverse effects on white alumroot, and it is very unlikely that extirpation or appreciable population reductions would occur. However, if undiscovered alumroot plants occur within the treatment areas, they could be harmed or killed. The proposed treatment could benefit white alumroot by preventing increased competition from invasive plants. The magnitude of any benefit is uncertain because the extent to which garlic mustard and tree of heaven invade white alumroot's typical rock outcrop habitat is not known.

Long-stalked Holly – Long-stalked holly is known to occur in or immediately adjacent to proposed treatment sites at Blister Run Botanical Area, Glade Run Botanical Area, and Dogway Fork road. At all three locations, most of the treatment is expected to consist of targeted spot applications of herbicide. Therefore the chance of inadvertently affecting long-stalked holly is low. However, if undiscovered holly plants exist in these sites, they could be harmed or killed by the small amounts of broadcast spraying that may be necessary for dense patches of invasive plants. Substantial population-level impacts are not expected to occur. The treatments may benefit long-stalked holly by preventing these important habitats from being overtaken by bush honeysuckles, reed canary grass, Japanese barberry, and garlic mustard.

Smoke Hole Bergamot – Proposed treatment sites in the Smoke Hole area include four known occurrences of Smoke Hole bergamot. The treatment site across the South Branch River from Blue Rock Geological Area and the treatment site on Cave Mountain near the Big Bend Campground each include two occurrences. The target species in these treatment sites are Japanese stiltgrass, viper's bugloss, and spotted knapweed. The Japanese stiltgrass portion of the control activity would occur away from the known Smoke Hole bergamot locations, and the viper's bugloss and spotted knapweed would be controlled primarily through foliar spot-spraying. Hand pulling would be used in any situation where drift cannot be prevented. Therefore, the Proposed Action is unlikely to cause detrimental impacts on the known occurrences of Smoke Hole bergamot. If any undiscovered Smoke Hole bergamot plants exist in the stiltgrass treatment area that may be subject to broadcast spraying, they could be harmed or killed. However, this is considered unlikely because Smoke Hole bergamot prefers dry, rocky habitats (NatureServe 2008), whereas the Japanese stiltgrass infestations are in moist habitats.

The Proposed Action is expected to benefit Smoke Hole bergamot by eliminating or greatly reducing viper's bugloss and spotted knapweed in the bergamot's limestone glade habitat. The reduction in Japanese stiltgrass nearby may also have a beneficial effect, although perhaps not a large effect because limestone glade habitat generally is too dry to accommodate dense invasions of stiltgrass.

Yellow Nailwort – Three proposed treatment sites near Blue Rock and Big Bend include six known occurrences of yellow nailwort. Invasive species to be treated at these sites include Japanese stiltgrass, viper's bugloss, and spotted knapweed. Two of the nailwort occurrences are in a treatment area for Japanese stiltgrass, which may require broadcast foliar application. The 100-foot buffer for broadcast spraying near sensitive plants will greatly reduce the chance of adverse impacts to these occurrences. If any undiscovered nailwort plants exist in broadcast spray areas, they could be harmed or killed. Adverse effects due to broadcast spraying are unlikely, because the dense stiltgrass infestations occur in moist microhabitats, whereas yellow nailwort prefers dry rock outcrops (Strausbaugh and Core 1977).

The Proposed Action is expected to benefit yellow nailwort by eliminating or greatly reducing viper's bugloss and spotted knapweed in the nailwort's limestone glade habitat. The reduction in Japanese stiltgrass nearby may also have a beneficial effect, although perhaps not large because limestone glade habitat generally is too dry to accommodate dense invasions of stiltgrass.

Lance-leaved Buckthorn – Lance-leaved buckthorn is known to occur in one proposed treatment site across the South Branch River from the Blue Rock Geological Area. Proposed treatments at this site would target viper's bugloss, with treatment of Japanese stiltgrass proposed within 200 feet of the buckthorn location. Due to uncertain accuracy of the GIS mapping, it is possible that stiltgrass treatment could overlap the buckthorn location. Treatments for viper's bugloss would be mostly targeted spot treatments and would be unlikely to affect lance-leaved buckthorn directly. If broadcast spraying is needed for Japanese stiltgrass, the potential for adverse impacts would be mitigated by the 100-foot buffer for broadcast spraying around sensitive plants. If any undiscovered buckthorn plants exist in broadcast treatment areas, they could be harmed or killed. Impacts from broadcast spraying are considered unlikely because Japanese stiltgrass typically does not share lance-leaved buckthorn’s dry, rocky habitat.

The Proposed Action is expected to benefit lance-leaved buckthorn by eliminating or greatly reducing viper’s bugloss in the buckthorn’s limestone glade habitat. The reduction in Japanese stiltgrass nearby may also have a beneficial effect, although perhaps not a large effect because limestone glade habitat generally is too dry to accommodate dense invasions of stiltgrass.

Rock Skullcap – Rock skullcap is widespread throughout the Ramshorn project area. Numerous subpopulations are included in or adjacent to proposed treatment areas for garlic mustard and Japanese stiltgrass. Four of these subpopulations are very large, numbering thousands of individuals each. The proposed treatments for garlic mustard in the nearby Shock Run project area would include three known subpopulations of rock skullcap, two of which contain over 1,000 individuals.

The known occurrences of rock skullcap would be protected from broadcast spraying by the 100-foot buffer requirement. However, spot-spraying within skullcap occurrences is likely, especially within the large occurrences. Therefore, some harm or mortality of rock skullcap is expected to occur. Overall, such mortality is expected to affect a small portion of each occurrence, and substantial population-level effects probably would not occur. If any undiscovered skullcap occurrences exist within the treatment areas, they could be adversely affected. However, even undiscovered occurrences are unlikely to be extirpated because broadcast treatments will be largely limited to roadsides and trails.

The Proposed Action is likely to benefit rock skullcap by preventing the continued spread of garlic mustard and Japanese stiltgrass into rock skullcap habitat. Although the extent to which these two invasive plants can harm rock skullcap has not been documented, some detrimental competition seems likely due to the formation of dense stands and the allelopathic chemicals produced by garlic mustard. Therefore, the Proposed Action is expected to have largely beneficial effects on rock skullcap in the long term.

Virginia Mountain Pimpernel – The proposed treatment sites at Big Bend and the Shock Run project area each include one known population of Virginia mountain pimpernel. The proposed spot treatment for viper’s bugloss and spotted knapweed at Big Bend would have little potential to affect Virginia mountain pimpernel through spray drift. The garlic mustard treatment at Shock Run would involve some broadcast treatment and would have a greater potential to affect Virginia mountain pimpernel. However, the 100-foot buffer for broadcast treatments near sensitive plants would be applied and would greatly reduce the chance of adversely affecting this species. If any undiscovered Virginia mountain pimpernel plants exist in broadcast treatment areas, they could be harmed or killed.

The Proposed Action could benefit Virginia mountain pimpernel by reducing or eliminating competition from invasive plants. This benefit would be most likely to occur at the Big Bend site. The viper's bugloss and spotted knapweed to be controlled at this site thrive in the dry, thin-soiled limestone glades that provide habitat for Virginia mountain pimpernel, so the proposed treatments should reduce competition. The garlic mustard at the Shock Run site is less likely to be a vigorous competitor on the dry, rocky sites that support Virginia mountain pimpernel. However, garlic mustard will grow on rocky sites and is likely to compete with Virginia mountain pimpernel to some extent. Therefore, at least a small beneficial effect is possible at the Shock Run site.

Canada Yew – Canada yew is known to occur at one location in the proposed treatment site at Blister Run Botanical Area. Most of the treatment at this location is expected to consist of targeted spot applications of herbicide. Therefore the chance of inadvertently affecting Canada yew is low. However, if undiscovered yew plants exist at this site, they could be harmed or killed by the small amounts of broadcast spraying that may be necessary for scattered dense patches of invasive plants. Substantial population-level impacts are not expected to occur. The treatments may benefit Canada yew by preventing this important habitat from being overtaken by bush honeysuckles, reed canary grass, and Japanese barberry.

Kate's Mountain Clover – Kate's Mountain clover is known to occur at one location in the proposed treatment site at Big Bend. Spot treatment is proposed for viper's bugloss and spotted knapweed at this site, which would have little potential for adversely affecting the known occurrence of Kate's Mountain clover. If undiscovered clover plants exist at the site, they could be harmed or killed, but such impacts are considered unlikely due to the targeted nature of the spot treatments. Beneficial impacts are likely to occur as competition from viper's bugloss and spotted knapweed is eliminated.

Kate's Mountain clover also is known to occur at the White's Draft Botanical Area, which is proposed for treatment of garlic mustard and Japanese honeysuckle. The treatment locations are concentrated along the botanical area boundary on the shoulder of a county road, well away from the clover location. Therefore, adverse effects from these treatments are not expected. The treatments could benefit Kate's Mountain clover by preventing invasive plants from penetrating into the botanical area.

Appalachian Blue Violet – Appalachian blue violet may occur on old skid roads that are used to access two of the wildlife openings along Forest Road 229 (Shaver's Mountain) that are proposed for control of reed canary grass. The Proposed Action would be unlikely to affect these violets because only widely scattered spot spraying would be needed on these old skid roads. The violets could be avoided easily. Appalachian blue violet also may occur in forested areas near the Five Lick wildlife openings, which also are proposed for treatment of reed canary grass. Control activities would be limited to the openings and would not affect violets in the nearby forest. Beneficial effects on Appalachian blue violet are unlikely at these two locations because reed canary grass does not pose a substantial threat to violets growing in shaded locations.

Cumulative Effects for Species Known to Occur at Specific Treatment Sites

Alternative 1 - No Action
Because the No Action Alternative would have no direct effects on these fourteen species of RFSS plants and potential indirect effects are not quantifiable, the No Action Alternative would not contribute measurably to the cumulative effects of other activities.

Alternative 2 - Proposed Action
Species Unlikely to be Adversely Affected – Based on the analysis above, the Proposed Action is unlikely to affect the following sensitive plant species directly or indirectly: Arctic bentgrass, Allegheny onion, Cooper's milkvetch, tall larkspur, Smoke Hole bergamot, yellow nailwort, lance-leaved buckthorn, Kate's Mountain clover, and Appalachian blue violet. Therefore, the Proposed Action is unlikely to make a measurable contribution to any cumulative adverse effects from other activities.

Of these nine species that are unlikely to be affected adversely, beneficial effects could occur for five species: Arctic bentgrass, Allegheny onion, Smoke Hole bergamot, yellow nailwort, lance-leaved buckthorn, and Kate's Mountain clover. No other past, present, or reasonably foreseeable future actions that benefit these species are known; therefore, the small beneficial indirect effect from the Proposed Action would constitute the entire cumulative effect on these species.

Species that may be Adversely Affected – The Proposed Action could have small adverse effects on white alumroot, long-stalked holly, Virginia mountain pimpernel, and Canada yew. If such adverse effects occur, they would contribute to the cumulative effects of other past, present, and reasonably foreseeable future actions. While past land management activities on both private and National Forest land likely had a variety of adverse effects on these species, the specific effects of individual activities are not known. Presently, deer browsing probably is adversely affecting Canada yew (Sullivan 1993), but the extent and severity of such effects cannot be quantified. No other specific ongoing activities on National Forest land are known to affect these species. Many ongoing and future land management activities on private land could affect these species, including timber management, mineral development, road construction, agriculture, and residential development. Information on specific effects of private activities is not available. On National Forest land, two foreseeable future actions have the potential to affect white alumroot. A proposed prescribed fire project in the Ramshorn project area would include three known locations of white alumroot. However, adverse effects from this project are considered unlikely because the alumroot occurrences are on rock outcrops that are not likely to carry fire. A completed gypsy moth control project might have affected white alumroot indirectly by affecting potential pollinators of this species, but any effects likely were minor and no occurrences are expected to be extirpated. Therefore, for white alumroot, long stalked holly, Virginia mountain pimpernel, and Canada yew, the potential for minor adverse effects from the Proposed Action would constitute all or most of the foreseeable, measurable cumulative adverse effects. These minor adverse effects are not expected to extirpate any occurrences or cause substantial population reductions; therefore, population viability on a Forest-wide basis is not expected to be impacted.

Beneficial effects also could occur for each of these four species. No other past, present, or reasonably foreseeable future actions that benefit these species are known; therefore, the small beneficial indirect effect from the Proposed Action would constitute the entire cumulative beneficial effect on these species.

Rock Skullcap – The Proposed Action is likely to have short-term adverse effects on rock skullcap, which would contribute to the cumulative effects of other past, present, and reasonably foreseeable future activities. Past land management activities on National Forest and private land likely affected this species, but information is not available regarding specific past effects. No ongoing activities on National Forest land are known to affect this species. Rock skullcap occurs within the project area for the Upper Williams timber project, but ongoing harvest activities are avoiding known occurrences. Ongoing and future activities on private land likely affect rock skullcap, including timber management, mineral development, road construction, agriculture, and residential development. However, information on specific effects of private activities is not available. Two reasonably foreseeable future activities on National Forest land would have the potential to affect rock skullcap. The Ramshorn prescribed fire project would include numerous rock skullcap subpopulations, including several large subpopulations numbering in the thousands of stems. However, the Ramshorn project is not expected to cause a substantial population reduction because the large subpopulations occur in moist, rocky ravines that are not likely to carry fire. While the combined effects of the Proposed Action and the Ramshorn prescribed fire project likely would kill individual rock skullcap plants, large subpopulations are not likely to be substantially reduced. Several large subpopulations in the Ramshorn area would remain unaffected, as well as all of the subpopulations in the Upper Williams project area. A recently completed gypsy moth control project might have affected rock skullcap indirectly by affecting potential pollinators of this species, but any effects likely were minor and no occurrences are expected to be extirpated. In total, approximately 30 subpopulations are known to exist across the Forest, and all of these are expected to persist. Therefore, the cumulative effects of the Proposed Action and other past, present, and reasonably foreseeable activities are not expected to impact population viability on a Forest-wide basis.

The Proposed Action is also expected to have long-term beneficial effects on rock skullcap due to a reduction of competition from garlic mustard and Japanese stiltgrass. No other past, present, or reasonably foreseeable future actions that benefit this species are known; therefore, the beneficial indirect effect from the Proposed Action would constitute the entire cumulative beneficial effect on rock skullcap. This beneficial effect is expected to help maintain the viability of rock skullcap by protecting the largest known occurrences on the Forest.

Direct and Indirect Effects for Species Not Known to Occur at Specific Treatment Sites

Alternative 1 - No Action

The No Action Alternative would not implement any new activities; therefore, it would not affect RFSS plants directly. Continued colonization and expansion by invasive plants could have indirect adverse effects on RFSS plants, but such potential effects are not quantifiable.

Alternative 2 - Proposed Action

Wetland and Riparian Habitat Plants – Wetland and riparian habitats are included in 12 site-specific treatment sites (Table PL-8). These sites cover a total of an estimated 3,321 acres, but only a small portion of this total acreage is actually wetland and riparian habitat. Most of the proposed control activities involve targeted spot treatments with little or no potential for inadvertent impacts on any undiscovered RFSS plants that may occur in these habitats. Sites near Blue Rock and Chestnut Ridge in the Ramshorn project area would involve up to 52 acres of broadcast foliar treatment, although much of this acreage would also lie outside of riparian and wetland habitat. If any undiscovered wetland/riparian RFSS exist in these broadcast treatment areas, they could be harmed or killed by herbicide, or by the non-herbicide alternative methods such as mowing. However, because site surveys did not locate wetland/riparian RFSS in these areas, the likelihood of such effects occurring is low. Therefore, major population-level impacts are not expected to occur. Habitat quality in these wetland/riparian habitats could be improved by controlling or eliminating invasive plants.

In addition to the thirteen sites that include wetland and riparian habitats, many of the roadside control sites cross or run adjacent to riparian areas. Control at these sites will be focused on the roadsides and is not likely to affect plants in the riparian habitat.

Under the programmatic component of the Proposed Action, future control activities could occur in potential habitat for wetland and riparian RFSS. These future activities would be preceded by an assessment of the potential for RFSS to occur, including site-specific botanical surveys if potential habitat is present. Forest Plan direction regarding avoidance and minimization of impacts would be followed. The potential for adverse impacts cannot be ruled out, but any adverse impacts are expected to be minor. Wetland and riparian RFSS habitat could be improved by future control activities that reduce or eliminate competition from invasive plants.

Table PL-8. Proposed Treatment Sites that Include Wetland and Riparian Habitat

Site	Species to be Controlled	Total Treatment Area (Acres)	Comments
Stuart Park	Garlic mustard	0.44	All riparian; mostly spot foliar spraying
State Road 26 Dry Fork ford	Garlic mustard	0.02	All riparian; very small area of broadcast and spot foliar spraying
Highway 33 at Glady Fork	Garlic mustard	0.28	All riparian; mostly spot foliar spraying
Blue Rock	Japanese stiltgrass	191	Most site acreage is non-riparian; mostly spot treatment with 18 acres of broadcast
West of Blue Rock (one of three sub-sites)	Japanese stiltgrass	18	Most site acreage is non-riparian; up to 6 acres of total may be broadcast
Big Mountain near Upper Tract (two of six sub-sites)	Autumn olive, bush honeysuckles, tree of heaven	73	Most site acreage is non-riparian; mostly basal spray and cut surface with spot foliar spray of seedlings
Pretty Ridge	Tree of heaven	40	Most site acreage is non-riparian; mostly basal spray and cut surface with spot foliar spray of seedlings
Brushy Run Mine	Garlic mustard	224	Most site acreage is non-riparian; mostly spot foliar spray with patch spraying in heavier infestations along roads
Cunningham Knob grazing allotment	Meadow knapweed	38	Most site acreage is non-riparian; only spot foliar treatment needed in riparian area
Blister Swamp	Yellow iris	1.7	All riparian; targeted glove or wick foliar treatment

Site	Species to be Controlled	Total Treatment Area (Acres)	Comments
Blister Run Botanical Area	Bush honeysuckles	312	Most site acreage is non-riparian; mostly basal spray and cut surface with spot foliar spray of seedlings
Chestnut Ridge-Stony Run (Ramshorn area)	Garlic mustard	2,423	Most site acreage is non-riparian; 28 acres of broadcast along roadsides, remainder is spot control in forests

Rocky Habitat Plants – An accurate inventory of rocky habitat within the proposed treatment sites does not exist. Rocky habitat is known to be common at the Blue Rock, Big Bend, Ramshorn, and Shock Run sites, and it likely exists at other sites as well. In these three areas, most of the treatment in the vicinity of the rocky habitat is likely to be targeted spot treatment, although some spraying of larger patches may be needed for garlic mustard at Ramshorn and Shock Run. If any undiscovered rocky habitat RFSS exist in these larger patch treatment areas, they could be harmed or killed by herbicide. However, because site surveys did not locate rocky habitat RFSS in these areas (other than those analyzed in the previous section), the likelihood of such effects occurring is low. Therefore, major population-level impacts are not expected to occur. Habitat quality in these rocky habitats could be improved by controlling or eliminating invasive plants.

Under the programmatic component of the Proposed Action, future control activities could occur in rocky habitat that has the potential to support RFSS. These future activities would be preceded by an assessment of the potential for RFSS to occur, including site-specific botanical surveys if potential habitat is present. Forest Plan direction regarding avoidance and minimization of impacts would be followed. The potential for adverse impacts cannot be ruled out, but any adverse impacts are expected to be minor. The suitability of rocky habitat for RFSS plants could be improved by future control activities that reduce or eliminate competition from invasive plants.

Shale Barren Plants – The Proposed Action includes one control site (White's Draft Botanical Area) that is near shale barren habitat. The actual control activities, however, would not occur within the shale barren. Treatments would focus on roadside habitat. Therefore, the site-specific portion of the Proposed Action would have little or no potential for adverse effects on shale barren RFSS. Control activities at this site could benefit shale barren habitat by preventing encroachment of invasive plants into the shale barrens.

Under the programmatic component of the Proposed Action, future control activities could occur in shale barrens that have the potential to support RFSS. These future activities would be preceded by an assessment of the potential for RFSS to occur, including site-specific botanical surveys if potential habitat is present. Forest Plan direction regarding avoidance and minimization of impacts would be followed. The potential for adverse impacts cannot be ruled out, but any adverse impacts are expected to be minor. The suitability of shale barrens for RFSS plants could be improved by future control activities that reduce or eliminate competition from invasive plants.

Limestone Glades and Barrens Plants – Three proposed treatment sites contain or adjoin limestone glade/barrens habitat. The proposed treatment at Blue Rock would adjoin four limestone glade/barrens habitats, but would not include these habitats in their entirety. The proposed treatment site west of Blue Rock includes two sub-sites that cover an estimated 14 acres of mostly limestone glades and barrens habitat. The proposed treatment site east of Big Bend contains 29 acres that are composed mostly of limestone glades and barrens habitat. The limestone glades and barrens that are in and adjacent to these three treatment sites are known to contain several RFSS plants; potential effects to these known occurrences are analyzed in the preceding section on known RFSS plant occurrences. Most of the proposed control activities involve targeted spot treatments with little or no potential for inadvertent impacts on any undiscovered RFSS plants that may occur in these habitats. Therefore, major population-level impacts are not expected to occur. Habitat quality in these limestone glades and barrens habitats could be improved by controlling or eliminating invasive plants.

Under the programmatic component of the Proposed Action, future control activities could occur in limestone glades and barrens. These future activities would be preceded by an assessment of the potential for RFSS to occur, including site-specific botanical surveys if potential habitat is present. Forest Plan direction regarding avoidance and minimization of impacts would be followed. The potential for adverse impacts cannot be ruled out, but any adverse impacts are expected to be minor. The suitability of limestone glades and barrens for RFSS plants could be improved by future control activities that reduce or eliminate competition from invasive plants.

Mesic Hardwood Forest Plants – Thirteen sites totaling approximately 3,500 acres include mesic hardwood forest habitat (Table PL-9).

Table PL-9. Proposed Treatment Sites that Include Mesic Hardwood Forest Habitat

Site	Species to be Controlled	Total Treatment Area (Acres)	Comments
Mail Route Trail	Garlic mustard	0.06	Very small area of broadcast and spot foliar spray
Stuart Park	Japanese stiltgrass	0.01	Very small area of broadcast and spot foliar spray
Bickle Knob	Garlic mustard	108	All mesic forest; all but 6 acres is spot treatment
Shaver’s Mountain B. Area	Japanese stiltgrass	0.5	All mesic forest; all targeted spot treatment
Blue Rock	Japanese stiltgrass	191	Site is a mixture of mesic and xeric oak; mostly spot treatment with 18 acres of broadcast
Big Mountain near Upper Tract (one of six sub sites)	Tree of heaven	29	Most site acreage is mesic hardwood; mostly basal spray and cut surface with spot foliar spray of seedlings
Brushy Run Mine	Garlic mustard	224	Most site acreage is mesic; mostly spot foliar spray with patch spraying in heavier infestations along roads
Gaudineer Scenic Area	Garlic mustard	10	Mixed mesic hardwood-spruce; hand pulling preferred, some spot spraying may occur
Blister Run Botanical Area	Bush honeysuckles	312	About half of site is mesic hardwood; mostly basal spray and cut surface with spot foliar spray of seedlings
Near Shaver’s Run off FR 1560C	Japanese barberry	0.02	Very small area of cut surface or basal spray; spot foliar spray if any seedlings present

Site	Species to be Controlled	Total Treatment Area (Acres)	Comments
Chestnut Ridge-Stony Run (Ramshorn area)	Garlic mustard	2,423	Mixture of mesic hardwoods and oak; 28 acres of broadcast along roadsides, remainder is spot control in forests
Shock Run FR 55 and Vicinity	Garlic mustard	194	Mixture of mesic hardwoods and oak; mostly spot spraying; 21 acres of broadcast is mostly along roadsides and trails
Blue Bend Recreation Area	Garlic mustard	8	Developed recreation site in a mesic hardwood setting; mostly spot spraying

Several of the sites include substantial areas of xeric oak forest and other habitats, so the acreage of mesic hardwood habitat that may be affected is less than the total site acreage. Most of the proposed control activities involve targeted spot treatments with little or no potential for inadvertent impacts on any undiscovered RFSS plants that may occur in these habitats. Sites at Bickle Knob and Blue Rock would include up to 24 acres of broadcast foliar treatment, and the Brushy Run Mine site would include some heavier spraying in scattered patches. If any undiscovered RFSS plants exist in these broadcast treatment areas, they could be harmed or killed by herbicide, or by the non-herbicide alternative methods such as mowing. However, because site surveys did not locate RFSS in these areas, the likelihood of such effects occurring is low. Therefore, major population-level impacts are not expected to occur. The Chestnut Ridge site at Ramshorn and the Shock Run site would include 49 acres of broadcast spraying primarily along roadsides, which would have a much lower likelihood of impacting RFSS plants. Quality of mesic hardwood forest habitat in all of these sites could be improved by controlling or eliminating invasive plants.

In addition to the thirteen sites that include mesic hardwood forest habitats, many of the roadside control sites run through mesic hardwood forests. Control at these sites would be focused on the roadsides and is not likely to affect plants in the forests.

Under the programmatic component of the Proposed Action, future control activities could occur in potential habitat for mesic hardwood forest RFSS. These future activities would be preceded by an assessment of the potential for RFSS to occur, including site-specific botanical surveys if potential habitat is present. Forest Plan direction regarding avoidance and minimization of impacts would be followed. The potential for adverse impacts cannot be ruled out, but any adverse impacts are expected to be minor. Mesic hardwood forest RFSS habitat could be improved by future control activities that reduce or eliminate competition from invasive plants.

Xeric Oak-Pine Forest Plants – Eight site-specific treatment areas include xeric oak-pine forest habitat (Table PL-10). The area of these sites totals 3,157 acres, but most sites encompass other habitats also, so the acreage of area of xeric oak-pine that may be affected is less. Most of the proposed control activities involve targeted spot treatments with little or no potential for inadvertent impacts on any undiscovered RFSS plants that may occur in these habitats. The two sites near Blue Rock would include up to 24 acres of broadcast foliar treatment. If any undiscovered RFSS plants exist in these broadcast treatment areas, they could be harmed or killed by herbicide, or by the non-herbicide alternative methods such as mowing. However, because site surveys did not locate xeric oak-pine forest RFSS in these areas, the likelihood of such effects occurring is low. Therefore, major population-level impacts are not expected to occur. The Chestnut Ridge site at Ramshorn and the Shock Run site would include 49 acres of broadcast spraying primarily along roadsides, which would have a much lower likelihood of impacting RFSS plants. The quality of xeric oak-pine forest habitat in all of these sites could be improved by controlling or eliminating invasive plants.

In addition to the eight sites that include xeric oak-pine forest habitats, some of the roadside control sites run through xeric oak-pine forests. Control at these sites will be focused on the roadsides and is not likely to affect plants in the forests.

Under the programmatic component of the Proposed Action, future control activities could occur in potential habitat for xeric oak-pine forest RFSS. These future activities would be preceded by an assessment of the potential for RFSS to occur, including site-specific botanical surveys if potential habitat is present. Forest Plan direction regarding avoidance and minimization of impacts would be followed. The potential for adverse impacts cannot be ruled out, but any adverse impacts are expected to be minor. Xeric oak-pine forest RFSS habitat could be improved by future control activities that reduce or eliminate competition from invasive plants.

Table PL-10. Proposed Treatment Sites that Include Xeric Oak-Pine Forest Habitat

Site	Species to be Controlled	Total Treatment Area (Acres)	Comments
Blue Rock	Japanese stiltgrass	191	Site is a mixture of mesic and xeric oak; mostly spot treatment with 18 acres of broadcast
West of Blue Rock (all sub-sites)	Japanese stiltgrass, viper's bugloss	28	Mixture of xeric oak, limestone glades, and riparian; up to 6 acres of total may be broadcast
East of Big Bend	Viper's bugloss, spotted knapweed	29	Mostly limestone glades and barrens with a little xeric oak; all targeted spot treatment
Cave Mountain Near Brushy Run	Tree of heaven	159	Mostly xeric oak; cut surface and basal spray treatment with foliar spray of seedlings
Big Mountain near Upper Tract (three of six sub-sites)	Tree of heaven, autumn olive, bush honeysuckles	93	Mostly xeric oak with some riparian; treatment is mostly basal spray and cut surface with spot foliar spray of seedlings
Pretty Ridge	Tree of heaven	40	Mostly xeric oak-pine; treatment is mostly basal spray and cut surface with spot foliar spray of seedlings
Chestnut Ridge-Stony Run (Ramshorn area)	Garlic mustard	2,423	Mixture of mesic hardwoods and oak; 28 acres of broadcast along roadsides, remainder is spot control in forests
Shock Run FR 55 and Vicinity	Garlic mustard	194	Mixture of mesic hardwoods and oak; mostly spot spraying; 21 acres of broadcast is mostly along roadsides and trails

Cumulative Effects for Species Not Known to Occur at Specific Treatment Sites

Alternative 1 - No Action

Because the No Action Alternative would have no direct effects on RFSS plants and any indirect effects are not quantifiable, the No Action Alternative would not make a measurable contribution to the cumulative effects of other activities.

Alternative 2 - Proposed Action

As outlined above, the Proposed Action is expected to have only minor direct and indirect effects on the RFSS plants that are not known to occur at specific treatment sites. Therefore, any contributions to the cumulative adverse effects of other past, present, and reasonably foreseeable future actions are also expected to be minor. Such other actions on National Forest land include timber harvest, recreational use, construction and maintenance of roads and facilities, wildlife habitat improvements, range management, mineral development, prescribed fire, and wildfire suppression. Past actions likely affected RFSS plants, but specific information on the location and magnitude of such effects is not available. Projects currently being implemented on National Forest land are avoiding direct and indirect impacts on known occurrences of RFSS plants. Future projects that are expected to affect specific RFSS occurrences are addressed in the previous section on RFSS plants that are known to occur at proposed treatment sites. Due to the lack of information on the effects of past actions, quantification of cumulative impacts is not possible. However, given the expectation of only minor direct and indirect adverse effects, the Proposed Action is not expected to make a substantial contribution to the adverse effects of other actions on National Forest land.

On private land within the proclamation and purchase unit boundary, past, present, and reasonably foreseeable future actions include timber management, mineral development, road construction, agriculture, and residential development. Information is not available concerning the extent and severity of the adverse effects of private actions. Therefore, the extent to which the Proposed Action would contribute to the cumulative adverse effects of private actions cannot be quantified. However, the contribution is expected to be very small given that only minor direct and indirect effects are expected.

The Proposed Action is also expected to have long-term beneficial effects on habitat for RFSS plants due to a reduction of competition from a variety of invasive plants. As described above in the cumulative effects analysis for terrestrial ecosystems, the Proposed Action’s 5,100 acres of control would combine with other reasonably foreseeable projects to produce a cumulative total of at least 6,178 acres of control. While this is a very small proportion of the 1.7 million acres of land within the proclamation and purchase unit boundary, the control activities included in the Proposed Action are focused on high-value ecosystems to maximize benefit to RFSS plants. While it is difficult to make specific quantitative predictions of the benefit to RFSS plants, the Proposed Action contributes most of the cumulative control acreage and focuses on areas that are likely to benefit RFSS plants. Therefore, the Proposed Action would be responsible for a very large proportion of the cumulative benefits to RFSS plants.

Effect Determinations for RFSS Plants

Alternative 1 - No Action
The No Action Alternative would not implement any new activities; *therefore it would have no effect on any RFSS plants.*

Alternative 2 - Proposed Action
The Proposed Action would be applied Forest-wide and has the potential to affect all of the habitat types that potentially support RFSS plants. As discussed in the analysis above, adverse impacts would be limited by project design features and mitigation measures such that substantial population level impacts are unlikely to occur. Beneficial effects are likely to occur for many species. *Therefore, for all 54 RFSS plant species on the Monongahela National Forest, the Proposed Action may affect individuals, but is not likely to lead to loss of viability or a trend toward federal listing.*

Unavoidable Adverse Impacts

Alternative 1 would take no action, therefore it would not directly cause any unavoidable adverse impacts to threatened and endangered or RFSS plants.

The Proposed Action (Alternative 2) could unavoidably harm or kill individual running buffalo clover plants and individual RFSS plants, as disclosed in the effects analyses above. Any unavoidable adverse impacts would be minimized from application of the mitigation measures described in Chapter 2 of this EA. Habitat capacity would not be damaged, and in many cases would be improved.

Irreversible Or Irretrievable Commitment of Resources

Alternative 1 would take no action; therefore it would not cause any irreversible or irretrievable commitment of resources related to threatened and endangered or RFSS plants.

The Proposed Action (Alternative 2) could irreversibly kill individual running buffalo clover plants and individual RFSS plants. However, habitat capacity would not be damaged, and in many cases would be improved, so the Proposed Action would not make any irreversible or irretrievable commitments of threatened, endangered, and sensitive plant habitat.

3.3.4 - Consistency with the Forest Plan

The No Action alternative would take no action. While lack of action would not make progress toward goals and objectives for TES plant conservation, it would not violate Forest Plan standards and guidelines for TES plants.

The Proposed Action contains design criteria and mitigation to limit adverse effects to threatened, endangered, and RFSS plants. The design criteria and mitigation measures would not avoid all adverse impacts, but would limit them such that major population level impacts would not occur. Therefore, the Proposed Action would be consistent with Forest Plan direction to avoid and minimize negative impacts on RFSS plants to the extent practical (see Forest Plan Standard VE13, p. II-19). For running buffalo clover, the Proposed Action would be consistent with Forest Plan direction to avoid activities with the potential to eliminate or have long-term detrimental effects on running buffalo clover (Standard TE71, p. II-27). The Proposed Action also would follow Forest Plan direction to mark known running buffalo clover locations prior to management activities and to inform managers and contractors of the need to limit activities near known running buffalo clover locations (Guidelines TE76 and TE77, p. II-28).

3.3.5 - Consistency with Laws, Regulations, and Handbooks

The No Action alternative would take no action that would have a direct effect on threatened, endangered, or RFSS plants; therefore, it would be consistent with the Endangered Species Act, the National Forest Management Act, and their implementing regulations.

Formal consultation with the U.S. Fish and Wildlife Service concerning the effects on running buffalo clover has been completed. The Proposed Action is not expected to have adverse effects on other threatened and endangered plants. Therefore, this alternative would be consistent with the Endangered Species Act, its implementing regulations, and Forest Service directives for threatened and endangered species.

Although effects to RFSS plants likely would occur, such effects would be limited and would not result in loss of viability or a trend toward federal listing. Because of this maintenance of viability, the Proposed Action would be consistent with requirements in the National Forest Management Act and its implementing regulations related to maintenance of biological diversity.

3.4 - Soil Resource

3.4.1 - Scope of the Analysis

This section addresses effects to Forest soils from NNIS and effects from proposed treatments to reduce, eradicate, or prevent NNIS on the Forest.

Spatial Boundary

For general direct, indirect, and cumulative effects from NNIS on soils, the spatial boundary of the analysis includes the soils on Monongahela National Forest lands, approximately 920,000 acres. This area represents the total amount of Forest soils that could be affected by NNIS should NNIS establishment and spread be allowed to continue unabated. For direct and indirect effects to soils from NNIS treatments, the spatial boundary is the area proposed for treatment under Alternative 2, the Proposed Action. For cumulative effects to soils from NNIS treatments, the spatial boundary includes all soils on Monongahela National Forest lands, as virtually any land within this boundary could be treated for NNIS in the future under the protocols that would be established under this EA and its Decision Notice.

Temporal Boundary

The temporal boundary for direct, indirect, and cumulative effects is ten years. Initial site-specific control activities are expected to be completed within that time frame. Although follow-up control and control of additional sites may occur beyond ten years, a review of the NEPA documentation is expected to be conducted at that time, and any effects beyond the scope of those considered here can be disclosed at that time. Review of the protocols would also likely occur after ten years to see if any changes in management strategies or practices are needed.

3.4.2 - Affected Environment

The soils of the MNF are developed under a mesic climatic temperature regime (mean annual air temperature is 48 degrees Fahrenheit) and an udic soil moisture regime (mean annual precipitation is 58 inches). The parent material that underlies the soils is comprised of sedimentary geology that makes up the Appalachia Ridge and Valley and the Allegheny Plateau Provinces. The soils on the Forest have been subject to the effects of extensive tree cutting and slash burning, most of which occurred between 1890 and 1935. These human-induced activities resulted in damaging floods, severe erosion, topsoil loss, and pollution of streams used for water supply. Subsequent fires further increased erosion. Some of the fires at the turn of the century burned so hot that soil carbon was lost to the atmosphere, and some areas on the Forest experienced irreversible losses of soil productivity. Although there has been recovery over the past century, soils on many forested landscapes on the Forest still have thin surface horizons, and in some areas soil is essentially non-existent.

The soils of the Forest have developed from sedimentary rocks and are divided into two zones, which differ in soil patterns. The Allegheny Plateau Province has relatively flat-lying bedrock. Soils on the plateau are characterized by high moisture content, thick humus, acidic conditions, and low nutrient levels. High timber productivity in this province is more a function of soil moisture than fertility. Limestone areas are more fertile and have often been cleared for pasture.

In the Ridge and Valley Province, bedrock is folded, faulted, and fractured. Rock outcrops and escarpments are common. Soils are often shallow, shaley, draughty, and not highly productive compared to their Allegheny Plateau counterparts. Most of the forest soils exhibit moderate to severe erosion potential, and high hazard areas exist in areas of shale and limestone. High hazard with regard to limestone refers to karst formations and caves. Sinks and land subsidence can occur and pose a risk, and ground disturbance within these areas can introduce sediment into the under workings of the karst formations. High hazard areas with regard to shale refer to shale formations that have exposed dips and can be prone to mass wasting events. Also, soils forming from these shales are often shallow, droughty, and difficult to keep vegetated. Therefore, operating in these areas could result in substantial loss of sensitive habitat (i.e., shale barrens) or result in a loss of soil productivity that could prevent the return of vegetation.

Soil inventories were completed on 85 percent of the Forest during the past 18 years. The Natural Resource Conservation Service is currently updating an existing but outdated soil inventory in Tucker, Barbour, Preston, and northern Randolph Counties for the remaining 15 percent of the Forest. The anticipated date of completion for these updated soil surveys is 2010. The Forest will then have a complete updated soil inventory layer that can be utilized in an integrated manner to assess effects from management activities. Existing information can now be publicly accessed through the Internet and NRCS databases (http://websoilsurvey.nrcs.usda.gov/app/).

Our Forest inventories of NNIS are not nearly as complete as our soil inventories, but we do know that the more we look for these plants, the more we find. It is reasonable to assume that NNIS populations are increasing on the Forest given the ever-increasing places we are finding them and the uncanny ability these plants have for proliferating once they become established. Ecological links between soils and NNIS are still being discovered, but some are already known. Disturbed soils can provide ready seedbeds for NNIS establishment and spread. Also, soil movement through erosion, sedimentation, or vectors like recreation use and livestock grazing can transport NNIS seed in the soil to new locations. Increases in NNIS establishment and spread are of concern to the Forest soil program because of the effects that NNIS can have on soil productivity. These effects are described in detail in the Environmental Consequences section that follows. This section will also look at the potential effects to soils from NNIS treatments that would occur under the proposed action.

Desired Conditions

Forest Plan desired conditions are to have soils with adequate physical, biological, and chemical properties to support desired vegetation growth (p. II-9).

3.4.3 - Environmental Consequences

This analysis focuses on the effects to the soil resource at two scales. The first scale is a broad analysis that looks at the general effects to soils from NNIS. The second focuses more on site-specific effects of the treatments proposed to reduce NNIS establishment and spread.

General Effects of NNIS on the Soil Resource

There are a number of negative effects that NNIS establishment and spread can have related to soils. Some of them are listed below:

- Root systems of many NNIS tend to be relatively shallow and do not bind soil in place the way many native species do. This can lead to soil erosion in areas where NNIS dominate.
- Invasion of wetlands by purple loosestrife, yellow iris, and other aquatic NNIS can alter hydrologic flow patterns and soil moisture regimes needed for native wetland vegetation.
- Alleopathic chemicals released by certain exotic plants—such as exotic buckthorns, garlic mustard, and barberries—into the soil can alter soil chemistry, which in turn can eliminate, or inhibit the establishment of, native plants.
- Lacey et al. (1989) showed that runoff and sediment yield were higher for sites dominated by spotted knapweed as compared to sites dominated by bunchgrass types. These sites were shown to have lower infiltration rates as a result of changes to the structure of live vegetative cover and the lower levels of litter on the soil surface.
- Soil structure and pH may be altered over time as a result of the type of biomass produced by NNIS vs. native plants, although research quantifying these changes is limited.
- NNIS are often more successful in competing for available nutrients in the soil than many native species, which can lead to the displacement of native species by NNIS.

The failure to control NNIS infestations on the Forest is currently having these types of impacts to soils and the native vegetation associated with them.

Alternative 1 – No Action

Under the No Action Alternative the impacts described above would not only continue, but they would likely increase over time as NNIS continued to spread in population numbers and distribution. Direct effects include increases in soil erosion and sediment yield, and changes to soil chemistry and moisture, all of which can lead to losses in soil productivity. Indirectly, forest health and productivity would be negatively affected as changes in soil chemistry and soil nutrient availability result from decreasing native vegetation and associated habitats. These impacts would occur because NNIS in the treatment areas would continue to exist and exert their influence over on-site soils and native vegetation. Some treatment to reduce or eradicate NNIS may still occur as it does now, but that treatment would not be systematic or widespread enough to have much positive influence. The cumulative effects of continued NNIS spread and inadequate treatment would be negative for soil and forest productivity.

Alternative 2 – Proposed Action

The proposed action would implement treatments to reduce or eradicate NNIS on about 5,000 acres over the short term (0-10 years). Thus, the direct impacts from NNIS on soils would be greatly reduced or eliminated in the treatment areas. Indirect effects to soils and native vegetation would also be reduced in treatment areas. Perhaps more important, the protocols established to effectively address NNIS infestations under the proposed action could also be used on any area of the Forest over both the short and long (greater than 10 years) terms. These protocols can be used to help reduce the cumulative effects on soils from new or currently unknown NNIS infestations indefinitely.

Effects to Soils from NNIS Treatments

NNIS treatments could result in impacts to soil productivity in two primary ways: 1) treatments may create soil disturbance, which could lead to soil losses from erosion and sedimentation, and 2) herbicide treatments may alter soil chemistry, which could affect such soil qualities as cohesion, toxicity, and nutrient availability. These effects to soils would generally occur within the proposed treatment areas, although erosion and sediment could affect other resources downslope or downstream from the treatment areas.

Alternative 1 – No Action

Under No Action it is assumed that no treatments would take place in the areas proposed for treatment under the Proposed Action. Therefore, the No Action Alternative would have no direct or indirect effects to soils from treatment activities that might create soil disturbance or alter soil chemistry. Indirect effects from the continued spread of NNIS in the treatment areas are described under the General Effects section, above.

Alternative 2 – Proposed Action

Direct and Indirect Effects from Soil Disturbance

Of the treatment methods described for the Proposed Action in Chapter 2 of this EA, the ones that are most likely to create some ground disturbance are hand pulling, grubbing, mowing, and prescribed fire.

Hand pulling and grubbing would directly disturb soil through the removal of NNIS plants and their root systems. We anticipate that this labor-intensive treatment method would typically be used for small infestations or in small areas too sensitive for herbicide application. Disturbance may create bare soil subject to erosion or localized mixing of material from different soil horizons. Erosion is the main concern. To address this concern, large areas of soil left bare of vegetation following treatment would be re-seeded with a mix of fast-growing grasses, forbs, legumes, and/or shrubs recommended for soil stabilization and erosion control by the Forest Botany Program. Mixes could include native plants or non-invasive exotic plants intended to stabilize the soil until longer-lived native species re-colonize the site.

Mowing, especially with heavier equipment such as brush hogs, could result in minor soil compaction. Where mowing would take place in field or forest environments, it would likely occur only once a year on vegetated sites, so compaction and its effects to soils would be minimal. Other mowing would occur from roads, where road compaction is already considered an irretrievable resource commitment, so no additional impacts related to compaction are expected.

Prescribed fire can burn vegetation off soils, exposing them to a higher risk of erosion. This risk can be addressed with erosion control methods described above for hand pulling and grubbing, thereby minimizing any potential direct, indirect, or cumulative effects to soils. Prescribed fire could also change soil properties by burning off carbon or other nutrients in the upper horizons, or by creating hydrophobic conditions where water will no longer percolate into the soil. However, these types of effects are more typically seen in very intense burns in areas of heavy fuel loading. We anticipate that most if not all of the prescribed fire used to control or reduce NNIS would be in open field or forest conditions with relatively light fuels where there would be minimal impacts to soils. Specific mitigation measures to reduce potential effects from NNIS due to prescribed burning are listed in the Mitigation Measures section of Chapter 2 of this EA.

Direct and Indirect Effects from Herbicide Treatments

Because herbicides kill but do not physically remove plants and their root systems, herbicide 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 re-establish naturally. Where herbicides kill most of the standing vegetation, re-seeding as described above would be used to help stabilize the soil and to prevent NNIS in the seed bank from re-establishing. Treating cut stumps of woody NNIS (such as exotic buckthorns and honeysuckles) with herbicides would discourage re-sprouting without the soil disturbance associated with physically grubbing the stumps out.

Herbicide application may have some short-term effects on soil resources. However, noxious weed infestations can also adversely impact soils by removing nutrients and increasing soil erosion (Montana Weed Control Association, Unknown date; University of Arizona AgNIC, 2001). To determine the level of risk for 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 SL-1).

Nine herbicides are proposed for use under this alternative, including Clopyralid, Fosamine, Glyphosate, Imazapic, Imazapyr, Metsulfuron methyl, Picloram, Sethoxydim, and Triclopyr. The effects of herbicide applications on the soil and groundwater resources relate directly to the type of herbicide and rate of application, the characteristics of the soil types present, and the timing and amount of precipitation following application. The main elements examined as potential effects include: 1) the absorption characteristics and persistence of herbicide residues in the soil, 2) the effects of herbicides on microbes and, 3) the likelihood of leaching of herbicide residues into groundwater systems or the accumulation in overland flows.

Table SL-1. Mobility and Persistence of the Proposed Action Selected Herbicides

Herbicides	Characteristics		
	Mechanisms of degradation	Half-life in soil	Mobility
Glyphosate	Degradation is primarily due to soil microbes[3]	Average of 47 days[3]	Has an extremely high ability to bind to soil particles, keeping it from being mobile in the environment.[3]
Sethoxydim	Sethoxydim is rapidly degraded by photolysis and microbes in the soil.[1]	4 to 5 days[1]	Does not bind strongly with soils, so it could potentially have high mobility, but degrades rapidly so there is limited movement.[1]
Triclopyr (Garlon 3A or Garlon 4)	Triclopyr is rapidly degraded to triclopyr acid by photolysis, microbes in the soil, and hydrolysis.[1]	30 days[1]	Ester formulation binds readily with soil, giving it low mobility. The salt formulation binds weakly in soil, giving it higher mobility. But both formulations rapidly degrade to triclopyr acid, which has an intermediate adsorption capacity, limiting mobility.[1]
Clopyralid	Clopyralid is degraded by soil microbes.[1]	40 days[1]	Does not bind strongly to soils. During the first few weeks, there is a strong potential for leaching and possible contamination of groundwater, but adsorption may increase over time.[1]
Imazapic	Degradation is primarily due to soil microbes.[1]	Average of 120 days (can range from 31 - 233 days)[1]	Weakly adsorbed in high pH soil. Limited horizontal mobility, but may leach vertically depending on soil type.[1]
Imazapyr	Degradation is primarily due to soil microbes.[1]	Ranged from one to seven months[1]	Under most field conditions imazapyr does not bind strongly to soils and can be highly available in the environment. Above pH 5, the herbicide will take on an ionized form, increasing risk of herbicide runoff. [1]
Fosamine	Degradation is primarily due to soil microbes.[1]	Ranged from one to six weeks[1]	Adsorption to soil particles likely prevents significant amounts of fosamine ammonium from leaching or otherwise moving into nearby waterway[1]
Picloram	Picloram is not readily degraded in soils and can be persistent[1]	Less than a month to more than three years[1]	Picloram is water-soluble and does not bind strongly to soil, it is capable of moving into local waterways through surface and subsurface runoff, depends largely on the type of soil, rates of application, rainfall received post-application, and distance from point of application to nearest water body or groundwater[1]
Metsulfuron methyl[2]	Breakdown in soils is largely dependent on soil temperature, moisture content, and pH. It will degrade faster under acidic conditions, and in soils with higher moisture content and temperature. Metsulfuron-methyl is stable to photolysis, but will break down in ultraviolet light.	Up to 120 days	The chemical has a higher mobility potential in alkaline soils than in acidic soils, as it is more soluble under alkaline conditions
Class Act Surfactant	Non-ionic surfactant and liquid ammonium sulfate solution breaks down in soil due to soil microbes.	N/A	Approved for aquatic use.

[1] Tu et al., 2001a [3] Tu et al., 2001b. [4] Mycogen Corporation, 1997.2 Extension Toxicology Network

The persistence of an herbicide is defined as the length of time that residues of the initial application remain detectable in the soil. The decay rate, also known as the half-life, is defined as the length of time for half of the initially measured residues to degrade to other chemical forms in the soil.

The herbicides proposed for application are primarily degraded by microbes after their adsorption to ionic sites provided by organic matter or soil colloids, otherwise known as the cation exchange capacity of the soil. Their persistence and half-life are thus directly related to the adsorption characteristics of the herbicide, the cation exchange capacity of the organic and combined A and A/C mineral soil horizons, and the amount of microbes that are present and active in the soil horizons in which residues accumulate. Initial residues may also be lost from a site from dilution by rainfall and subsequent movement in overland flows.

Spraying herbicides inevitably results in the short-term accumulation of herbicide residues in soil. Once in the soils, herbicides can migrate via gravity, leaching, and surface runoff to other soils, groundwater, or surface water. Examples of factors influencing herbicide persistence include leaching potential, soil moisture content, soil and water acidity, amount of organic matter in the soil, organisms present, and molecular binding of chemicals to organic and soil particles. Table SL-1 displays known persistence for herbicides in the half life column, which indicates that residues may be typically detected anywhere from days to months, depending on the herbicide.

Precipitation patterns following application also heavily influence potential effects to soils, and potential contamination of groundwater and surface waters. The Forest receives a varied amount of precipitation from West to East due to a rain shadow effect. Therefore there would be more risk of such events on the western side of the Allegheny Front. See the project area maps in Appendix A for site-specific projects that are more susceptible to higher rainfall and more frequent precipitation events.

Being aware of weather patterns and having well-prepared planning documents and/or contracts that include weather restrictions can proactively mitigate concerns related to weather effects during herbicide application. No spraying should occur if rain is predicted. A time constraint based on anticipated precipitation should also be written into contracts. Examples of such constraints are shown below.

<u>Climatic Limitations.</u> Spraying operations shall not occur when any of the following conditions exist:

a. Rain, fog, or morning dew causes moisture to drip from the foliage, or
b. Precipitation is anticipated within 6 hours at the spray area.

Contractor may be required to re-spray any area or portion of an area treated where rain falls within 6 hours of the time of treatment.

For all herbicides used in this project with the exception of Fosamine, risk assessments were done by the SERA Company for the USFS. Summaries of these assessments and the assumptions used in them can be found in the Soil Resource Report in the Project File.

Impurities - "Virtually no herbicide synthesis yields a totally pure product. Technical grade herbicides undoubtedly contain some impurities" (SERA, all risk assessments). Herbicide-specific risk assessments include the identity of impurities, if it is available. In some instances, toxicity and mobility of impurities is studied in conjunction with the technical grade of the herbicide. In other instances, risks of the impurities are assessed separately from the herbicide. Some impurities are more toxic than the associated herbicide, but the risks are minimized due to low concentrations of the impurity in the herbicide.

Hexachlorobenzene, classified as a human carcinogen, is an impurity in both clopyralid and picloram. Hexaclorobenzene is ubiquitous and persistent in the environment and volatizes from the soil surface. Because hexachlorobenzene binds tightly to soil, it is not likely to percolate through soil to contaminate groundwater.

Metabolites - Metabolites are substances created by the metabolism of herbicides. Most herbicides considered are not readily metabolized by aquatic animal species, and are passed through their bodies unchanged. Most herbicides are metabolized microbially. Herbicide-specific risk assessments include the identity of known metabolites. Some metabolites are more toxic or persistent than the associated herbicide, but the risks can be minimized by choosing herbicides appropriate to environmental factors such as soil type and climate. Soil microbes are able to use nonyl-phenol ethoxylate (NPE) surfactants and breakdown products. Concern has been expressed about the potential for surfactants to increase the movement of other harmful materials, such as pesticides, into soils. A study shows that this is not a concern at soil concentrations resulting from typical USDA Forest Service application rates. In the presence of oxygen, NPE is biodegradable in soil or water, with a half-life of a few up to 90 days.

Aquatic Formulations of Herbicides - More detailed information on potential effects to water quality and aquatic species from herbicide application is provided in the Soil Resource Report in the Project File. Label direction would be followed to prevent groundwater and surface water contamination from mobile chemicals. Only those herbicides registered for aquatic use would be applied near open water. Herbicide treatment in riparian areas would follow the guidelines presented in the Chapter 2 Mitigation Measures Table 2.4 to protect aquatic resources. When used according to label specifications, no long-term impacts to soils, groundwater, or surface waters are expected.

Site Specific Observations (SSO) For NNIS-Plants Project

Site-specific observations for soil-related concerns were conducted in representative areas proposed for NNIS treatment, including the Gaudineer area, along Forest Road 485, along the Highland Scenic Highway, adjacent to the Cranberry Backcountry Road, adjacent to the Dolly Sods roads, the Sinks of Gandy area, and a site around Blue Rock Geological Area. See the maps and project locations in Chapter 2. Several Soil Map Units (SMUs) were observed for potential effects of herbicides on soil. Table SL-2 summarizes the primary concerns identified and the mitigation measures that would be used to address those concerns.

Table SL-2. Site-specific Soil Concerns and Mitigation

Area	Concern	Mitigation
Springs, seeps, small streams	Contamination of water quality and aquatic habitat	Use an aquatic herbicide formulation or remove plants by hand
Limestone karst topography	Contamination of ground water and cave habitat from chemical spills	Mix and transfer chemicals on non-karst soils
Poorly drained soils at elevations > 3000 feet with inclusions of unnamed soils that are classified as Histosols	The application of herbicides to these areas may kill the vegetation creating the soil, increasing the risk of erosion and reducing water-holding capacity	Remove invasive species by hand or by using the hand/glove swab method of application
Grazing allotments in karst topography	Use of picloram poses risks to non-target species, stock, and wildlife	Substitute metsulfuron methyl or clopyralid for picloram in these areas

Summary of Herbicide Direct and Indirect Effects

Researchers view the forest floor and soil as a superb environment for minimizing the potential impact of herbicides on the watershed. Herbicides could briefly leave residues in soils and water, but the proposed herbicides are generally of low half-life in environmental media. High infiltration rates of most forest soils would prevent overland movement of herbicides to water bodies. The absorptive phenomena of soils and organic matter would retard chemical movement through the soil, while chemical and biological processes would alter the herbicide to a substance not considered harmful to vegetation. Leaching of herbicides, stream pollution, and harmful effects to the soil microorganisms would be minimal when carefully controlled applications of herbicides are made. Controlled application should include the mitigation measures listed in Chapter 2.

Cumulative Effects of Herbicide Treatments

Based on the predicted movement and persistence of the herbicides and typical treatment scenarios, no accumulation of herbicides is expected in either soil or groundwater. Treatments are dispersed in locations across the Forest. Most of the herbicides are expected to be decomposed in the soil, within weeks or several months, by natural processes. Therefore, if herbicides are applied according to guidelines and standards and there are no unforeseen weather patterns in the treatment areas post application; cumulative effects would be minimal for the action alternative.

Unavoidable Adverse Impacts

There would be no unavoidable adverse impacts of the soil resource in this project, for either alternative, with implementation of the mitigation measures described in Chapter 2 of this EA.

<u>Irreversible or Irretrievable Commitment of Resources</u>

There would be no irreversible or irretrievable commitments of the soil resource in this project, for either alternative.

3.4.4 - Consistency with the Forest Plan

All alternatives would be implemented consistent with Forest Plan goals, objectives, standards, and guidelines and desired conditions.

3.4.5 - Consistency with Laws, Regulations, and Handbooks

All alternatives would be implemented consistent with Forest Service laws, regulations, and handbooks regarding management of the soil resource.

3.5 - Aquatic Resources

3.5.1 - Scope of the Analysis

No significant aquatic resource issues were identified during scoping. However, activities proposed under the action alternative may affect aquatic resources. Specifically, there may be short-term impacts from herbicide application and other proposed treatments, as well as potential long-term benefits from treating non-native invasive plant species (NNIS), and limiting access through road storage, which may reduce erosion and other road-related problems. This section addresses effects to Forest aquatic resources from NNIS and effects from proposed treatments to reduce, eradicate, or prevent NNIS on the Forest.

Spatial Boundary

For the purposes of this analysis, the **spatial** area considered for direct and indirect effects will be the site-specific areas proposed for treatment, along with the fifth-level watersheds that contain the treatment areas. Effects to aquatic and watershed resources can occur throughout connected streams within these watersheds, and activities within the watersheds can have effects on aquatic and riparian habitats that run through the watersheds. The spatial area for cumulative effects include the fifth-level watersheds within the Forest proclamation boundary and the potential effects of Forest, state and private activities on the waters leaving the Monongahela National Forest (MNF). Cumulative effects address the environmental consequences from activities implemented or projected within the watersheds in the past, present and reasonably foreseeable future. The combination of activities on NFS, state and private lands can create an effect at a watershed scale that otherwise would not be perceived as a problem at the project or subwatershed scale. In addition to their natural variability, watersheds differ by their management history, ownership patterns, and the types and levels of contemporary management activity. The combination of natural variables, ownership patterns and management activities, contribute to the cumulative effects that shape the current conditions of the aquatic ecosystems within the analysis area. Given the variability in watershed conditions, both natural and management related, the discussion of cumulative effects will be general in nature.

Temporal Boundary

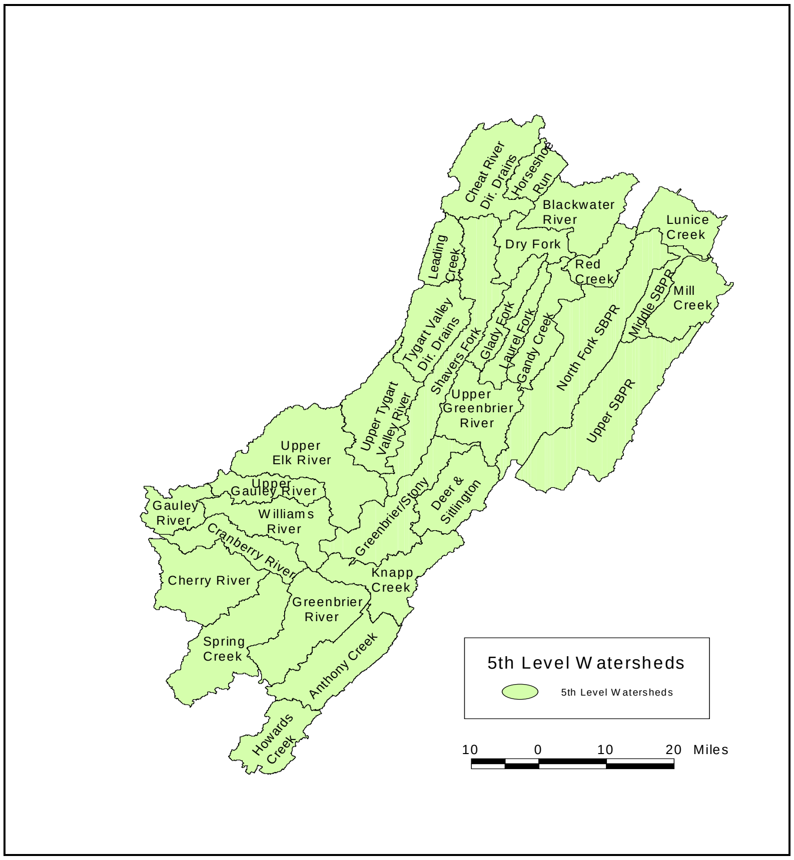
Although the herbicides proposed to be used have half-lives in aquatic environments that range from an hour to ten weeks, the **temporal** scale for the cumulative effects analysis will be 10 years, which is the life of this planning effort. Areas may be treated and re-treated during this time period to control NNIS plant species as necessary.

3.5.2 - Affected Environment

The programmatic element of the EA establishes protocols for prevention and eradication of NNIS plant species where they may threaten important ecosystems or resources Forest-wide. NNIS plants are often dispersed along travel corridors (*e.g.*, roads, skid roads, and trails) so the affected environment for aquatic resources could be any watershed across the Forest.

The MNF is located in the east-central portion of West Virginia among the Ridge and Valley and Allegheny Mountains Geographic Regions. The MNF lies within 44 fifth-level watersheds (Figure AQ-1) nested within 6 different fourth-level sub basins, including the Cheat River, Elk River, Gauley River, Greenbrier River, Tygart Valley River, and South Branch Potomac River.

Figure AQ-1. 5th Level Watersheds Overlapping the Monongahela National Forest



Watersheds can be characterized by their natural features such as soils, geology, topography, etc. and management related features such as road densities, number of road crossings, or ownership patterns. These same variables may also influence the dispersal of NNIS plants, our ability to effectively treat them and the potential effects on aquatic resources.

Water Quality

Water chemistry of streams and rivers is the by-product of dynamic nutrient pathways and chemical processes occurring within the contributing watershed environment—atmospheric, terrestrial, and biological. Water quality in rivers and streams is an important consideration when establishing management priorities on the Forest to provide for the maintenance of healthy aquatic ecosystems. Water chemistry is one component of water quality and represents a fundamental building block for aquatic communities. The potential exists that herbicides used to control NNIS plant species could affect water chemistry within the treatment areas.

Section 303(d) of the Clean Water Act requires each state to submit to the Environmental Protection Agency (EPA) a list of impaired waters that do not meet state water quality standards. In support of the recent Forest Plan revision effort, an analysis was done on the miles of streams within the proclamation boundary, and on NFS lands, that were on the November 2004 303(d) list (WVDEP 2004). Table AQ-1 displays this information. While a similar analysis has not been conducted on the more current 303(d) list, we assume the numbers are relatively similar.

Table AQ-1. Stream Miles within the Forest Boundary on the 2004 303(d) List

Impairment	Within Proclamation Boundary	On NFS Lands
Aluminum (dissolved)	326 miles	122 miles
Benthic Macro-invertebrates	62 miles	27 miles
Fecal Coliforms	39 miles	1 mile
Mercury	159 miles	28 miles
pH	172 miles	126 miles

In all, an estimated 630 miles of stream within the proclamation boundary were on the 2004 303(d) list, and 250 miles are on NFS lands. It should be noted that a given stream mile may be counted more than once if it does not meet water quality standards for more than one criterion. The impaired streams occur in 21 watersheds within the Forest proclamation boundary. On NFS lands, impairments due to dissolved aluminum, mercury and pH are probably closely related to the effects of acid deposition and to a lesser extent acid mine drainage. Effects typically associated with forest management activities would generally be non-point sources of pollution that contribute to benthic macro-invertebrate impairments. The concern with the use of herbicides to treat NNIS plant species is the potential for contaminating water quality in streams draining the treatment areas. Although the herbicides do not contain aluminum, mercury, or fecal coliforms, they may have compounds that could cumulatively affect stream pH. Similarly, herbicide contaminants or sediment from ground-disturbing activities could affect benthic macro-invertebrates.

Aquatic and riparian habitats within the MNF proclamation boundary are still heavily influenced by historic impacts associated with agricultural developments and logging. Simplified channel conditions and elevated levels of fine sediment are a legacy of past land use activities and contemporary disturbances. Fine sediment can adversely affect aquatic communities by reducing habitat quantity, habitat quality, water quality, and food supplies (Waters 1995). Opportunities identified in the Proposed Action to put roads into storage could reduce existing erosion and sources of sedimentation associated with the roads and could be beneficial for streams draining the treated area over the long term.

Aquatic Biota/Management Indicator Species

The MNF straddles the divide between the Mississippi River Basin and the Atlantic slope, and forms the headwaters of several major river systems. The location of the Forest, in the central Appalachians, has influenced stream characteristics and the evolutionary pathways of aquatic communities. The result is fairly high aquatic diversity on the Forest, with species that may be unique to either side of the divide and species that are common on both sides. Overall, the streams and rivers on the Forest support 87 species of fish as well as numerous species of invertebrates including insects, mollusks, and crayfish. Fish species are predominantly native, non-game species.

There are no federally listed aquatic species within the Forest proclamation boundary, but there are ten species on the Regional Forester's Sensitive Species (RFSS) list, including seven fish, two mollusks, and one amphibian. These species are distributed throughout the Forest and could potentially be affected by treatments to control NNIS plants within the watersheds they occupy. Table AQ-2 displays the aquatic species on the RFSS list and their distribution on the Forest.

Table AQ-2. Distribution of Aquatic Species on the RFSS List

Species	Watershed	% NFS Land within Proclamation Boundary	Number of Collections	Last Year Reported*
FISH				
Appalachia darter (*Percina gymnocephala*)	Upper Greenbrier River	81%	6	2001
	Greenbrier River 1	32%	1	1971
	Anthony Creek	76%	N/A	N/A
	Howards Creek	88%	N/A	N/A
	Upper Gauley	13%	N/A	N/A
	Williams River	89%	2	1977
	Cherry River	27%	2	1980
Candy darter (*Etheostoma osburni*)	Upper Greenbrier River	81%	14	2001
	Deer Creek/Sitlington Creek	41%	6	2001
	Greenbrier River 1	32%	1	1960
	Knapp Creek/Marlin Run	57%	6	2000
	Greenbrier River	49%	N/A	N/A
	Anthony Creek	76%	4	1999
	Upper Gauley	13%	1	1994
	Williams River	89%	9	2001
	Gauley/Big Ditch Run	57%	N/A	N/A
	Cherry River	27%	9	2001
Cheat minnow (*Rhinichthys bowersi*)	Shavers Fork	71%	2	1999
	Gandy Creek	30%	1	1976
	Laurel Fork	58%	1	1986
	Glady Fork	67%	1	1986
	Horseshoe Run	39%	1	1977
	Cheat River Direct Drainages	39%	N/A	N/A
Kanawha minnow (*Phenacobuus teretulus*)	Upper Greenbrier River	81%	9	2001
	Greenbrier River 1	32%	1	1971
	Williams River	89%	1	1944
	Cherry River	27%	N/A	N/A
New River shiner (*Notropis scabriceps*)	Upper Greenbrier River	81%	5	1999
	Deer Creek/Sitlington Creek	41%	4	2001
	Greenbrier River 1	32%	1	1971
	Knapp Creek/Marlin Run	57%	6	2000
	Spring Creek	31%	N/A	N/A
	Greenbrier River	49%	N/A	N/A

Species	Watershed	% NFS Land within Proclamation Boundary	Number of Collections	Last Year Reported*
	Anthony Creek	76%	N/A	N/A
	Howards Creek	88%	N/A	N/A
	Williams River	89%	2	1944
	Cherry River	27%	1	1944
Pearl dace (*Margariscus margarita*)	NF South Branch Potomac	53%	N/A	N/A
	U. Tygart Direct Drainages	37%	N/A	N/A
	Red Creek	70%	2	1986
	Gandy Creek	30%	5	1984
	Glady Fork	67%	N/A	N/A
	Dry Fork	72%	N/A	N/A
	Horseshoe Run	39%	N/A	N/A
	Cheat River Direct Drainages	39%	2	1987
Redside dace (*Clinostomus elongatus*)	Blackwater River	31%	N/A	N/A
MOLLUSKS				
Elktoe (*Alasmidonta marginata*)	Upper Greenbrier River	81%	1	1998
	Greenbrier River 1	32%	1	1996
Green Floater (*Lasmigona subviridis*)	Upper Greenbrier River	81%	1	2001
	Greenbrier River 1	32%	1	2001
AMPHIBIANS				
Eastern Hellbender (*Cryptobranchus alleganiensis*)	Shavers Fork	71%	2	1997
	Gandy Creek	30%	1	N/A
	Cheat River Direct Drainages	39%	1	1937
	Upper Greenbrier River	81%	4	1998
	Williams River	89%	1	1996
	Cranberry River	97%	4	1995
	Cherry River	27%	1	2001

The Forest identifies native brook trout (*Salvelinus fontinalis*) as an aquatic Management Indicator Species (MIS) that is used as a bio-indicator to assess the effects of Forest management activities on the health of aquatic ecosystems. The concept of MIS suggests that the status and trend of one or more key species provide insights as to the integrity of the larger ecological system to which it belongs. The selection of native brook trout as the Aquatic MIS is based on their sensitivity to potential habitat changes associated with land management activities, their broad distribution across the Forest, and their location within headwater streams that are often in relatively close proximity to management activities and contribute to aquatic habitat conditions downstream. If land management activities affect native brook trout populations, then chances are the communities downstream may also be affected.

Optimum habitats for native brook trout are streams with clean, cold, well-oxygenated water. They prefer water temperatures around 57-61^{o} F and do poorly when water temperatures exceed 68^{o} F for extended periods (NatureServe 2005). Brook trout are fall spawners and excavate redds in clean gravel beds. Brook trout feed primarily on aquatic and terrestrial insects, but will eat a wide range of organisms. Brook trout also prefer a mix of habitat types (pools, riffles, runs) and hiding cover (USFWS 1982).

The current distribution of brook trout populations appears to be relatively stable across the Forest, but some populations losses have occurred, primarily due to acid deposition. Where populations occur, brook trout productivity is likely impaired from a number of factors. Some factors are associated with stochastic events, such as periodic floods and droughts, which occur unpredictably in nature. Deterministic factors associated with in-stream habitat conditions have also impaired trout populations. These factors include but are not limited to water chemistry (*e.g.* pH), habitat composition and quality (*e.g.* pool and riffle development), structural complexity (*e.g.* large woody debris density), channel stability (*e.g.* vertical and lateral stability), sediment composition (*e.g.* percent fine sediment), habitat connectivity (*e.g.* migration barriers), and stream temperatures (*e.g.* shade). Fishing pressure (or more specifically, harvest mortality) can also influence trout populations. The primary concern associated with the action alternative is the potential to impact brook trout productivity due to contamination from the use of herbicides. Protocols have been identified in the programmatic portion of the proposed action that will help reduce the potential risk to native brook trout and other aquatic resources.

Site-Specific Treatments

In addition to the programmatic protocols identified in the proposed action, there are 14 areas that have been identified for site-specific treatments to control NNIS plants. These treatments are designed to protect high-priority sites such as botanical areas, candidate research natural areas, National Natural Landmarks, TES species habitat, landscape-scale ecological reserves, tree regeneration, and roads and facilities. Treatments of continuous infestations would total an estimated 134 acres; spot treatments would be conducted across another 4,960 acres.

Table AQ-3 shows the areas proposed for treatments, the watersheds that contain those areas, NNIS to be treated, potential treatment options, and the sensitive aquatic species present that could be affected by those treatments. More detailed information on these parameters may be found in the Aquatic Resources Report in the project file.

Table AQ-3. Sensitive Aquatic Species in Treatment Areas for Proposed Action

Treatment Area	Watershed(s)	NNIS To Be Treated	Treatment Options	Sensitive Aquatic Species*
Parsons Area	Cheat River Direct Drainages, Horseshoe Run, Dry Fork	Garlic mustard, oriental bittersweet, common privet	Foliar spray, basal spray, hand pull, grub, cut surface, fire	Cheat minnow, pearl dace, eastern hellbender
Otter Creek Area, but outside of wilderness	Shavers Fork, Dry Fork, Glady Fork	Garlic mustard, Japanese stiltgrass	Foliar spray, hand pull, fire, mow	Cheat minnow, pearl dace, eastern hellbender
Dolly Sods Area, along Roads 75 & 19	Red Creek, NF South Branch Potomac	Garlic mustard, reed canary grass	Foliar spray, hand pull, fire,	Pearl dace
Smoke Hole Area	South Branch Potomac River	Japanese stiltgrass, viper's bugloss, spotted knapweed, tree of heaven, autumn olive, bush honeysuckles	Foliar spray, hand pull, mow, biological control, grubbing, basal spray, cut surface,	None

Treatment Area	Watershed(s)	NNIS To Be Treated	Treatment Options	Sensitive Aquatic Species*
Seneca Creek Vicinity	Gandy Creek, North Fork South Branch Potomac River	Garlic mustard	Foliar spray, hand pull, fire	Cheat minnow, pearl dace, eastern hellbender
Laurel Fork Vicinity	Laurel Fork, Gandy Creek	Garlic mustard, brown knapweed	Foliar spray, hand pull, fire, biological control	Cheat minnow, pearl dace, eastern hellbender
East Fork Greenbrier/ Burner Mountain Area	Upper Greenbrier River	Yellow iris, garlic mustard, Japanese stiltgrass, bush honeysuckles, reed canary grass	Foliar spray, foliar application with wick/glove, hand pull, fire, mow, basal spray, cut surface, grubbing	Appalachia darter, candy darter, Kanawha minnow, New River shiner, elktoe, green floater and eastern hellbender
Cheat Mountain/ Shavers Mountain Vicinity	Shavers Fork, Upper Tygart Valley River	Reed canary grass, bush honeysuckles, Japanese barberry, garlic mustard, and Japanese stiltgrass	Foliar spray, hand pull, fire, mow, basal spray, cut surface, grubbing,	Cheat minnow, pearl dace, eastern hellbender
Ramshorn/Shock Run Area	Deer Creek/ Sitlington Creek	Garlic mustard, Japanese stiltgrass, common privet	Foliar spray, hand pull, fire, mow, cut surface, basal spray, grubbing	Candy darter, New River shiner
Buzzard Ridge Area	Upper Elk River (Slaty Fork)	Garlic mustard	Foliar spray, hand pull, fire	None
Highland Scenic Highway Area	Cranberry River, Williams River	Numerous	All applicable methods may be applied	Appalachia darter, candy darter, Kanawha minnow, New River shiner and eastern hellbender
Cranberry Area, but outside of wilderness	Cranberry River (South Fork and Dog Fork), Cherry River	Garlic mustard, reed canary grass, crown vetch, autumn olive, bush honeysuckles, yellow iris	Foliar spray, hand pull, fire, basal spray, cut surface, grubbing, foliar application with wick/glove, mow	Appalachia darter, candy darter, Kanawha minnow, New River shiner and eastern hellbender
Middle Mountain near Rimel	Knapp Creek, Anthony Creek	Garlic mustard, tree of heaven	Foliar spray, hand pull, fire, basal spray, cut surface, grubbing	Appalachia darter, candy darter and New River shiner
Anthony Creek Area	Anthony Creek	Numerous	All applicable methods may be applied	Appalachia darter, candy darter and New River shiner

*Potential presence based on known occurrences from past collections (see Table AQ-2)

Desired Conditions

The Forest Plan desired conditions for aquatic resources is to maintain or expand the distribution of native and desired non-native fish and other aquatic species into previously occupied habitat, with inter-connectivity between and within meta-populations (p. II-29).

3.5.3 - Environmental Consequences

The following is an analysis of the potential effects on aquatic resources from control of non-native invasive plant species (NNIS). Of particular concern are potential effects associated with the use of herbicides. Please refer to Chapters 1 and 2 of this EA for more detailed descriptions of the project area and proposed activities. The health of aquatic resources is closely linked to the health of the soil resources, so please refer to the Soil Resources report for more detailed descriptions of soil resources in the planning area and the potential effects of the alternatives. This analysis addresses both programmatic and site-specific control of NNIS plants.

Direct and Indirect Effects

Direct effects are caused by activities that have a direct impact on aquatic resources and occur at the time the project is implemented. Activities in the action alternatives that may have direct effects on aquatic resources include pulling culverts and restoring drainages when roads are placed in storage. Otherwise, the proposed action is designed to avoid direct impacts to stream channels. **Indirect** effects are effects that occur at a later time or location from where or when the project is implemented. The primary concerns for potential indirect effects associated with the proposed action are changes to water quality due to herbicides leaching or running off into adjacent streams.

Alternative 1 - No Action

Under Alternative 1, current management activities and natural processes would continue, and no new activities proposed in this assessment would be implemented. Currently, the NNIS plant species targeted for control are having relatively little effect on the health of aquatic ecosystems on the Forest. In the short term, existing aquatic habitat conditions will likely persist or slightly worsen. In the long term, the continued expansion of NNIS plants could reduce riparian and aquatic conditions in localized areas. Plants such as yellow iris and purple loosestrife have been known to aggressively out-compete native vegetation and to alter the hydrology of streams and wetlands they infest, typically to the detriment of the many aquatic and wildlife species that depend on these areas.

No access management activities would be implemented under Alternative 1, so any existing erosion or other road-related problems associated with the roads proposed for storage would persist. These problems would have negative effects on aquatic resources over the long term.

Alternative 2 – Proposed Action

Alternative 2 includes the potential use of nine herbicides (clopyralid, glyphosate, imazapic, imazapyr, metsulfuron-methyl, picloram, sethoxydim, triclopyr, and fosamine) to help control or eradicate NNIS plant species. (Chapter 2 and Appendix A of this EA have details on where the herbicides will be used and the methods and rates of application.) The use of herbicides to treat NNIS plant species can potentially affect water quality by spray entering surface waters, leaching into ground water, or running off treated sites. There are a number of variables that affect the potential risk to aquatic environments, including properties of the herbicide, application rates, application methods, proximity to surface waters, soil properties, and precipitation patterns.

Methodology - The environmental risk associated with herbicide treatments was assessed for this project using information from Human Health and Ecological Risk Assessments and risk analysis worksheets prepared for the Forest Service by Syracuse Environmental Research Associates (SERA). This assessment also used the GLEAMS (Groundwater Loading Effects of Agricultural Management Systems) model that characterizes environmental risk for each herbicide in terms of a hazard quotient (HQ). The GLEAMS model was run using 125 percent of the proposed application rate for each herbicide to account for the potentially highest application rate allowed under the standard application contract—essentially a worst case scenario. If the HQ did not indicate an environmental concern, given a range of soil types and annual rainfall totals, the assumption was made that herbicide application would not be a concern given site-specific conditions on the Forest. If the HQ did indicate a concern, other than that resulting from an accidental spill, the model was rerun using more site-specific information to evaluate the potential risk. For this project, the site-specific condition information involved potential chemical concentrations derived from loam soils and an annual rainfall of 50 inches per year. The results represented a calculation of the potential concentration of each herbicide in a small stream assuming no buffer strip was present.

Results – SERA information indicated that most of the herbicides proposed for treatment under the Proposed Action have a low to very low potential for having adverse effects an aquatic species. The GLEAMS model results showed that, under site-specific conditions, there were no concerns with respect to aquatic resources at the proposed application rate and volume, outside of an accidental spill.

SERA did not have a risk assessment for fosamine, so there were no results from the GLEAMS model related to the proposed application rate and volume. Potential risks to aquatic resources from the use of fosamine are considered to be low. Fosamine rapidly degrades in aerobic and anaerobic environments, and should not pose a threat to groundwater and surface water (EPA 1995). Fosamine is practically non-toxic to aquatic organisms and does not appear to bio-accumulate. Although fosamine is highly soluble in water, it does not appear to readily leach or move into nearby waterways due to adsorption to soil particles (Tu et al. 2001 - http://www.csu.edu/cerc/documents/WeedControlMethodsHandbook.pdf).

For more details on the SERA information and GLEAMS modeling, see the Aquatic Resources Report in the project file.

Mitigation of Potential Herbicide Effects

Information obtained from reviews of the effects of herbicides, and on the results of recent monitoring work, has shown that these herbicides are safe to water quality and aquatic biota when they are applied according to label directions and all applicable laws and regulations. In general, the forest floor and soil is effective in minimizing the potential effect of herbicides on the watershed. Most forest soils have high infiltration rates that prevent overland flow of herbicides to streams. The chemical and biological processes of the soils alter the herbicide to a substance not considered harmful to vegetation and aquatic organisms. Please see the Soil Resource Report for a more detailed description of how herbicides and soils interact.

Additional safeguards related to herbicide treatment include:
- Buffer strips next to stream channels where only aquatic-registered herbicides would be used,
- Only herbicides registered for aquatic use would be used near open water
- Target-specific application methods,
- Wet weather restrictions on application,
- Strict adherence to herbicide label instructions, and
- Supervision of herbicide treatments by a State-certified applicator.

These measures have been incorporated into the project design and the recommended mitigation measures in Chapter 2. With the implementation of these safeguards and mitigation measures, no substantial adverse effects to streams, groundwater, or aquatic species are expected. If more than one herbicide is suitable for a particular treatment site, potential leaching and losses to runoff can also be minimized by selecting an herbicide that is less water-soluble or one that is less persistent in the environment. Sites that have been treated with herbicides can even be mulched to reduce erosion and potential movement of herbicides that are bound to soil particles. Options for non-herbicide control methods may be used within riparian areas and sites adjacent to stream channels to eliminate the risk of contamination or accidental spills.

Effects from Non-herbicide Treatments

Other NNIS plant control methods are identified in the proposed action. These include mowing, hand pulling, grubbing, biological controls and prescribed fire. These control methods are relatively limited in scope and/or result in very little disturbance. They are not expected to have a measurable effect on aquatic resources in the planning area. Sites are typically located along previously disturbed areas such as roads, skid roads, wildlife openings so additional watershed effects are not anticipated.

Road Storage Effects

In addition to the control of NNIS plant species, the proposed action includes an estimated 11.5 miles of roads to be placed in storage. The intent is to reduce vehicle access and the potential spread of NNIS plants into sensitive areas of the Shavers Fork drainage. The roads will remain on the transportation system, but they will be closed and their hydrologic conditions restored to avoid creating any resource problems during their dormant period. Activities to store roads may include removing culverts, constructing water bars or dips, seeding and mulching. Storage activities may result in a short-term pulse of sediments while the work is being implemented, but in the long term, watershed conditions should be enhanced by improving the drainage patterns along the roads and allowing them to revegetate and stabilize.

Cumulative Effects

Cumulative effects address the environmental consequences from activities implemented within the planning area in the past, present and reasonably foreseeable. The combination of activities on NFS and private lands can create effects at a watershed scale that otherwise would not be perceived as a problem at the project, or subwatershed scale.

The existing conditions of the aquatic resources in the planning area reflect the cumulative effects of past and present actions. As described earlier, streams in the planning areas are stressed by a number of factors related to physical habitat conditions and water chemistry. Future activities can contribute to these effects or alleviate some of the problems. Specific to this analysis, there is the potential to affect water chemistry as well as physical features, but on a limited scale.

Alternative 1 – No Action

Alternative 1 would result in the continuation of ongoing management actions and current aquatic conditions would persist as described under the Direct and Indirect Effects section. No NNIS plant activities associated with the proposed action would be implemented, so no cumulative effects would occur.

Alternative 2 – Proposed Action

Alternative 2 would utilize a variety of NNIS plant control measures at a number of sites across the Forest. Although widespread, the actions are relatively limited in scope within the planning area. No measurable effects are anticipated to the physical or chemical conditions of aquatic environment due to the implementation of this project and the incorporation of design and mitigation features that have been discussed.

The area proposed for chemical control is relatively limited in size, totaling 5,094 acres of site-specific treatments and numerous spot treatments of smaller areas across the Forest. If more treatments are implemented under this EA, the protocols established under the proposed action would be applied.

Risk assessment information and modeling show limited risk to aquatic resources, outside of an accidental spill, and only herbicides registered for aquatic use would be used near open water. The proposed herbicides are expected to degrade quickly in soil or water, within weeks or several months, by natural processes. Because 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 and water resources.

Effects to Sensitive Species and Aquatic MIS

Alternative 1 – No Action

No project activities would be implemented, so the existing aquatic resource conditions would persist. This is likely to have no effect to sensitive species reported in planning area. However, existing conditions likely limit the presence and productivity of the sensitive species, and those conditions are not likely to change under the No Action alternative. Over the 10-year period, effects from acid deposition or cumulative sediment sources could worsen. Native brook trout are also found in a number of streams within the planning area, and existing conditions likely limit their numbers and productivity. These populations should persist and their productivity should be relatively unchanged under the No Action alternative.

Alternative 2 – Proposed Action

The risks to sensitive aquatic species and native brook trout from implementing the proposed action are relatively minor. Outside of an accidental spill, no concerns have been identified that would affect aquatic MIS or sensitive species. Project design features—such as the use of less toxic forms of herbicide near streams, target-specific application methods, non-herbicide control techniques within riparian areas, and the protection of buffer strips—help to protect aquatic resources in the planning area. Watershed conditions would be improved where roads are placed in storage, but the beneficial effects are limited to localized areas and should not result in a measurable improvement to sensitive aquatic species or native brook trout habitat.

Unavoidable Adverse Impacts

Alternative 1, No Action, would not implement activities that would cause unavoidable adverse impacts. Alternative 2 would implement activities that would disturb soils and result in unavoidable soil disturbance. Activities that result in crossing stream channels (e.g. road storage) will have unavoidable short term impacts as the project is implemented. Design features and mitigation measures are intended to reduce the potential effects of NNIS plant control measures on aquatic resources.

Irreversible Or Irretrievable Commitment of Resources

There are no irreversible or irretrievable commitment of aquatic resources associated with this project.

3.5.4 - Consistency with the Forest Plan

All alternatives would be implemented consistent with Forest Plan goals, objectives, standards, and guidelines.

3.5.5 - Consistency with Laws, Regulations, and Handbooks

All alternatives would be implemented consistent with Forest Service laws, regulations, and handbooks regarding management of aquatic resources.

3.6 - Recreation and Scenery

3.6.1 - Scope of the Analysis

This section discloses the effects to recreation for the Forest-wide nonnative invasive species (NNIS) project. No specific issue was identified during public scoping for this project; however, the Forest recognizes that NNIS treatments could impact local recreational opportunities and uses during NNIS treatments. We also recognize that recreation use can affect the establishment and spread of NNIS on the Forest, and that NNIS can affect scenic resources and recreational opportunities and uses.

Spatial Boundary

The spatial boundary used to evaluate direct and indirect effects is the project area boundary. This area was selected because the trail systems, dispersed sites, developed sites, and recreation areas fall within this boundary. Recreational opportunities adjacent to or outside the boundary would not be impacted by treatments proposed in this project. The spatial boundary for cumulative effects is National Forest System land within the Forest proclamation boundary. Programmatic protocols under the Proposed Action could be used anywhere on the Forest and could have beneficial effects to scenery and recreation.

Temporal Boundary

The temporal boundary used to assess direct, indirect, and cumulative effects is generally ten years, which is the life of this NEPA decision. As discussed below, most negative impacts to the action alternative are immediate, but conditions would rapidly improve after treatment. It is assumed that any negative impacts under the No Action alternative (Alternative 1) from NNIS would continue, even after the ten-year time frame of this decision.

3.6.2 - Affected Environment

The desired condition for recreation management on the Monongahela National Forest (MNF) is to offer a wide spectrum of recreational opportunities. The Management Prescriptions in the Forest Plan provide for a variety of recreational settings, from semi-primitive backcountry, to roaded areas with motorized access and developed recreation complexes. Dispersed recreation opportunities abound for hiking, backpacking, fishing, hunting, and trail use.

The MNF also provides some of the highest quality scenic landscapes in the East. Enjoyment of these scenic resources is an integral part of many recreation experiences, and these scenic attractions have contributed to making a number of locations on the Forest nationally recognized recreation destinations (USDA Forest Service 2006a).

The MNF is a major outdoor recreation attraction in the State of West Virginia. Visitor use estimated the Forest receives about 1.3 million visitors annually. The Forest provides over 50 percent of the forested public recreation lands in the State.

Tourism represents an ever-increasing portion of the State economy in West Virginia, and trails are developing into the backbone of the state outdoor recreation industry (State of West Virginia 2002). Maintaining a high quality, accessible, and natural appearing trail system is important both for the resource and the visitors using trails on the Forest.

Currently, there are five congressionally designated wilderness areas on the MNF, totaling over 78,000 acres. Treatment of NNIS is allowed in wilderness areas. Management direction states that managers shall manage the wilderness resource to ensure its character and values are dominant and enduring. Also, management must maintain wilderness in such a manner that ecosystems are unaffected by human manipulation and influences so that plants and animals develop and respond to natural forces (USDA Forest Service 2007). The introduction of NNIS is well documented to be a human influence. However, this project does not include the treatment of NNIS within a congressionally designated wilderness or wilderness study area. Documented NNIS sites within any of the wilderness or wilderness study areas on the MNF are not considered priority sites for treatment at this time.

Recreation participation on the Forest was determined through surveys that took place in 2003. The top five popular recreation activities were: 1) viewing natural features, 2) viewing wildlife, 3) hiking/walking, 4) relaxing, and 5) driving for pleasure (USDA Forest Service 2004). With all of these activities, the condition of the natural environment is a key element.

Desired Conditions

Applicable Forest Plan desired conditions for recreation and scenery include: 1) recreation facilities are managed to provide a range of opportunities and development scales in a relatively safe environment (p. 11-32), and 2) scenic integrity is maintained or enhanced in areas of high scenic value and highly used recreation areas (p. II-35).

3.6.3 - Environmental Consequences

The following section describes environmental consequences for the two alternatives that were studied in detail on recreation and scenic resources.

Direct and Indirect Effects

Alternative 1 – No Action

Taking no action to control NNIS would have no immediate adverse impacts on recreation. However, failure to control the spread of NNIS may adversely affect recreation in the long term. The establishment of dense thickets of thistle, stilt grass, multiflora rose, and honeysuckle (just to name a few) could interfere with hiking, birding, viewing wildflowers, and other recreation opportunities. The spread of monocultures of NNIS could alter the natural aesthetics of the Forest. Visitors wishing to view the area's natural landscape may encounter a dominance of invasive plants and diminishing wildlife, as species become more difficult to see or go elsewhere to forage on native vegetation.

Alternative 2 – Proposed Action

Control of NNIS could have direct affects on recreation if treatment methods pose potential risk to the public, such as some herbicide use or prescribed fire, because the area would be closed to the public until treatment of NNIS is completed. Many of the proposed treatment sites are not popularly used for recreation, but others are, including the Stuart Recreation Area, Dolly Sods Scenic Area, Gaudineer Scenic Area, Highland Scenic Highway, Tea Creek Campground, Summit Lake, and the Blue Bend Recreation Area. Exclusionary effects would be temporary, as treatments would typically be completed over a period of hours or days. Additionally, Forest recreation staff would determine the appropriate timing for treatment of NNIS in popular recreation areas and avoid treatment during heavy recreation use days, such as weekends and holidays. Appropriate notification of the public would take place in local newspapers, through the Forest website, and postings at recreation sites and/or along trails. This information would provide advance warning of potential closings as well as information on NNIS treatment.

NNIS control could indirectly affect the recreation experience of visitors to the MNF. Area closures could be disappointing for visitors if they were not aware of the closure prior to arriving to recreate. Treated areas may not be visually pleasing, especially when herbicides and prescribed fire are used. However, the appearance of burned and dead vegetation would be short term, as vegetative recovery typically occurs within a growing season or two.

Long-term indirect benefits of treating NNIS include improved wildflower viewing and overall improvements to the aesthetics of the Forest by replacing monocultures of NNIS with a diverse mix of native plants. Backcountry and trail use on the Forest would be improved as thickets of NNIS are controlled.

Cumulative Effects

Past, present and future recreation activities contribute to the spread of invasive species. Recreational activities such as hiking and driving facilitate the spread of invasive species. It is anticipated that these activities will continue in the project area under either alternative.

As noted above, an indirect effect of no action would be to allow invasive species to continue to spread, largely unabated, in areas that would be proposed for treatment under the Proposed Action. This effect would contribute to the past, present, and reasonably foreseeable spread of NNIS infestations on the MNF. Other Forest projects may provide some very limited invasive species control in the future, but with no action there is a lost opportunity to coordinate and expand NNIS control activities, so the cumulative effect would result in further spread of invasive plants, which could have similar negative impacts on recreation as described under Direct and Indirect Effects for Alternative 1, above.

The possible impacts caused by treatment of NNIS as proposed in Alternative 2 would be temporary, relatively small, and essentially negligible to recreation. Impacts from treatments proposed in this project, when combined with impacts of past, present, and reasonably foreseeable activities, are not expected to contribute to any cumulative loss of recreation experiences. In addition, the programmatic protocols for treating NNIS under Alternative 2 could be used in areas beyond those proposed for treatment in this EA, which could lead to additional reductions of NNIS in recreation areas, with associated benefits for recreation uses and opportunities as described under Direct and Indirect Effects for Alternative 2, above.

Unavoidable Adverse Impacts

Treating NNIS under Alternative 2 would have the unavoidable impact of restricting recreational use during treatments. This impact is expected to be temporary and local, and minimized by mitigation proposed in Chapter 2.

Irreversible or Irretrievable Commitments of Resources

There are no irreversible or irretrievable commitment to the recreation and trails resources within or adjacent to the project area.

3.6.4 - Consistency with the Forest Plan

Alternative 2 is consistent with the 2006 Monongahela National Forest Land and Resource Management Plan for recreation management.

3.6.5 - Consistency with Laws, Regulations, and Handbooks

There are no conflicts between Alternative 2 and the Federal, regional, State, and local laws, land use plans, policies, and controls for recreation resources based on the following:
- Monongahela National Forest Wild and Scenic River Study Report.
- The National Wild and Scenic Rivers Act of 1968.
- The Wilderness Act, Public Law 88-577, September 3, 1964.
- The Eastern Wilderness Act of January 3, 1975 (Dolly Sods and Otter Creek Wilderness areas and the Cranberry Wilderness Study Area).
- Monongahela National Forest West Virginia Land Designations, Public Law 97-466, January 13, 1983 (Cranberry Wilderness, Laurel Fork North and South Wilderness Areas).

3.7 – Human Health and Safety

3.7.1 - Scope of the Analysis

This analysis discloses expected direct, indirect, and cumulative effects of the proposed Monongahela Forest-wide Nonnative Invasive Plant Management project on human health and safety. The Proposed Action would involve prevention and treatment activities at a variety of locations across the Forest.

The Proposed Action (Alternative 2) is the only action alternative. A no action alternative (Alternative 1) is also being studied to provide a basis for comparison to current conditions and conditions that are expected to occur in the absence of a coordinated Forest-wide management effort for invasive plants.

Spatial Boundary

For direct, indirect, and cumulative effects, the spatial boundary of the analysis is the proclamation and purchase unit boundary of the Monongahela National Forest (MNF) (see Figure 1.1 in Chapter 1). This boundary includes all activities proposed in all alternatives. Because effects to human health and safety are expected to be minor or nonexistent (see Direct and Indirect Effects, below), off-site effects are not expected to occur. Therefore, the proclamation and purchase unit boundary is an appropriate boundary for analyzing effects of the activities. The proclamation and purchase unit boundary includes approximately 920,000 acres of National Forest land and approximately 780,000 acres of private, state, and other federal land.

Temporal Boundary

The temporal boundary for direct, indirect, and cumulative effects is ten years. Initial site-specific control activities are expected to be completed within that time frame. Although follow-up control and control of additional sites may occur beyond ten years, a review of the NEPA documentation is expected to be conducted at that time, and any effects beyond the scope of those considered here can be disclosed at that time.

3.7.2 - Affected Environment

Most human visitors to the Monongahela National Forest are involved in recreational activities, such as hunting, fishing, hiking, camping, mountain biking, and horseback riding. Visitor use estimates indicate that the Forest received about 1.3 million recreational visits during fiscal year 2003 (USDA Forest Service 2006a). The Forest provides over 50 percent of the forested public recreation lands in the state of West Virginia.

Most other human visitors to the Forest are involved in the management of the Forest. These visitors include Forest employees, employees of the West Virginia Division of Natural Resources, loggers and permittees, Forest Service and university researchers, and contractors.

A third group of visitors to the Forest is comprised of subsistence users of Forest resources. This group includes people who gather firewood, berries, medicinal herbs, or other non-timber forest products.

The population that could be exposed to hazards related to invasive plant control can be divided into two groups. The group with the most potential for exposure to hazards consists of the people conducting the invasive plant control work. This group would include Forest Service employees and contractors, but could also include cooperators such as employees of other agencies, employees of non-governmental organizations, volunteers, and adjacent landowners involved in cross-boundary cooperative control activities. This group is termed “workers” in this analysis. The second group consists of anyone else who may be in the treatment area for any reason other than the invasive plant control work. This group is termed “general public” in this analysis, but the group can include Forest Service employees, contractors, cooperators, etc. who may be in the control area for some reason other than the control work.

Desired Conditions

Desired conditions in the Vegetation section of the Forest Plan indicate that pesticide treatments are to pose little or no risk to humans (USDA Forest Service 2006b, p. II-18). Desired conditions in the Recreation Resources section state that recreation programs and facilities are to meet all applicable local, state, and national standards for health and safety (p. II-32).

3.7.3 - Environmental Consequences

Direct and Indirect Effects

Alternative 1 - No Action

The No Action alternative would not implement any new uses of herbicides or mechanical control methods. Therefore, it would not expose workers or the general public to any of the hazards associated with the Proposed Action. The No Action alternative would allow non-native invasive plants to continue to spread and grow, including tree of heaven. With this species becoming more prevalent, mechanical maintenance of roads, trails, recreation sites, and administrative sites would be more likely to expose workers and the public to the toxic sap, which causes myocarditis. This potential increase in exposure could be mitigated through worker training and standard safety practices such as protective clothing.

Alternative 2 - Proposed Action

Effects to Workers
Workers conducting invasive plant control activities could be exposed to a variety of potentially hazardous situations, including herbicide drift and spills, accidents involving hand tools used for cutting and grubbing, back strain from bending over to pull plants, general tripping/falling hazards due to working in rough terrain, and natural hazards such as poison ivy and stinging insects. Road storage activities may expose workers to typical hazards associated with working on or around heavy equipment.

Herbicide risks to workers were analyzed using worksheets prepared for a group of human health and ecological risk assessments that were conducted for many of the pesticides that are commonly used by the Forest Service nationwide (Durkin 2007). One of the herbicides proposed for use by this project, fosamine ammonium, is not covered by an existing Forest Service risk assessment. This herbicide was analyzed based on an assessment contained in The Nature Conservancy's *Weed Control Methods Handbook* (Tu et al. 2001) and information from the Washington State Department of Transportation (2006). The risk assessment worksheets consider several typical scenarios that could potentially lead to a worker being exposed to herbicide. These scenarios include general exposure during application, which incorporates inhalation and dermal absorption; an accidental spill onto an unprotected part of the body; and use of contaminated clothing such as gloves. The worksheets also include some exposure scenarios that are not applicable to this project, such as exposures from aerial application. These exposure scenarios are not included in this analysis because they would not occur under the Proposed Action. Risk assessment worksheets were run using project-specific estimates of the maximum application rates for each herbicide. These maximum application rates could occur during broadcast applications to large, continuous infestations. Because only about 3 percent of the proposed site-specific treatments would consist of such broadcast treatments, the risk assessments are considered worst-case scenarios.

The risk assessments summarize potential risks as a hazard quotient, which is the ratio of the expected exposure dose to the highest dose for which research has documented no adverse effects. A hazard quotient greater than 1.0 indicates that the expected exposure dose exceeds the highest dose that can safely be assumed to have no adverse effect. Therefore, a hazard quotient greater than 1.0 indicates that the exposure scenario in question may pose a risk of adverse effects. The risk assessment worksheets do not specify what those adverse effects might be, although the risk assessment narratives that accompany the worksheets summarize the adverse effects that have been observed for each herbicide (Durkin 2001, Durkin 2003a, Durkin 2003b, Durkin and Follansbee 2003, Durkin and Follansbee 2004a, Durkin and Follansbee 2004b, Durkin and Follansbee 2004c, Klotzbach and Durkin 2004).

Of the eight herbicides with risk assessment worksheets for workers, only Triclopyr produced any hazard quotients greater than 1.0 at a maximum application rate of 1 lb per acre (Table HS-1). The BEE formulation of triclopyr produced a hazard quotient greater than 1.0 for the scenario that involved a sensitive worker wearing gloves that have been grossly contaminated on the inside for an hour a day for 90 days. Project-specific application prescriptions and contracts would contain specifications requiring safe handling of herbicides, prompt changing of contaminated clothing, and prompt washing of any affected body parts. Therefore, hazardous exposure via contaminated clothing is unlikely to occur.

Table HS-1. Summary of Herbicide Hazard Quotients for Workers, Monongahela Forest-Wide Nonnative Invasive Plant Management Project

Herbicide	Exposure Scenario	Chronic	
		Typical Exposure	Maximum Exposure
Clopyralid Max. app. rate 0.625 lbs/ac	Contaminated gloves	0.00005	0.0002
	Spill on legs	0.0004	0.002
	General exposure – backpack spray	0.05	0.3
	General exposure – mechanical ground spray	0.09	0.6
Glyphosate Max. app. rate 5.0 lbs/ac	Contaminated gloves	0.0001	0.0005
	Spill on legs	0.007	0.002
	General exposure – backpack spray	0.03	0.2
	General exposure – mechanical ground spray	0.06	0.4
Imazapic Max. app. rate 0.47 lbs/ac	Contaminated gloves	0.08	0.1
	Spill on legs	0.002	0.005
	General exposure – backpack spray	0.01	0.08
	General exposure – mechanical ground spray	0.02	0.1
Imazapyr Max. app. rate 0.63 lbs/ac	Contaminated gloves	0.0008	0.002
	Spill on legs	0.0003	0.0008
	General exposure – backpack spray	0.003	0.02
	General exposure – mechanical ground spray	0.006	0.04
Metsulfuron methyl Max. app. rate 0.07 lbs/ac	Contaminated gloves	0.000004	0.00002
	Spill on legs	0.00001	0.0001
	General exposure – backpack spray	0.004	0.02
	General exposure – mechanical ground spray	0.007	0.04
Picloram Max. app. rate 0.63 lbs/ac	Contaminated gloves	0.009	0.02
	Spill on legs	0.0004	0.001
	General exposure – backpack spray	0.04	0.3
	General exposure – mechanical ground spray	0.07	0.5
Sethoxydim Max. app. rate 0.47 lbs/ac	Contaminated gloves	0.02	0.03
	Spill on legs	0.001	0.003
	General exposure – backpack spray	0.07	0.4
	General exposure – mechanical ground spray	0.1	0.8
Triclopyr (acid formulation) Max. app. rate 1.0 lbs/ac	Contaminated gloves	0.002	0.005
	Spill on legs	0.02	0.07
	General exposure – backpack spray	0.3	***1.6***
	General exposure – mechanical ground spray	0.4	***3***
Triclopyr (BEE formulation) Max. app. rate 1.0 lbs/ac	Contaminated gloves	0.7	***1.3***
	Spill on legs	0.07	0.1
	General exposure – backpack spray	0.3	***1.6***
	General exposure – mechanical ground spray	0.4	***3***

Both formulations of triclopyr also produced chronic hazard quotients greater than 1.0 for the maximum exposure scenarios associated with backpack spray and mechanical ground spray applications. These exposure scenarios assume that a worker would be applying triclopyr for 8 hours a day for a 90-day period. Although this exposure scenario seems somewhat implausible, as a precaution, project-specific application prescriptions and contracts would contain the following conditions:

- No worker is allowed to apply or handle triclopyr for more than 7 hours in any one day.

- No worker is allowed to apply or handle triclopyr for more than 14 consecutive days. If a worker has been applying or handling triclopyr for 14 consecutive days on this project or any other job prior to working on this project, the worker must refrain from working with triclopyr for 7 consecutive days prior to beginning or resuming such work on this project.

The typical backpack and mechanical application scenarios, which did not produce problematic hazard quotients, used a 7-hour work day for a 90-day period. Therefore, with the above conditions in place, and assuming safe handling practices and label directions are followed, handling and applying triclopyr should not adversely affect workers.

Risk assessments for clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, and sethoxydim did not produce any hazard quotients greater than 1.0 for workers. Therefore, the proposed use of these herbicides should not present a hazard to workers, provided safe handling practices and label directions are followed.

Fosamine ammonium is considered to have very low toxicity for oral exposure, but moderate toxicity when exposure occurs through dermal absorption (Tu et al. 2001). A risk assessment conducted by the Washington State Department of Transportation concluded that for a typical roadside application scenario, fosamine ammonium presented a negligible risk to workers (WSDOT 2006). For this project, fosamine ammonium is proposed for use in the control of roadside invasives along the Highland Scenic Highway, which is similar to the scenario modeled in the WSDOT risk assessment. Therefore, as long as label directions and safe handling practices are followed, fosamine ammonium is not expected to present a hazard to workers.

Other non-herbicide-related risks to workers would be mitigated through standard safety practices. Existing job hazard analyses would be implemented, and job hazard analyses would be created for any activities not covered by an existing analysis. Tail gate safety sessions would be conducted prior to beginning work. Any cooperators and volunteers working on the project would be covered by these same safety practices.

Effects to General Public

The risk of direct effects to the general public is very low because active work sites would be closed to the public during the application of herbicides and the implementation of mechanical control measures. The potential for indirect or delayed effects would be mitigated by signing to alert the public to hazards, as well as area closures until sites are considered safe for re-entry. Re-entry restrictions printed on herbicide labels would be followed.

Herbicide risks to the general public were analyzed using the risk assessment worksheets that were also used to assess worker risk (Durkin 2007). Fosamine ammonium was assessed using The Nature Conservancy's *Weed Control Methods Handbook* (Tu et al. 2001) and information from the Washington State Department of Transportation (2006). The risk assessment worksheets consider several typical scenarios that could potentially lead to a member of the general public being exposed to herbicide. These scenarios include contact with treated vegetation and dietary exposure through consumption of contaminated fruit, vegetation, water, and fish. Scenarios involving direct spray of a person, consumption of water after an accidental spill, and consumption of fish by a subsistence population were considered implausible for this project and are not discussed here. As with the worker scenarios, risk assessment worksheets were run using project-specific estimates of the maximum application rates for each herbicide, so the risk assessments are considered worst-case scenarios.

Clopyralid, glyphosate, imazapic, picloram, sethoxydim, and both formulations of triclopyr produced hazard quotients greater than 1.0 for the consumption of contaminated vegetation (Table HS-2). Triclopyr produced a hazard quotient greater than 1.0 for both the typical and the maximum exposure scenario, whereas the others only produced a problematic hazard quotient for the maximum exposure scenario. The maximum exposure scenario assumes that a person consumes freshly treated vegetation equal to 1 percent of body weight. The typical scenario assumes that a person consumes freshly treated vegetation equal to 0.36 percent of body weight. This exposure scenario is considered unlikely to occur because most invasive plants are not typically eaten by people. However, garlic mustard, which comprises most of the site-specific treatment acreage, can be used as a potherb, so the scenario is not totally implausible. Also, inadvertent overspray could contaminate berries or other edible plants. To guard against this scenario, project-specific application prescriptions and contracts would contain the following conditions:

- Where foliar herbicide applications are conducted near areas that are accessible to the general public, such as roads, trails, trailheads, recreational sites, administrative sites, etc., the treatment areas shall be closed to the public during treatment. Treated areas shall be signed to warn of the herbicide application, and shall remain signed until the treated vegetation dies or defoliates, or until enough time has passed for the herbicide to degrade to nontoxic levels.

- Where foliar herbicide applications are conducted near areas that are accessible to the general public, such as roads, trails, trailheads, recreational sites, administrative sites, etc., any edible berries or other fruit that are contacted by the herbicide shall be removed from the site.

These conditions should eliminate the possibility of exposure through the consumption of contaminated vegetation or fruit.

In addition to the consumption scenarios, both formulations of triclopyr produced hazard quotients greater than 1.0 for vegetation contact. This scenario assumes that a person wearing shorts and a tee-shirt contacts freshly treated vegetation for one hour and does not wash affected areas for 24 hours. Given the signing required by the condition above, this scenario is considered extremely unlikely to occur.

Risk to the general public from fosamine ammonium was evaluated in a risk assessment conducted by the Washington State Department of Transportation (WSDOT 2006). The scenarios were based on typical roadside application, which is similar to the use of fosamine ammonium that is proposed in this project. A maximum exposure scenario concluded that consumption of drift-contaminated vegetables could pose a moderate risk. The signing and fruit removal conditions discussed above should prevent such a scenario from occurring; therefore, the proposed use of fosamine ammonium is unlikely to affect human health and safety adversely.

Table HS-2. Summary of Herbicide Hazard Quotients for The General Public, Monongahela Forest-Wide Nonnative Invasive Plant Management Project

Herbicide	Exposure Scenario	Acute		Chronic	
		Typical Exposure	Maximum Exposure	Typical Exposure	Maximum Exposure
Clopyralid Max. app. rate 0.625 lbs/ac	Vegetation contact	0.001	0.006	NA	NA
	Dietary: Fruit	0.01	0.2	0.002	0.4
	Vegetation	0.1	***1.1***	0.3	***3***
	Water	0.001	0.007	0.0008	0.002
	Fish	0.004	0.004	0.000004	0.000008
Glyphosate Max. app. rate 5.0 lbs/ac	Vegetation contact	0.003	0.007	NA	NA
	Dietary: Fruit	0.03	0.5	0.02	0.3
	Vegetation	0.4	***3***	0.2	***1.8***
	Water	0.004	0.1	0.00007	0.0007
	Fish	0.005	0.005	0.005	0.005
Imazapic Max. app. rate 0.47 lbs/ac	Vegetation contact	0.007	0.01	NA	NA
	Dietary: Fruit	0.01	0.2	0.0007	0.03
	Vegetation	0.2	***1.3***	0.01	0.2
	Water	0.00004	0.0000007	0.0000005	0.000001
	Fish	0.0006	0.0006	0.0000000003	0.0000000004
Imazapyr Max. app. rate 0.63 lbs/ac	Vegetation contact	0.0007	0.002	NA	NA
	Dietary: Fruit	0.003	0.05	0.001	0.02
	Vegetation	0.04	0.3	0.02	0.2
	Water	0.00004	0.00000008	0.0000007	0.000009
	Fish	0.001	0.001	0.000000002	0.00000002
Metsulfuron methyl Max. app. rate 0.07 lbs/ac	Vegetation contact	0.00005	0.0004	NA	NA
	Dietary: Fruit	0.003	0.06	0.001	0.02
	Vegetation	0.05	0.4	0.02	0.2
	Water	0.00004	0.000002	0.000002	0.000004
	Fish	0.00009	0.00009	0.000000005	0.00000001
Picloram Max. app. rate 0.63 lbs/ac	Vegetation contact	0.001	0.003	NA	NA
	Dietary: Fruit	0.04	0.6	0.005	0.07
	Vegetation	0.5	***4***	0.06	0.5
	Water	0.01	0.07	0.00009	0.0004
	Fish	0.02	0.02	0.0000004	0.000002
Sethoxydim Max. app. rate 0.47 lbs/ac	Vegetation contact	0.002	0.004	NA	NA
	Dietary: Fruit	0.009	0.1	0.003	0.05
	Vegetation	0.1	***1.1***	0.04	0.3
	Water	0.01	0.04	0.0001	0.0002
	Fish	0.01	0.01	0.000004	0.000006
Triclopyr (acid formulation) Max. app. rate 1.0 lbs/ac	Vegetation contact	0.6	***1.3***	NA	NA
	Dietary: Fruit	0.06	0.7	0.03	0.5
	Vegetation	***3***	***27***	***1.6***	***18***
	Water	0.007	0.05	0.02	0.03
	Fish	0.0007	0.0007	0.000005	0.000009
Triclopyr (BEE formulation) Max. app. rate 1.0 lbs/ac	Vegetation contact	***1.3***	***1.7***	NA	NA
	Dietary: Fruit	0.06	0.7	0.03	0.5
	Vegetation	***3***	***27***	***1.6***	***18***
	Water	0.0009	0.001	0.006	0.008
	Fish	0.0007	0.0007	0.000002	0.000002

Cumulative Effects

Alternative 1 - No Action

The expected increase of tree of heaven under the No Action alternative could contribute to the cumulative health effects of the spread of this species on private lands within the Forest boundary. Information is not available to quantify this effect.

Alternative 2 - Proposed Action

Due to standard safety practices and the specific mitigations outlined above, the Proposed Action is expected to have little or no direct or indirect effects on human health and safety. Therefore, it would not contribute to the cumulative effects of other actions.

Unavoidable Adverse Impacts

Neither alternative is expected to have unavoidable adverse impacts on human health or safety.

Irreversible or Irretrievable Commitment of Resources

Neither alternative would make any irretrievable or irreversible commitment of human health and safety. The Proposed Action would have little or no effect on human health and safety. Under the No Action alternative, the potential increase in myocarditis related to tree of heaven could be mitigated through safety practices. The condition is reversible once exposure to the sap ceases.

3.7.4 - Consistency with the Forest Plan

The Proposed Action would comply with all Forest Plan standards and guidelines related to human health and safety (VE29, VE33, VE34, VE35, and VE37).

3.7.5 - Consistency with Laws, Regulations, and Handbooks

Both alternatives are consistent with the following laws and regulations:

- Federal Insecticide, Fungicide, and Rodenticide Act
- West Virginia Pesticide Control Act of 1990
- Forest Service Handbook 2109.14 Chapters 10, 20, and 30.

3.8 – Wildlife Resources

3.8.1 - Scope of the Analysis

This analysis addresses effects to wildlife species that are federally listed as threatened or endangered (T&E), and also those species that are listed as Regional Forester Sensitive Species (RFSS) on the Monongahela National Forest (MNF or Forest). The analysis also covers effects to terrestrial Management Indicator Species (MIS) and Birds of Conservation Concern (BCC). This section discloses effects to Forest wildlife resources from both NNIS and from proposed treatments to reduce, eradicate, or prevent NNIS on the Forest.

Spatial Boundary

For the purposes of this document, analysis of **direct and indirect** effects of the proposed action will be focused on specific treatment areas, as listed in Chapter 2 of the EA, and adjacent habitats. The spatial boundary for analysis of **cumulative** effects is the Monongahela National Forest. This was determined to be the appropriate approach because, while proposed activities are site-specific and not expected to have impacts to habitats outside the area of treatment and any associated drift zone, this analysis is considered programmatic in that additional site-specific areas may be identified within the MNF in the future. Furthermore, cumulative effects to wildlife resources include those for species using more than one habitat type. However, within that broad spatial boundary, effects will be limited to particular habitat types. NNIS issue areas focused on by this proposal are generally limited to disturbed habitats within the Forest, (e.g., roadway right-of-ways and skid roads, range allotments or wildlife openings, and reclamation sites) and high human traffic areas. Thus, little treatment is planned for, and no negative effects are expected for, forest interior habitats, extensive wetland areas, wilderness areas, or the interior of other large unbroken habitat patches as a result of the proposed action.

For those wildlife species that are considered wide-ranging or habitat generalists, the project area makes up a relatively small part of the species range. For more endemic species and habitat specialists, determining suitable habitat on the Forest and in treatment areas is adequate to disclose potential impacts to those species. This determination was based on review of the project area, current information, and best professional judgment. Cumulative effects address the environmental consequences from activities implemented or projected within the Forest in the past, present and reasonably foreseeable future.

Temporal Boundary

Although the herbicides proposed to be used have half-lives in soils that average from 5-141 days (Project File, Wildlife Resources Report, Table 6), the temporal scale for the **cumulative** effects analysis will be 10 years, which coincides with the Forest Plan Planning cycle and allows for initial and subsequent treatments of NNIS infestations to occur. Individual areas may be treated and re-treated during this time period to control NNIS plant species as needed, assuming that no new information comes to light regarding potential unforeseen impacts. **Direct and indirect** effects to wildlife resources are not expected to last beyond the treatment periods.

3.8.2 Affected Environment

Wildlife Resources

The MNF is located in the east-central portion of West Virginia among the Ridge and Valley and Allegheny Mountains Geographic Regions. The geology of the area features steep north-south mountain ridges and deep river valleys, with elevations ranging from 900 feet near Petersburg to 4,863 feet atop Spruce Knob, West Virginia's highest point. Due to its geographic location, elevation range, and complex geology, the Forest has great vegetative diversity. A number of rare plants and plant communities exist, with some at their northern- or southernmost limit of their ranges. This topographic and vegetative diversity goes hand-in-hand with the diversity of wildlife habitats and associated wildlife species that can be found on the Forest.

As a result of the topographic, geologic and vegetative diversity noted above, the MNF and adjacent areas provide diverse habitat for a a wide variety of animal species during part or all of their life cycle; these species include approximately 34 amphibians, 24 reptiles, 229 birds and 65 mammals. Landscape patterns unique to this area also exert a strong influence on the animal communities present. Plant communities are broken into patterns of islands, pennisulas and corridors in a mosaic pattern, which includes a significant amount of natural edge with corresponding wildlife benefits and, in the case of interior dependent species, certain restraints.

Game species, including deer, black bear, hares, rabbits, turkey and ruffed grouse may be found in or near the project area. A variety of nongame species—including raptors, songbirds, small mammals, reptiles, and amphibians—may also use habitats in or adjacent to the project area. Some of these species require very specific habitat while others are generalist in nature. Other species, particularly those with large home ranges, may use several habitats within the project area on an intermittent basis (different habitats for different life history requirements).

The programmatic element of the EA (see Chapter 2) establishes protocols for prevention and control of NNIS plants where they may threaten important Forest ecosystems or resources. NNIS plants are often dispersed along travel corridors and other disturbed areas, so the affected environment for wildlife resources could be any habitat across the Forest. However, a full analysis of the existing conditions and environmental effects for all existing or potential forms of wildlife within the MNF is impossible to address. Consequently, this report addresses wildlife species and habitats that may occur within the treatment areas generally, while providing greater detail for representative species of concern such as BCC, MIS, RFSS or T&E species.

Birds of Conservation Concern (BCC)

The MNF hosts over 919,000 acres of diverse habitat used by 230 species of birds. The Forest is comprised of stands of various tree species and age classes, and non-forest areas (e.g., shrubby habitats, wetlands, grassy meadows, other natural and maintained openings, cliffs and rocky outcrops, and streams), which all provide places for birds to feed, rest, and raise their young. This diverse landscape provides habitat for some 70 species of resident birds, 89 breeding neotropical migrants, and 71 non-breeding migratory bird species.

Based on the document "Birds of Conservation Concern 2002" (USFWS 2002) the MNF and the state of West Virginia occur within the Appalachian Mountain Bird Conservation Region (BCR) 28. There are 27 species of birds that are listed as BCC for the Appalachian Mountain BCR. However, based on Forest bird surveys, range maps, and the WV Breeding Bird Atlas (Buckelew and Hall 1994), several of these species do not occur on the MNF; the species that are known or expected to occur on the Forest based on surveys or the Atlas are listed in Table WL-1. To simplify a discussion of the potential affects of the alternatives to the remaining species, they have been grouped by the type of habitat they use.

Table WL-1. Birds of Conservation Concern and Their Primary Habitats on the Forest

Forest (deciduous, coniferous, and mixed)	
Kentucky Warbler	Dense understory of mature, humid deciduous forest, wooded ravines, oak-pine or northern hardwood forest
Louisiana Waterthrush	Along streams flowing though heavily wooded valleys, deciduous forest, some hemlock, northern hardwoods
Worm-eating Warbler	Mature deciduous woodland that lacks dense ground cover, mature beech-maple or oak-pine forest
Cerulean Warbler	Mature forest, mixed mesophytic and oak forest below 600 meters in elevation, common in the west part of the state, sparse in the mountains.
Wood Thrush	Mature or near mature deciduous forest, prefers dense shade on forest floor.
Acadian Flycatcher	Mature mixed deciduous forest dissected by small streams and ravines; lower elevations; not in spruce, oak or pine forest; nests over water; more common in the west side of the state.
Yellow–bellied Sapsucker (breeding)	Upland black cherry forest, cut over mature hardwoods, spruce-hardwoods.
Whip-poor-will	Mixed deciduous woods, upland oak-hickory forest, not in spruce, hardwood-pine or hardwood-hemlock, few in northern hardwoods, rare in dense forest.
Prothonotary Warbler	Swamps (wooded wetlands) and large streams, not in the highlands.
Northern Saw-whet owl (breeding populations)	Spruce and mixed spruce-hardwoods, swampy areas in coniferous forest, high elevations.
Forest openings; woodlands	
Red-headed Woodpecker[1]	Open oak groves with little understory, groves of oaks and grazing lands, Ohio River valley and low elevations in the Allegheny Mountains.
Black-billed Cuckoo	Moist thickets in low overgrown pastures and orchards; also occurs in thicker undergrowth and sparse woodlands.
Olive-sided Flycatcher[1]	Openings in northern spruce forests, such as bogs, old beaver ponds, burned over slash from lumber operations with scattered snags and trees for perches.
Early successional habitats (e.g., young forest, shrubland, wetland, and grassland)	
Golden-winged Warbler[1]	Low, brushy second growth forest and open woodland, pasture lands and powerline rights of way at higher elevations.
Prairie Warbler	Young pine forests and brushy scrub, young second growth hardwoods, overgrown pastures, Christmas tree plantations.
Sedge Wren	Wet grass & sedge meadows, nests near water surface, needs wetlands, grassy marshes
Henslow's Sparrow[1]	Grassy, weed-filled fields, fields of broom sedge and weeds, early years of plant succession.
Cliff (or cliff-like) habitat	
Peregrine Falcon[1]	Nests in cliffs, bridges over water, or high rise buildings in urban areas. Feeds over fields, forest, or urban areas by catching birds during flight.

[1] Also a Regional Forester Sensitive Species.

Of the 18 species of BCC in BCR28 that expected to occur on the MNF, ten utilize primarily mature forest habitats (Table WL-1). Most of the remaining species either use more open woodland, early successional habitats, or a combination of the two. The peregrine falcon has very specific nest site requirements (cliffs/rock faces), but forages over a broad variety of habitats. Because the proposed NNIS control treatments are restricted to areas where disturbance has allowed invasion of non-native plant species, forest interior habitats will generally not be impacted by the proposed control treatments. However, a forested site in the Ramshorn area is proposed for treatment of garlic mustard that has encroached into the woodland. This site has some disturbance (e.g., skid roads) that probably assisted the spread of the invasive, and control is proposed as spot treatment where needed rather than a broadcast spray across the area. Because of the primary habitat types that are proposed for treatment, adverse effects are highly unlikely for those species that are found primarily in mature forested habitats during the breeding season and, as such, these species and their primary habitats will not be discussed further in this document. Potential impacts to the species found in earlier successional habitats (either for nesting or foraging) during the summer are discussed in more detail in the EA Effects section.

Desired Conditions

The amount, distribution, and characteristics of habitat are present at levels necessary to maintain viable populations of native and desired non-native wildlife and fish species (Forest Plan, p. II-29).

Management Indicator Species

National Forest Management Act regulations have directed the National Forests to identify Management Indicator Species (MIS). A purpose of this designation is to manage for the needs of one species that is "representative" of a given habitat and thereby manage for the habitat needs of numerous other species. Typically, MIS have fairly specific habitat requirements. Changes in their condition and population are used to assess impacts of management actions on other species that may also use those habitats. The 2006 Monongahela Forest Plan identifies four MIS: West Virginia northern flying squirrel *(Glaucomys sabrinus fuscus)*, cerulean warbler *(Dendroica cerulea)*, wild turkey *(Meleagris gallopavo)*, and wild brook trout *(Salvelinus fontinalis)*.

Table WL-2. Wildlife MIS and Their Habitats on the Forest

Species	Typical Habitat
Cerulean warbler (*Dendroica cerulea*)	Mid-late and late successional (>80 years old) mixed mesophytic and cove forest. This species is considered a forest interior species that is believed to be sensitive to fragmentation; generally associated with large trees, gaps, and complex canopy layering characteristic of old-growth forests.
Wild turkey (*Meleagris gallopavo*)	Oak and pine-oak forest 50-150 years old, with sustainable mast production, open understory typical of fire-maintained conditions, and open/semi-open inclusions of woodlands and savannas. This species requires herbaceous openings for brood range, and uses shrub/sapling stands for nest sites.
WV northern flying squirrel (*Glaucomys sabrinus fuscus*)	Mid-late and late successional (>80 years old) spruce and spruce/northern hardwood forest. This species is associated with certain late successional characteristics (snags, canopy gaps, moist microclimate).

This analysis will discuss potential effects to the bird and mammal MIS species and their habitats from the alternatives (Table WL-2); brook trout are addressed in the Aquatics Resources section of the EA.

Cerulean Warbler

The cerulean warbler is a forest interior species that is believed to be sensitive to fragmentation, and is typically associated with large trees and complex structure characteristic of mature and old-growth forests. Breeding bird surveys have shown that *D. cerulea* is common and broadly distributed across West Virginia (Buckelew and Hall 1994). Breeding bird surveys and point count surveys on or near the MNF indicate that the species is also broadly distributed across the Forest in suitable habitat (MNF, unpublished data). Because the species' mature forest habitat is generally characterized by gaps and complex canopy layering, certain forest management actions may benefit local populations. The Forest is involved in an ongoing study, associated with a broader regional research effort across the species' breeding range, to determine the potential effects of differing forest harvest types on cerulean populations. As described in Chapters 1 and 2 of this EA, NNIS species typically inhabit early-mid successional habitats. Thus, treatments are unlikely to affect the primary habitat of the cerulean warbler in any measurable fashion.

Wild Turkey

The wild turkey, found throughout much of the MNF, is typically associated with a mosaic of grassy openings, thickets of dense cover, scattered clumps of conifers, and extensive tracts of mature/late-successional forests. Eastern wild turkeys eat a variety of plant and animal matter as it is available but important fall and winter foods are the fruits, seed, or nuts from wild grape, oaks, beech, dogwood, yellow poplar, and black cherry. While acorns are the primary food of wild turkey in fall, winter and into spring, insects, herbaceous material and grass seed dominate the diet in summer (Dickson 1990). Eastern wild turkey and their young use grass/forbs habitat to forage for insects in the late spring and summer months. Because NNIS species targeted for control treatments typically inhabit early-mid successional habitats, no effects are expected to the mature forest component of wild turkey habitat. However, edge habitat, roadways and other disturbed areas adjacent to these forested areas may be treated, as may herbaceous openings and early successional habitats used by turkeys for foraging in spring and summer.

West Virginia Northern Flying Squirrel

See "Regional Forester Sensitive Species" section for a description of this species, also an RFSS.

Desired Conditions

The amount, distribution, and characteristics of habitat are present at levels necessary to maintain viable populations of native and desired non-native wildlife and fish species. Human activities do not prevent populations from sustaining desired distribution and abundance, especially during critical life stages (Forest Plan, p. II-29).

Threatened and Endangered Species

Federally threatened and endangered animal species on the Forest include the Indiana bat (*Myotis sodalis*), Virginia big-eared bat (*Corynorhinus townsendii virginianus*), and Cheat Mountain salamander (*Plethodon nettingi*; Table WL-3). In addition to direct observations of these species via capture, the MNF has mapped broader habitat areas based on distances from hibernacula or maternity caves (for the bats) and broadly mapped or modeled habitat for the threatened Cheat Mountain salamander (CMS) as well as the WVNFS, an RFSS. Our databases, observations and discussions also indicate occurrence or potential habitat for many RFSS within the proposed NNIS control treatment areas. Those species are listed in Table WL-3 along with their status and typical habitats.

Table WL-3. RFSS and T&E Animal Species and Their Habitats on the Forest

Threatened and Endangered Species	
Species (Federal Status)	**Typical habitat**
Indiana bat (Endangered)	Summer: wooded or semi-wooded areas, often along streams or other small openings; tree cavities and loose bark of living or dead trees used for roosting and maternity colonies. Hibernacula: caves. Fall swarming: near the hibernacula; males roost in trees nearby during the day and fly to the cave during the night.
Virginia big-eared bat (Endangered)	Winter: cool, well-ventilated caves for hibernation; roost sites are often near cave entrances or where there is considerable air movement. Summer: males occur singly or in groups in caves; maternity colonies settle deep within caves, far from entrance; these caves are warmer than those used for hibernation. Foraging: often in old fields and above cliffs.
Cheat Mountain salamander (Threatened)	Red spruce-yellow birch or spruce-dominated forests (occasionally mixed deciduous hardwoods), generally with an abundance of rocks or downed logs and bryophytes are common. Eggs have been found in and under rotting logs, and under rocks.
Regional Forester Sensitive Species	
Species	**Typical habitat**
Mammals	
WV northern flying squirrel[1] (*Glaucomys sabrinus fuscus*)	Mid-late and late successional (>80 yrs old) spruce and spruce- hardwood forest; associated with late successional characteristics, widely spaced mature trees and an abundance of snags.
Southern rock vole (*Microtus chrotorrhinus caroliniensis*)	High elevation montane boreal forests of spruce/fir and mixed northern hardwood/spruce forests. Upper-mid elevation hemlock forests and bogs and other cool wet forested situations lower-mid mountain elevations.
Eastern small-footed myotis (*Myotis leibii*)	Hibernacula: caves with relatively low temperatures and humidity, often near cave entrances and cracks or crevices along the cave floor, walls, and ceiling. Summer roosts and maternity colonies: caves, buildings, bridges, rock wall crevices, and under rocks. Foraging: fly low over the land or water bodies to forage on insects.
Allegheny woodrat (*Neotoma magister*)	Extensive rocky areas such as outcrops, cliffs, talus slopes with boulders and crevices, and caves, generally at higher elevations (to ~ 1000 m); rarely found in lowlands or open areas. In WV, woodrats are common in caves, rock shelters, outcrops with deep crevices, and riverbanks with abundant sandstone rocks and boulders.
Southern water shrew (*Sorex palustris punctulatus*)	Along mountain streams, especially in northern hardwood and sub-alpine conifer forests; and in peatlands with small streams. Closely associated with swift, rocky streams, often with moss-covered rocks and rhododendron on the banks, and yellow birch in the canopy.

Birds	
Northern goshawk (*Accipter gentilis*)	Nests in a wide variety of forest types, but typically in larger tracts of mature or old-growth forests. Forages in both heavily forested and relatively open habitats.
American peregrine falcon (*Falco peregrinus analum*)	Breeding: ledge or hole on face of rocky cliff or crag; river banks, tundra mounds, open bogs, large stick nests of other species, tree hollows, and man-made structures; nests are typically on ledges of vertical rocky cliffs. Non-breeding: areas where prey concentrate (e.g., farmlands, marshes, lakeshores, river mouths and valleys, tidal flats, cities, and airports).
Migrant loggerhead shrike (*Lanius ludovicianus migrans*)	Breeding: Open country with scattered trees and shrubs. Nests in shrubs or small trees or in fence lines or hedgerows; may also use poles, wires or fence posts as hunting perches. Non-breeding: during periods of cold with snow cover, may move from pastures to into woodlots, shrub and open forest habitats.
Red-headed woodpecker (*Melanerpes erythrocephalus*)	Open oak groves with little understory, groves of oaks and grazing lands, Ohio River valley and low elevations in the Allegheny Mountains.
Olive-sided flycatcher (*Contopus cooperi*)	Openings in northern spruce forests, such as bogs, old beaver ponds, burned over slash from lumber operations with scattered snags and trees for perches.
Golden-winged warbler (*Vermivora chrysoptera*)	Low, brushy second growth forest and open woodland, pasture lands and power line rights of way at higher elevations.
Henslow's sparrow (*Ammodramus henslowii*)	Breeds in open fields, meadows, and un-mowed hayfields with grass mixed with weeds or shrubby vegetation; forages on the ground
Vesper sparrow (*Pooecetes gramineus*)	Breeds in prairie, dry shrublands, savanna, weedy pastures, arid scrub, woodland clearings, fields and fencerows between agricultural fields; forages along fencerows and in weedy areas.
Amphibians	
Green salamander (*Aneides aeneus*)	Damp crevices in shaded rock outcrops and ledges, under loose bark and in cracks of standing or fallen trees, and in or under fallen logs; eggs are generally laid in rock crevices or rotting stumps.
Timber rattlesnake (*Crotalus horridus*)	Summer: mountainous or hilly deciduous or mixed forest, with rocky outcroppings, steep ledges, and rock slides. Males and non-gravid females are primarily forest dwellers and gravid females use open, sparsely forested sites, flat slab rocks and grassy, open slopes. Hibernacula: rocky area where underground crevices provide retreats for over-wintering.
Insects	
Columbine Duskywing (*Erynnis lucilius*)	Open areas containing columbine·
Boreal Fan Moth (*Brachionycha borealis*)	Oak and pine-oak forests/woodlands with blueberries
Appalachian Grizzled skipper (*Pyrgus Wyandot*)	Shale barrens, pastures and power lines on south to west facing shale slopes always with much bare rock or soil.
Cobweb skipper (*Hesperia metea*)	Dry, grassy openings (usually rocky hillsides) with bluestem or broomsedge. Nectar sources include early spring flowers bird's foot violet, spring beauty, wild strawberry and clovers.
Barren's Tiger Beetle (*Cicindela patruela*)	Specialized to sandy/coarse gravel or eroding sandstone. Open mixed or deciduous (mainly oak) woodlands with open ground, such as along trails, outcrops or on ridge summit openings dominated by lichen and dry mosses.
Diana fritillary (*Speyeria Diana*)	Moist and well-shaded forest with rich soils; uses small openings and roadsides by woods in search of nectar plants; usually found nectaring along woodland edges in milkweeds, thistles, butterfly weed, etc. Larval host is woodland violets

[1]Delisted from the Federal Endangered Species list in 2008

Indiana Bat

Distribution and Habitat - The Indiana bat is a migratory species ranging throughout the eastern U.S., from Oklahoma, Iowa, and Wisconsin, east to Vermont and south to northwestern Florida (Hall 1962, Romme et al. 1995). The Indiana bat's annual life cycle consists of hibernation, spring migration, birthing (parturition), raising of young by females (lactation), fall migration, mating (swarming), and hibernation. Each of these critical stages in this complex cycle is integral to species survival and recovery.

The MNF provides habitat for swarming, hibernating, and summering Indiana bats. The 2006 Forest Plan includes measures to protect and manage habitats that support these three key life stages. Additional measures to minimize impacts on other areas of the Forest have also been implemented. When combined, these measures should provide an appropriate means to ensure that suitable habitat conditions are maintained and potentially enhanced, on a Forest-wide programmatic scale (USFWS 2006). Additional information on Indiana bat swarming, roosting, hibernating, and foraging can be found in the Wildlife Resources Report in the Project File.

Habitat in the Project Area - Important habitats for Indiana bat on the MNF are currently recognized as four distinct areas:

1) Maternity sites, as evidenced by lactating females or juveniles discovered prior to August 15. NNIS control treatments are proposed for both of the maternity colony areas designated on the MNF.

2) Hibernacula, or the caves and mines that are occupied by hibernating Indiana bats. No NNIS control activities are proposed within or adjacent to Indiana bat hibernacula. The closest (Cave Hollow/Arbogast Cave) is located 0.6 miles from a proposed NNIS treatment, and NNIS control activities would occur during the non-hibernating period. Thus, no impacts are expected for hibernacula or hibernating bats.

3) Key areas, which provide mature forest habitat near hibernacula. A key area is at least 150 acres in size, and, as appropriate, includes 20 acres of older growth forest and 130 acres of mature forest located as close to the cave as possible. No activities are proposed within key areas, thus no effects would occur to those habitats or bats using them.

4) Primary range, which includes summer foraging, roosting, and fall swarming areas. On the MNF, foraging, roosting, and swarming are believed to be concentrated within five miles of hibernacula, although individual bats can occur outside this area (USFS 2001). This primary range is intended to be managed to provide the basic habitat components needed by the Indiana bat over time. Many of the proposed NNIS focus treatment areas are located within Indiana bat primary range.

Virginia Big-eared Bat

Distribution and Habitat - Virginia big-eared bat (VBEB) is a geographically isolated and sporadically distributed cave obligate species. West Virginia supports the largest populations of

VBEB, particularly Pendleton County (Barbour and Davis 1969, Stihler pers. com. 2000). West Virginia's Cave Mountain Cave, Hellhole, Hoffman School Cave, Sinnit Cave, and Cave Hollow/Arbogast Cave are designated as "critical habitat" for this species based on the precise physical structure, temperature, and humidity conditions required for its continued survival, as well as the significant number of Virginia big-eared bat that occur there. Important habitat for the VBEB on the MNF consists of identified summer colony sites, hibernation sites, and foraging areas (6 mile radius from hibernacula and summer colonies).

Virginia big-eared bat populations use differing foraging habitats in different areas (Dalton et al. 1989, Adam et al. 1994, Buford and Lacki 1995). In Virginia, VBEB forage over open pastures, corn and alfalfa fields, and around tree crowns (Dalton et al. 1989). In contrast, VBEB populations on the Daniel Boone National Forest in Kentucky disproportionately use cliffs and forest habitat to forage, and rock shelters at cliff bases are used as night roosts. Use of different foraging habitats among VBEB populations or subspecies is a response to different habitat availabilities and demonstrates its flexibility to local conditions (Adam et al. 1994).

A WVDNR study found that bats foraged in wooded areas and open habitats (Stihler 1995). Grazed areas used by the bats consisted of old fields with vegetative structure composed largely of thistles, scattered trees, and riparian vegetation along a small creek. The greatest distance traveled was about 6 miles from the cave. Even when return trips to the cave were necessary, bats did not select foraging areas close to the cave. Individual bats often had foraging areas that they used on consecutive nights, but most bats appeared to have more than one foraging area.

Habitat in the Project Area - The cave closest to the proposed NNIS control areas known to support the VBEB is Harper Valley Trail Cave, with an entrance located about 250 meters from a proposed spot treatment site within the Cheat Mountain/Shavers Mountain area. While the Harper Valley Trail Cave is not known to harbor a VBEB maternity colony, Peacock Cave (~0.3 miles from the nearest proposed NNIS treatment area) does support a maternity colony, with the 2007 count showing an increase to 985 bats (WVDNR 2008). The closest "critical habitat" cave is Cave Hollow/Arbogast Cave, located 0.6 miles from the nearest proposed treatment area.

Cheat Mountain Salamander

Distribution and Habitat - The CMS is a woodland species found only in West Virginia. Historically, the CMS range was likely more extensive than it is today. CMS is now a relict species of approximately 80 disjunct populations (Pauley 2007). Their range is presently known to occur in five counties: Randolph, Pendleton, Pocahontas, Tucker, and the most western edge of Grant County (Pauley 2007).

While CMS appear to prefer red spruce and mixed spruce/northern hardwood forests, it has been found in hardwood stands some distance from spruce. These salamanders largely occur in forest stands with a bryophyte (*Bazzania* spp.)-dominated forest floor at elevations above 2,000 feet, in or under logs, under rocks and mosses, and where critical temperatures, humidity, and moisture regimes meet their close tolerance needs. Pauley (1980) found CMS to occur not only in red spruce forests but also in northern hardwoods stands dominated by red maple, yellow birch, black cherry and other hardwoods with little or no conifer component. Rock outcrops, emergent rocks, boulder fields, bryophytes and/or downed logs are usually present in CMS habitat.

Because of its physiological requirements, CMS require microhabitats with high relative humidity or moisture (Feder 1983) and acceptable temperatures. Surface activity and abundance of CMS is influenced by environmental conditions (Santiago 1999). Foraging on the forest floor and occasionally on tree trunks is done at dusk, when relative humidity is high (Green and Pauley 1987). On dry nights they do not leave their moist retreats to forage (Spotila 1972). Eggs have been found in and under rotting logs, and under rocks (Brooks 1948, Green and Pauley 1987). Depending on soil temperature, CMS retreat to underground refugia around mid-October and emerge from winter refugia at the end of March (AmphibiaWeb, 2008).

Vegetative structure affects salamander populations. Moist old growth stands have greater abundance and species richness than dry old growth or younger stands of various moisture levels (Welsh and Lind 1988), probably due to the complex structure of older stands and resulting amenable microclimates. Old stands provide dense litter layers, abundant woody debris, and stratified canopies, which all enhance moisture retention (Petranka et al. 1994) and limit moisture and temperature variations in the forest floor.

Home ranges for CMS tend to be only a few meters to a few dozen meters in diameter. CMS are thought to rarely successfully traverse inhospitable habitats such as roadways, waterways, or open, dry sites. These areas pose impediments to movement and generally function as barriers.

Habitat in the Project Area - Mapped known or potential CMS habitat overlaps with proposed NNIS treatment sites in several areas and documented observations are located in close proximity to proposed treatment areas in the Dolly Sods and Cheat Mountain areas. Most of the CMS observations in the Dolly Sods area are far enough off the road that road ROW treatments probably would not affect the species. However, observations near the Gaudineer Scenic Area (on Cheat Mountain) are close enough to proposed treatments that their habitat probably would be affected (Dr. T. Pauley, pers. com.). Both areas are mapped as known habitat for the CMS.

Desired Conditions

Habitats for threatened and endangered species are managed to maintain or enhance populations consistent with established and approved recovery plans.

Regional Forester Sensitive Species

West Virginia Northern Flying Squirrel

Distribution and Habitat - WVNFS occur in forested areas throughout the northern U.S. and Canada. The southern and central Appalachian Mountains, the Black Hills, the southern Rocky Mountains, and the Sierra Nevada contain disjunct populations (Wells-Gosling and Heaney 1984). The West Virginia subspecies of the northern flying squirrel occurs in a very small range that appears to have been isolated by habitat changes since the last ice age (USFWS 2001). This nocturnal species inhabits disjunct “islands” of high-elevation forest in the central Appalachians of eastern West Virginia and western Virginia (Menzel et al. 2004). In West Virginia, the range of the WVNFS) extends southward from the Mount Storm Reservoir (Tucker County), to Briery Knob (Pocahontas County) and Rabbit Run (Greenbrier County) (Stihler et al. 1995, C. Stihler pers. comm. 2004).

The MNF is believed to contain a large majority of the range-wide habitat for the WVNFS, with other habitat blocks distributed across high-elevation federal, state, and private properties in Grant, Greenbrier, Pendleton, Pocahontas, Randolph, Tucker, and Webster Counties. In Virginia, the subspecies is restricted to western Highland County on the George Washington National Forest and surrounding private lands. Within the MNF, suitable habitat is defined based on Forest-wide mapping for the species (MNF, unpublished data), as well as other modeling and mapping efforts (e.g., Menzel et al. 2006) and aerial photography-based forest cover type mapping) and reviews of aerial photography, modified at the project level based on capture data and field reviews. All mapped suitable habitat is assumed to be occupied by WVNFS, and emphasis is placed on protecting this habitat. The current version of the map shows approximately 150,000 acres of suitable habitat on NFS lands.

G. s. fuscus commonly prefer conifer/hardwood ecotones or mosaics dominated by red spruce and fir with hemlock (*Tsuga canadensis*), beech (*Fagus grandifolia*), yellow birch (*Betula allegheniensis*), sugar or red maple (*Acer rubrum*) and black cherry (*Prunus serotina*) associates. NFS have also been captured in northern hardwoods with conifer understory (Stihler et.al. 1995). WVNF have been captured in stands of various ages, understories, densities, and species composition, but most have been in moist forests with some widely-spaced, mature trees, abundant standing and downed snags (USFWS 2001), usually with some conifer (spruce, hemlock, fir) present (Stihler 1994). These habitats seem well suited to WVNFS' gliding locomotion, cavity nest requirements, and reliance on wood-borne fungi and lichens for food (USFWS 1990). While the squirrels apparently subsist primarily on lichens and fungi, they also eat seeds, buds, fruit, staminate cones, and insects (USFWS 2001). Fecal samples indicate the most common foods eaten were lichens, fungi (mostly underground/hypogeous), pollen, and insects (Mitchell 2001). Throughout their range, WVNFS use both tree cavities and leaf nests (Menzel et al. 2004).

Habitat in the Project Area - Mapped suitable WVNFS habitat exists across the Forest, overlapping proposed treatment sites in several areas. However, because this mapping is forest stand-based, it incorporates habitats that would not be considered primary habitat for the squirrel (e.g., early successional habitats and roadside rights-of-way). Thus, the majority of the proposed NNIS control areas probably are not used regularly, if at all, by NFS. Nevertheless, individuals moving between patches of high quality habitat on either side of roads or dispersing juveniles may well cross some of these proposed control areas. In addition, WVNFS have been captured via nest boxes or trapping near several proposed treatment sites.

Eastern Small-footed Myotis

Distribution and Habitat - The range of the eastern small-footed myotis extends from Arkansas and Missouri, east to the Appalachians and Ohio River basin, and north into Canada (Johnson and Gates 2007). This species may hibernate close to summer roosting and maternity habitat (Whitaker and Hamilton 1998). Eastern small-footed myotis hibernate in colder portions of mines and caves, and are often found in cracks or crevices along the cave floor, walls, and ceiling near cave entrances (Whitaker and Hamilton 1998, Harvey et al. 1999, Wilson and Ruff 1999). Eastern small-footed myotis depart the winter hibernacula in March (Dalton 1987).

Summer roosts and maternity colonies have been found in caves, buildings, bridges, rock wall crevices, and under rocks. Maternity colonies consist of 20 or more bats (Whitaker and Hamilton 1998, Harvey et al. 1999, Wilson and Ruff 1999). Eastern small-footed myotis forage in and along wooded areas at and below canopy height, over streams and ponds and along cliffs and ledges (Erdle and Hobson 2001). These bats emerge shortly after sunset and fly low over the ground to forage on insects, and may specialize in preying on Lepidoptera (Harvey et al. 1999, Johnson and Gates 2007)

Habitat in the Project Area - Suitable foraging habitat exists across much of the Forest, including areas targeted for NNIS controls. Data from mist net surveys on the MNF from 1999-2007 indicate the occurrence of *M. leibii* near several proposed NNIS control treatments areas, with one capture occurring on a roadway proposed for treatment of a garlic mustard infestation (FS790 in Middle Mountain).

Southern Rock Vole

Distribution and Habitat - The southern rock vole was originally identified as a new subspecies based on a collection of *Microtus* in the Great Smoky Mountains in 1931 (Komarek 1932). The range of this subspecies currently extends from eastern West Virginia and western Virginia southward through the Appalachian Mountains to North Carolina and Tennessee. In the central Appalachians, this vole is primarily a high-elevation species (generally > 3,000 ft), occurring in rocky, boulder-strewn, coniferous, deciduous, and mixed deciduous-coniferous forests. They are typically associated with areas of cool, moist talus, mossy boulders, and logs close to a stream, spring, or seep. Orrock and Pagels (2003) found that, within mixed mesophytic forests, sites with rock voles were generally more mature and rocky than other sites, and dominated by yellow birch and basswood. However, the southern rock vole is also known to occur in red spruce and northern hardwood forests, and associated with other tree species as well, including red maple, northern red oak, American beech, yellow poplar, and black cherry (Kirkland 1977).

Habitat in the Project Area - Suitable habitat for this species is distributed patchily across the MNF. Our databases indicate that the closest recorded location is 74 meters from proposed roadway treatment west of FR102; two other observations are recorded from other locations in this general area (Kennison Mountain). Thus, while the proposed NNIS treatment areas do not overlap known rock vole sites, potential habitat may exist adjacent to those sites.

Southern Water Shrew

Distribution and Habitat - This subspecies of the water shrew occurs in only six Appalachian states. In West Virginia, the water shrew has been found in Preston, Randolph, Pendleton, Tucker, and Pocahontas Counties at locations over 2,000 feet in elevation (WVDNR 2004). The southern water shrew can be found along mountain streams, especially in northern hardwood and sub-alpine conifer forests and wetlands with small streams. The species' habitat is closely linked with swift, rocky streams, often with moss-covered rocks and rhododendron on the banks, and yellow birch in the canopy (Handley 1991, NatureServe 2008). This species inhabits the banks of both perennial and ephemeral streams (Beneski and Stinson 1987, Pagels et al. 1998). They are seldom far from water and feed extensively on immature stages of aquatic insects. Because of their small size and secretive habits, the range and abundance of water shrews are probably underestimated in the state (Whitaker and Hamilton 1998).

Habitat on the Project Area - Appropriate habitat for the southern water shrew occurs in several areas across the MNF. In relation to the proposed NNIS treatments, the habitat of concern is in the Cheat Mountain area, in the vicinity of the Blister Run Botanical Area near FR 27. Our databases indicate several observations across a fairly wide area here. NNIS of concern in this area and proposed for treatment as part of this proposal include reed canary grass along the roadway and bush honeysuckle within the wetland.

Allegheny Woodrat

Distribution and Habitat - The Allegheny woodrat's historic range extended from western Connecticut, southeastern New York, northern New Jersey, and northern Pennsylvania southwestward through western Maryland, Tennessee, Kentucky, West Virginia, and northern and western Virginia to northeastern Alabama and northwestern North Carolina, with isolated populations in southern Ohio and southern Indiana. Surveys in several of the more disjunct populations have since failed to find the species (NatureServe 2009). The current distribution is focused within the central and southern Appalachians from New York to Tennessee, with populations in West Virginia at the core of the range (Wiley 1980, Hall 1981, Wood 2001).

Allegheny woodrats generally occupy steep, rocky habitats (e.g., rock outcrops, cliff and talus slopes, and caves), which probably provide protection from predators (Poole 1940, Balcom and Yahner 1996), but this opportunistic species may build nests in abandoned buildings as well. The rocky habitats occupied by Allegheny woodrats are usually located in or around hardwood forests that have an abundance of oaks and other mast-bearing trees. In addition to hard mast, woodrats rely on soft mast, green vegetation, and fungi to round out their diet (Catleberry et al. 2002). They may also occasionally feed on snails, insects, or other invertebrates. In autumn woodrats habitually cache (store) large quantities of acorns, twigs, leaves, and other edible vegetation to ensure a constant food supply throughout the winter months. The woodrat is nocturnal and remains active throughout the year.

Habitat in the Project Area - The closest recorded observation of *N. magister* to a proposed NNIS treatment area is in the northeastern portion of the Forest, east of the Dolly Sods Wilderness area and Forest Service road FS75, and about 100 meters from proposed control treatments for reed canary grass along that road.

Timber Rattlesnake

Distribution and Habitat - Historically, the timber rattlesnake ranged through most of the United States, extending from Ontario, Minnesota and Maine south to northern Florida and Texas, with scattered populations elsewhere. The species has since been extirpated in Canada, Maine, Rhode Island, Delaware and several other areas. Timber rattlesnakes occupy a wide variety of habitats, from upland forests to riparian areas. They tend to inhabit specific microhabitats within deciduous hardwood forests including over-winter dens, rookeries, and summer ranges (Brown 1993). In the summer this species commonly occurs in open woods, grassy fields, and secondary growth (Green and Pauley 1987, DeGraaf and Yamasaki 2001).

In West Virginia, *C. horridus* populations are distributed primarily in the east-central and southern counties as well as in the eastern panhandle, and are most numerous in mountainous and forested areas where brushy ridges and rocky hillsides with ledges abound (Green and Pauley 1987, Adams 2005). It is common in second growth wooded areas, where rodent prey is abundant, but also may occur along streams, in valleys, and among slab piles around old sawmill sites (Green and Pauley 1987, Conant and Collins 1998). Most local populations are centered around communal winter den sites, usually situated on rocky south-facing hillsides (Harding 2000). Den sites in West Virginia are associated with southern exposures and chestnut oak stands at lower elevations and mixed northern hardwood stands at higher elevations. This species shows an affinity for particular basking crevices and hibernacula at den sites (Adams 2005).

Habitat in the Project Area – This snake is known to occur in several locations near proposed NNIS control sites, and potentially suitable forested habitat exists in other areas as well. Rocky outcrop areas near proposed control sites may provide potential den sites; however no dens have been identified in these areas to date. The diet of the timber rattlesnake primarily consists of small mammals, but also includes songbirds, frogs, and other snakes (Green and Pauley 1987, Mitchell 1994, DeGraaf and Yamasaki 2001), all of which are abundant in the project area.

Green Salamander

Distribution and Habitat - The range of the green salamander extends from extreme south-western Pennsylvania, extreme western Maryland, and southern Ohio to northern Alabama and extreme north-eastern Mississippi, with disjunct populations in south-western North Carolina and adjacent South Carolina and Georgia, and additional isolated populations in central Tennessee, north-eastern West Virginia, and Crawford County, Indiana (Conant and Collins 1991, Madej 1998).

Preferred habitat for the green salamander is crevices in well shaded and moist, but not wet, rock faces in mesophytic forests, but the species has also been found in caves, dry rock outcrops, under bark on logs, and in arboreal habitats (Wilson 1995, Petranka 1998, Waldron 2000, Lanoo 2005, Waldron and Humphries 2005). Rock types used include sandstone, limestone, dolomite, granite, and quartzite. Type of rock may be less important than crevice size and moisture (Gordon and Smith 1949). While this species has generally been characterized as preferring rock outcrop habitats, Waldron and Humphries (2005) found that seasonal use of trees was distinct, indicating that salamanders over-winter in rock outcrops and move into trees and logs at the beginning of spring. Their summer observations showed primarily arboreal habitat use by green salamanders, with salamander presence in trees having a positive relationship with tree diameter and hardwoods (vs. conifers), and a negative relationship with distance to rock outcrops.

Habitat in the Project Area - The closest known occurrence of green salamanders is about 0.5 miles from the proposed NNIS treatment along the Highland Scenic Highway. However, rock outcrops are not well inventoried on the Forest, and potential habitat probably exists closer to proposed treatment sites than is evident based on available survey data.

Northern Goshawk

Distribution and Habitat - The northern goshawk breeding range within North America extends from western and central Alaska to Newfoundland, south to central California, southern Arizona, eastern foothills of Rockies, central Alberta, southern Manitoba, central Michigan, Pennsylvania, northwestern Connecticut, and in the Appalachians south to West Virginia and Maryland (Natureserve 2009). The population in West Virginia represents the southerly edge of the species range in the Appalachians.

The goshawk nests in a wide variety of forest types including deciduous, coniferous, and mixed forests, but typically in mature or old-growth stands in larger contiguous tracts. The species has complex nesting and fledgling habitat requirements in the breeding season, which vary among forest types and region (Johnsgard 1990). Breeding habitat requirements appear to differ extensively across the species' range, and non-breeding habitat needs are poorly understood.

Northern goshawks forage for small mammals and birds during short flights alternated with brief prey searches from perches or during extended flights along forest edges, across openings, and through dense vegetation. Prey is taken on the ground, in vegetation, or in the air (Natureserve 2009). The goshawk's diet may vary with prey availability, with fledgling passerines making up a greater portion of the diet as they become more available during summer (Linden and Wikman 1983, Reynolds and Meslow 1984).

Habitat in the Project Area - The closest historical goshawk nest site on the Forest to a proposed NNIS treatment area is in the Gauley district, near FR102/76 that is a proposed site (roadway) for patches of garlic mustard. The nest site was located about 0.5 miles from the proposed treatment along this road.

Golden-winged Warbler

Distribution and Habitat - Golden-winged warblers breed in the northeastern U.S. and southern Canada, and densities seem to be highest in parts of Minnesota, Wisconsin, Pennsylvania, New York, West Virginia, New Jersey, Maryland, and southern Ontario, with scattered populations elsewhere (Confer 1992). This neotropical migrant uses high elevation, early successional habitats, that are generally characterized by patches of herbs, shrubs, scattered trees, and a forested edge (Frech and Confer 1987, Confer 1992, Klaus and Buehler 2001, Martin et al. 2007). They have been found in a variety of habitats, both natural and disturbed, that have those characteristics, including abandoned farmlands, utility rights of way, reclaimed mines, clearcuts, meadows, and wetlands (Confer 1992, Confer and Tupper 2000, Martin et al. 2007). *V. chrysoptera* is generally thought to winter in southern Central America and northern South America (Confer 1992).

Habitat in the Project Area - The golden-winged warbler has been found in several range allotments on the MNF and on surrounding private lands during breeding bird surveys (MNF, unpublished data). The species is known to breed near at least one proposed treatment focus area, the Otter Creek area. An ongoing golden-winged warbler study site is located on the Coberly Sods North range allotment, just west of a proposed NNIS treatment area for garlic mustard, with another site located on private land south of that treatment area. That area represents the closest known location of breeding golden-winged warblers to a project area. The proposed garlic mustard treatment limits are 250-300 meters from warbler nest locations in both of those study sites. However a review of aerial photographs indicate that the intervening habitat (between nest sites and proposed NNIS treatment) make it highly unlikely that the warbler territories extend into proposed treatment areas or any potential drift associated with foliar herbicide spray used for control on that herbaceous NNIS.

Vesper Sparrow

Distribution and Habitat - The vesper sparrow breeds across most of northern North America, from British Columbia east to Nova Scotia, and south to the California, Arizona, Tennessee and N. Carolina (Natureserve 2009). West Virginia lies at the southern boundary of the breeding range. The vesper sparrow is found in grasslands over 30 acres in size. This species is a ground nester, found in pastures, hayfields, and along the edges of cultivated fields of adequate size where hedgerows, trees, power lines, or other tall structures can be used as song perches.

Habitat in the Project Area - Our spatial database shows one vesper sparrow record from a 2007 point count survey conducted on the Mower Tract, a reclaimed strip mine area in the Greenbrier District. Other historical summer observations include the Elleber Sods grazing allotment east of Green Bank, Canaan Valley, Roaring Plains area, and near Bartow.

Henslow’s Sparrow

Distribution and Habitat - The Henslow’s sparrow preferred breeding habitat is large areas of tall dense grassland with a well-developed, uncompressed littler layer and tall standing dead forbs. While the species native habitat is tall grass prairie and similar grasslands, the species is also known to breed in managed or otherwise altered habitats, including hayfields, pastures, wet meadows, old grassy fields, and reclaimed mine areas (Winter 1999). The sparrow’s woven grass nests are typically constructed on or near to the ground

Habitat in the Project Area - The only observation of Henslow’s sparrow in the available databases is on private land (a reclaimed strip mine) just outside the MNF proclamation boundary and over 6 miles from the closest proposed treatment area.

Red-headed Woodpecker

Distribution and Habitat - Red headed woodpeckers occur throughout North America from Maine and Quebec south to Florida and west to Montana and New Mexico (Natureserve 2009). The red-headed woodpecker was historically a common species inhabiting oak savanna, farmlands, and woodlots of the central and eastern United States, but has exhibited a sharp decline over the last century (Smith et al. 2000). This species occupies a wide range of habitats, but most are characterized by open areas for catching flying insects, large snags for nesting and roosting, and a secure food supply. Red-headed woodpeckers forage on ground, capture insects in flight, glean food from vegetation, or chisel trees for wood-boring insects and sap. They are known to store food for winter (grasshoppers, nuts, corn, and fruit) in natural crevices of trees and posts, in tree cavities, under bark, and under railroad ties and shingles.

Habitat in the Project Area - Potential habitat for the red-headed woodpecker exists in many areas on the MNF, particularly in open beech or oak woodlands, savannahs and other managed openings with scattered trees. Breeding bird surveys show one record of breeding red-headed woodpeckers on the Forest, in the Cheat-Potomac Ranger District. This site is an estimated 3.3 mi. from the nearest proposed NNIS treatment. Historical summer observations are noted from Tygart Valley, north of Parsons, near Seneca Rocks, and east of Greenbank.

Olive-sided Flycatcher

Distribution and Habitat - Olive-sided flycatchers breed in openings with standing dead trees in coniferous forest across the northern and mountainous regions of North America (Altman and Sallabanks 2000, Natureserve 2009). In western states, they are generally associated with patchy landscapes and abundant edge habitat generated by disturbances such as wildfire, blowdowns, and timber harvesting (Hutto 1995, Meehan and George 2003). However, individual nest success in timbered areas may be significantly lower than that in naturally burned forest, indicating that some of these anthropogenically-induced habitats that mimic the appearance of suitable natural habitat could be ecological traps for the species (Robertson and Hutto 2007). Other data suggest that fire may have a negative impact on reproduction in the short term (Meehan and George 2003). Typical habitat in West Virginia appears to be forest openings or edge areas with standing dead trees associated with wetlands, blowdowns, and managed areas.

Habitat in the Project Area - The olive-sided flycatcher is known to nest in the Blister Swamp and has potential breeding habitat in the Blister Run Botanical Area, proposed for NNIS treatment of bush honeysuckle. Additional known breeding records on the Forest include the Cranberry Glades area and Gaudineer Knob, among others.

Invertebrate RFSS Species with Potential Habitat in the Project Area

Our discussions and databases do not indicate the presence of any RFSS invertebrate species within the proposed treatment areas; however, few surveys for these species have been conducted in the area. Given the habitat preferences for some of the RFSS insect species, suitable habitat may exist in some of the proposed NNIS control areas (particularly in the Smoke Hole area) for these species (Table WL-3).

Desired Conditions

The amount, distribution, and characteristics of habitat are present at levels necessary to maintain viable populations of native and desired non-native wildlife and fish species. For RFSS, management actions do not contribute to a trend toward federal listing (Forest Plan, p. II-29).

Site-Specific Treatments and Known or Potential TES Species Locations & Habitats

In addition to the programmatic protocols identified in the proposed action, there are 14 areas that have been identified for site-specific treatments to control NNIS plants. These treatments are designed to protect high-priority sites such as botanical areas, candidate research natural areas, National Natural Landmarks, TES species habitat, landscape-scale ecological reserves, tree regeneration, and roads and facilities. Treatments of continuous infestations would total an estimated 134 acres; spot treatments would be conducted across another 4,960 acres. Most of these areas (as defined in Chapter 2 of the EA) contain at least some known or potential habitat for TES wildlife species, as shown in Table WL-4. See the Wildlife Resources Report in the Project File for more information on individual species habitat determinations.

Table WL-4. Known or Potential TES Wildlife Species Habitat Associated with Proposed Treatment Areas

Treatment Area	TES Wildlife Species Potentially Present*
Parsons Area	Indiana bat[3], Virginia big-eared bat[3]
Otter Creek Area, but outside of wilderness	Indiana bat[1, 3], Virginia big-eared bat[3], eastern small-footed bat[1], golden-winged warbler[4], southern rock vole[4]
Dolly Sods Area, along Roads 75 & 19	Cheat Mountain salamander[1,2], WV northern flying squirrel[2], small-footed bat[1], Allegheny woodrat[4]
Smoke Hole Area	Indiana bat[3], Virginia big-eared bat[3], small-footed bat[1], Allegheny woodrat[4], timber rattlesnake[4]
Seneca Creek Vicinity	Indiana bat[1, 3], Cheat Mountain salamander[2]
Laurel Fork Vicinity	Virginia big-eared bat[3], Cheat Mountain salamander[2], WV northern flying squirrel [2]
East Fork Greenbrier/ Burner Mountain Area	Cheat Mountain salamander[2], WV northern flying squirrel [2]
Cheat Mountain/ Shavers Mtn. Vicinity	Indiana bat[3], Virginia big-eared bat[3], Cheat Mountain salamander[1,2], WV northern flying squirrel [1,2], Eastern small-footed bat[1], olive-sided flycatcher[1], southern rock vole[1]
Ramshorn/Shock Run Area	Timber rattlesnake[4]
Buzzard Ridge Area	WV northern flying squirrel [2]
Highland Scenic Highway Area	Indiana bat[3], WV northern flying squirrel [2], E. small-footed bat[1], northern goshawk[4], Allegheny woodrat[4], southern water shrew[4], southern rock vole[4], green salamander[4]
Cranberry Area, but outside of wilderness	Indiana bat[3], WV northern flying squirrel [2], E. small-footed bat[1], northern goshawk[4], southern rock vole[4], timber rattlesnake[4]
Middle Mountain Area	Timber rattlesnake[4]
Anthony Creek Area	E. small-footed bat[1]

*Potential presence in area based on known occurrences from past surveys [(1)], mapped habitat based on modeling [(2)], or high probable occurrence based on proximity to caves (within 5 miles of Indiana bat or 6 miles of Virginia big-eared bat caves)[(3)], or potential habitat in area [(4)].

3.8.3 Environmental Consequences

The analysis for terrestrial animal species included a review of the following: 1) species-specific literature as cited, 2) internal agency information (e.g., digital spatial information), and 3) field knowledge and/or review. Digital spatial information is a compilation of wildlife surveys and sightings collected over many years and stored in an ArcGIS format. The analysis also included a review of the 2006 Forest Plan, and Biological determinations involving herbicide use made in the Hogback EA, Lower Williams EA, and Little Beech Mountain EA. For detailed descriptions of methodologies used in the analysis, see the Wildlife Resources Report in the Project File.

<u>Alternative 1 – No Action</u>

All Wildlife Species – Direct and Indirect Effects

Under the No Action Alternative, current management activities and natural processes would continue, and no new actions proposed in this assessment would be implemented. Taking no action to control NNIS would have no direct effects to terrestrial wildlife on the Forest. However, indirect impacts in the form of changes in terrestrial wildlife habitat from existing NNIS are already discernable in many areas on the Forest. Furthermore, no proposed access management activities would be implemented, so any existing human disturbance problems associated with the access currently provided by roads proposed for storage would persist.

Invasions of knapweed species have resulted in severe losses of native winter forage species for large mammals in Montana and Colorado (Westbrooks 1998). Tamarack invasions into riparian areas in the southwest have also had severe impacts on large mammals, such as bighorn sheep, as well as bird species densities, diversity and individual health; these include quantifiable adverse impacts to federally listed species, such as the southwestern willow flycatcher (Zavaleta et al. 2001). In wetlands, purple loosestrife, narrow-leaved cattail, glossy buckthorn, giant reed grass, and reed canary grass can create monocultures of single species. Invasions of purple loosestrife have long wreaked havoc with wetland habitats in many areas, resulting in adverse impacts to nesting black terns, sandhill cranes, Canada geese, and other waterfowl as a result of loss of native food species and nesting and juvenile habitat (Smith 1964, Thompson et al. 1987).

NNIS impacts to large bird and mammal species, particularly game species, are generally those most easily noticed in terms of species' population declines or displacement of local populations. However, impacts from NNIS often can be most directly felt by amphibians, reptiles, insects and smaller birds and mammals, which may have territories in, or spend their entire life cycle, in relatively small areas. When the herbaceous community of these areas is altered, it can have severe impacts to individuals that rely on microhabitat conditions that existed there prior to the invasion of the non-native species. In addition to species changes in the vegetative community, NNIS can result in dramatic changes in vegetative structure as well as travel corridors, soil moisture content, and other physical habitat components.

All Wildlife Species – Cumulative Effects

Because Alternative 1 (No Action) would result in the continuation of ongoing management actions, current terrestrial habitat conditions would persist. Thus, the No Action alternative would not contribute to any incremental effect when combined with the impacts of other past, present, or foreseeable future activities.

Alternative 2 – Proposed Action

General Effects from Proposed Activities

Control of NNIS through mechanical, biological or chemical means could have substantial beneficial effects to wildlife resources, including TES and MIS. Infestations of non-native species may result in extensive modification of plant community composition and, over time, may result in severe changes to ecosystem dynamics. Potential effects to wildlife habitat include changes in food webs, reduction in forage or shelter, and modification of the overall quality of native habitats. Impacts to already threatened species may be especially severe, as invasive species are now considered the second biggest threat to biodiversity and endangered species, behind only habitat destruction (Natureserve 2008).

While the need to control NNIS is widely accepted, the best means to meet this need, while minimizing potential risks to human and ecological health, are not always clear and the best methods often vary depending on the invasive plant species in question. Programmatic Protocols are given for several different treatment types (Chapter 2), including foliar, cut surface, and basal spray application of herbicide, hand pulling, mowing, grubbing, biological control, and prescribed fire. However, prescribed fire is not proposed for any of the focus areas as part of this document (though prescribed burns have been analyzed through separate, previous NEPA documents in some of the same areas that are proposed for NNIS controls). Potential impacts from prescribed burns would vary widely depending on specific site location, species and habitat types present nearby, and a variety of other site- and project-specific factors that would need to be addressed in project-specific analyses, burn plans, and associated documents. Thus, as this action is not proposed as part of the NNIS control actions in this project, potential impacts to TES from prescribed fire will not be discussed further as part of this document.

The Proposed Action also includes the use of nine herbicides (clopyralid, glyphosate, imazapic, imazapyr, metsulfuron-methyl, picloram, sethoxydim, triclopyr and fosamine) to aid in the control of NNIS. Chapter 2 of this EA has details on where the herbicides will be used and the methods and rates of application; the potential impacts of herbicides on terrestrial wildlife are discussed in more detail below.

Studies of NNIS removal have generally shown positive effects to native faunal communities. For example, eastern fence lizards and New Mexico whiptails increased in relative abundance after non-native plants were removed from riparian forest along the Middle Rio Grande in the southwestern United States (Bateman et al. 2008). The use of herbicides to remove spotted knapweed from an elk winter range in Montana, where it had crowded out native bunchgrass forage, resulted in a 266 percent increase in the use of the area by elk (Westbrooks 1998).

Mechanical Control Methods

The proposed alternative includes mechanical control of NNIS (mowing, grubbing, hand-pulling of herbaceous species, and cutting of woody species) and storage of selected roads that may provide invasion pathways into sensitive ecosystems. These control methods are relatively limited in scope and/or are expected to result in very little disturbance. In addition, sites are typically located along previously disturbed areas such as Forest roads, skid roads, and wildlife openings. As a result, adverse wildlife resource effects are expected to be minimal or non-existent, depending on the type and location of proposed treatments. However, mechanical control methods do have some potential to disturb wildlife species and their habitat, particularly on a short-term basis. Grubbing or cutting down shrubs and saplings could remove or disturb bird nests or animal burrows. Ground-disturbing activities associated with mechanical control methods, such as hand pulling or grubbing, could also disrupt habitat for ground dwelling or subterranean species. Brief periods of noise could startle some wildlife, leading to temporary evacuation of areas where work is in progress. Less mobile wildlife could be inadvertently injured or killed by people or equipment during control efforts.

While mechanical method impacts to control NNIS are expected to be negligible in the short term and positive in the long term for most terrestrial wildlife species, there is potential for individuals of some species to be harmed if special precautions are not taken. Thus, mechanical control methods, their potential adverse impacts, and precautionary measures to eliminate or minimize impacts will be discussed in more detail in the TES effects section of this document.

Biological Controls

The use of biological control agents involves releasing animal species, in this case insects that feed on nonnative plants. Biological control agents are listed as one means of control for invasive knapweed on the Forest (EA, Chapter 2, Table 2.1), and are proposed for the Cunningham Knob range allotment in the Laurel Fork vicinity (See EA Chapter 2 and Appendix B). The NNIS species targeted for control in this area is meadow knapweed, and the bio-agents established for control of this species are *Urophora quadrifaciata* (a fly), *Metzneria paucipunctella* (a moth), and the beetles *Larinus minutus*, *L. obtusus*, and *Bangasternus fausti*.

APHIS has permitted the insects proposed for use for release in the United States, under the Plant Protection Act of 2000. As noted in Chapter 2 of this EA, proposed biological control agents eat only knapweeds and do not pose a risk to non-target plants or animals. Thus, the use of these biological controls in this area is not expected to have any adverse effect on terrestrial wildlife or native vegetation in wildlife habitats in the area, and they will not be discussed specifically in further detail in this document.

Herbicide Application

Some wildlife species could potentially come in direct contact with herbicides as a result of spray streams. Wildlife could also be exposed to herbicides by ingesting treated foliage, insects or other prey species, or through contact with treated foliage or water sources. In order to characterize the potential risk to terrestrial wildlife species on the MNF from the proposed herbicide treatments, SERA models were run for individual herbicides (except fosamine, which had no SERA model available). The application rates used in the model were 125 percent of the proposed application rate to account for language used in standard herbicide contracts. The tables generated from these models, containing the resultant hazard quotients for different species groups and scenarios addressing different exposure routes, are located in the Wildlife Resources Report in the Project File. Models were run using the default SERA settings in most cases. However, where the resultant risk hazard quotient for aquatic resources was equal to or greater than 2.0, the model was rerun using 50 inches of rain and loamy soils to represent local conditions for this area. In those cases, the results of the local model were used to assess risk to terrestrial wildlife species as well. The change from the SERA default model to the modified local model did not affect the hazard quotient (HQ) conclusions for terrestrial species.

If the hazard quotient did not identify a concern (i.e., HQ $\leq$ 1.0) for the target taxa based on the representative or "surrogate" organism, then the assumption is made that it will not be a concern given site-specific conditions. Hazard quotients greater than 1.0 are referred to as "exceeding a level of concern" and indicate that the chronic reference dose is being exceeded; hazard quotients > 2.0 are generally "red flagged" by the model. Surrogate species serve as a substitute for the species of interest, because all species of interest cannot be tested. Surrogates are typically species that are easily tested using standardized methods, are readily available, and inexpensive. Rare species are not tested and the physiological requirements for some organisms prohibit their use in toxicity testing because these requirements cannot be met within the test system (USFS 2005). While surrogates are meant to be representative of larger groups (e.g., large mammal or fish-eating bird), caution should be taken when assessing ecological risk to native wildlife species, particularly TES species, since some herbicides show more variation in effects among species than others, and few species have been thoroughly tested. More detailed information on the individual herbicides testing is located in the Wildlife Resources Report in the Project File.

Summary of Effects of Proposed Herbicide Applications on Terrestrial Wildlife

The SERA models use results for surrogates to assess the potential risk for both large and small (herbivorous and carnivorous) mammals and birds, fish, and insects (honey bee) under a variety of scenarios (e.g., direct spray, acute dose to mammals eating contaminated vegetation, or chronic dose to a bird eating contaminated insects). However, these models do not address amphibians and reptiles which, because of their more permeable skin and the lack of protective fur or feathers to minimize absorption, may be especially susceptible to chemicals. Thus, despite the paucity of information available for the potential effects of herbicides on amphibians and reptiles, we will have to rely on what is available in the literature to assess risks to these taxa.

Based on the SERA model run worksheets for the proposed chemicals, four of the herbicides are not expected to increase risks to terrestrial wildlife species using the proposed application rates in the limited sites described in Chapter 2. Those herbicides include imazapic, imazapyr, metsulfuron-methyl, and sethoxydim. Because the hazard quotients for these herbicides indicate no risk above the NOEL (No Observed Effect Level), and our literature review did not indicate any conflicting results, it is assumed that the use of these chemicals, as proposed, will pose no direct or indirect effects or cumulative impacts to terrestrial wildlife.

Model runs for clopyralid, glyphosate, picloram and triclopyr showed an upper hazard quotient of over 1.0 for at least some scenarios, indicating that the risks from these chemicals at the proposed application rates (modeled at 125%) may be greater than the NOEL. Based on the surrogate animal used in the SERA test modeling and the scenario modeled, the potential effects of these herbicides on wildlife groups is discussed below and in the TES effects section.

Mammals - The potential for mammals to be exposed to herbicides, whether in an acute or chronic dose, depends on the life history of the species (their breeding and foraging needs, territory sizes, etc.). Several of the SERA herbicide worksheets showed HQs over 1.0 for large mammals (chronic exposure ingesting contaminated vegetation scenario), including clopyralid, glyphosate, and triclopyr. Also, the scenario of small mammals ingesting contaminated insects (acute rather than chronic dosage) resulted in an HQ over 1.0 for picloram and glyphosate.

The model run for triclopyr reflected a relatively high level of risk for chronic effects to large grazing mammals and birds. Data suggest that extensive and intensive use of this herbicide in habitats frequently used by large grazing birds (e.g., geese) and mammals (e.g., deer) could result in potential effects to those animals. To err on the side of caution, it is recommended that NNIS foliar herbicide treatments in wildlife openings, fields and other open habitats frequented by game animals in particular use an alternative herbicide (e.g., metsulfuron methyl or imazapyr).

Birds - Like mammals, the potential for birds to be exposed to herbicides depends on the life history of the species. Generally, the potential for exposure is low in proposed treatment areas because they are largely roadways or open, disturbed areas. However, certain groups are at more risk than others in those habitats. For example, game birds that use early successional habitats (e.g., grouse and turkey) may return to the same areas to feed on a regular basis, so that chronic exposure may occur. Other birds that may be subject to chronic exposures include small insectivorous birds that defend breeding territories in or near open or disturbed habitats and feed in the same area.

None of the SERA worksheets showed an HQ of over 1.0 for small birds under any of the scenarios run for the proposed herbicides, nor for carnivorous or piscivorous birds (Project File, Wildlife Resources Report, Appendix C). However, the worksheets did red flag results for glyphosate and triclopyr for large birds (chronic exposure ingesting contaminated vegetation scenario). The model run for clopyralid also exhibited an HQ of over 1.0 for the same scenario. The comments noted for mammals above in regard to triclopyr would apply here for large birds foraging on vegetation.

Amphibians and Reptiles - The potential toxicological effects of herbicides on amphibians and reptiles are not well understood. Substantial declines in the populations of several amphibian species have been documented (Lannoo 2005). One of the suspected causes of the widespread amphibian population declines is increased use of pesticides, including but not limited to herbicides (Bury et al. 2004). Unfortunately, amphibians and reptiles are rarely included in toxicological studies and even fewer in field studies. Field studies that have been conducted are generally confined to mesocosm studies with experiments on tadpoles. However, many amphibian species spend all or the majority of their life cycle in a terrestrial environment.

In one of the few studies of the direct effects of herbicides on both terrestrial and aquatic life stages of amphibians, Relyea (2005) investigated the effects of Roundup on juvenile frogs, as well as on larval amphibians of the same species. After one day following a direct overspray of Roundup in laboratory containers, 68-86 percent of the juveniles were dead. Roundup is the commercial name for glyphosate with the surfactant. Because of known impacts to aquatic life, the non-aquatic formulation of glyphosate is not proposed for use in the vicinity of Forest aquatic resources. Herbicide applications in the vicinity of aquatic systems would use only herbicides registered for aquatic use. Results from SERA model runs did not indicate any difference in HQ values for terrestrial animals tested using glyphosate with or without the surfactant.

Environmental contamination studies and ecological risk assessments of reptiles are even sparser than those for amphibians. Campbell and Campbell (2002), in a review of existing reptile toxicological data, found that the biological significance of the contaminant concentrations was rarely studied. Thus, it is particularly difficult to assess the potential risks to reptiles from herbicide use proposed as part of this NNIS control project.

Invertebrates - Only glyphosate was shown to have a hazard quotient over 1.0 (1.5) based on SERA model runs. A study of clopyralid showed that it was toxic to three insects including a ladybug, a pirate bug, and a lacewing (Hassan et al. 1994); however, the relative application rate in that scenario is unknown.

Birds of Conservation Concern

Direct, Indirect, and Cumulative Effects

As noted above, none of the SERA worksheets showed an HQ >1.0 for small birds or carnivorous or piscivorous birds for any of the herbicides analyzed, and available information for fosamine indicated a similarly low risk. Only large grazing birds exhibited hazard quotients over the NOEL. None of the BCC breeding on the Forest (Table WL-1) falls into the large grazing bird category. As noted previously, little treatment will occur within mature forests and no adverse effects are expected for forest interior species or their primary habitats. Furthermore, no trees greater than 5 inches diameter at breast height or 6 feet tall will be cut or foliar sprayed as part of any of the proposed NNIS treatments. This constraint should avoid direct impacts to cavity and tree nesting species. Mechanical control techniques could have some negative effects on ground-nesting birds, such as the golden-winged warbler, or those nesting in shrub species targeted for treatment in early successional habitats. However, these mechanical treatments will be very site-specific and any impacted nests are not expected to have a noticeable adverse effect on local populations. In addition, mowing and grubbing activities associated with the proposed action would be limited to August 15 through March 15 in areas with known RFSS ground- or low cover-nesting bird species, several of which overlap with BCC. As such, the proposed NNIS treatments are not expected to have direct, indirect, or cumulative adverse impacts on BCC. However, by eliminating invasive plant species that are competing with native species, control treatments are likely to have a long-term beneficial effect on BCC that feed on these native species.

Management Indicator Species

Cerulean Warbler – Direct, Indirect, and Cumulative Effects

Because the cerulean warbler is typically associated with mature and old-growth forests, the species and its habitat are not expected to be directly, indirectly or cumulatively affected by NNIS control treatments, which are proposed mostly for early-mid successional habitats and other open or disturbed areas. Thus effects to this MIS species will not be discussed further.

West Virginia Northern Flying Squirrel – Direct, Indirect, and Cumulative Effects

The primary habitat for the WVNFS, mid-late and late successional spruce and spruce/northern hardwood forest, also is not expected to be affected by proposed treatments for the reason noted above. However, this species is known to use habitats bisected by roads and other disturbed habitats, and proposed treatment areas do overlap with mapped suitable habitat for the species. Thus, while the typical habitat for the species would not be affected and so will not be discussed further here, other habitats used by WVNFS for dispersal or other purposes may be affected. As such, potential impacts to this species will be discussed in detail in the TES section of this EA.

Wild Turkey – Direct, Indirect, and Cumulative Effects
Of the three terrestrial MIS, wild turkey is most representative of habitats that may be affected by the proposed NNIS control treatments. In addition to the oak and oak-pine woodlands that this MIS represents, the wild turkey is often associated with the types of disturbed and managed openings that are commonly invaded by non-native vegetative species (e.g., wildlife openings, thickets). The grasses and forbs in these habitats are especially used by both adults and young for foraging in late spring and summer, the same time that herbicides, if proposed, will most likely be applied. The mechanical and biological control methods called for in the proposed treatment areas are unlikely to have any adverse impacts on wild turkeys, assuming that mowing is limited to the period between August 15 and March 15 as noted above for RFSS ground-nesting species. Most herbicides also are of little concern for turkey and other species using oak-pine woodlands. However, the results of the SERA models for triclopyr indicate that the short-term, chronic risk to wild turkey and other large birds relying on vegetation for a large part of their diet may be high in areas where this herbicide is applied. Thus, it is recommended that alternatives to this herbicide be used for foliar applications in and around wildlife openings and forest/herbaceous edges to minimize the potential for impact to individuals of these species.

Threatened and Endangered Species

Detailed life history requirements, general biology, distribution, habitat information, causes for decline, environmental baseline, and specific guidance for T&E species may be found in the Wildlife Resource Report in the Project File, the Forest Plan (USFS 2006): the Biological Assessment for Threatened and Endangered Species (USFS 2006) p. 35, and the Programmatic Biological Opinion (BO) for the Monongahela National Forest 2006 Forest Plan Revision (USFWS 2006) p. 27.

Indiana Bat – Direct and Indirect Effects
Maternity Habitat - Tree removal may negatively impact maternity roosts and other summer roosting sites. No treatment of woody vegetation is proposed for the vicinity of the maternity colony in the Otter Creek focal area (Lower Glady), and so no loss of maternity sites will occur. However, one of the NNIS proposed for treatment in the Smoke Hole area is tree of heaven (*Ailanthus altissima*), a species which can grow to 98 feet in height (USFS 2006). Proposed treatment areas for this NNIS are located within 2.5 miles of a post-lactating female Indiana bat capture; in addition several male Indiana bats were tracked to roost trees in this area. While no *A. altissima* trees have been identified as Indiana bat roost trees on the Forest, it is possible that these trees may provide potential roost habitat. Thus, treatment methods for the tree of heaven and other NNIS trees greater than 5 inches diameter at breast height (dbh) will be limited to basal spray or “hack and squirt” herbicide application to avoid loss of potential maternity or other roost trees (i.e., no trees over 5 inches dbh will be cut); also, no foliar spray will be used on trees over 5 inches dbh or 6 feet tall to avoid the potential for direct herbicide spray on roosting bats.

Primary Range Roosting and Foraging Habitat - As noted above, no trees over 5 inches dbh will be cut as part of this project. Other treatments used to non-native invasive tree species might result in death of potential roost trees. However, these treatments are more likely to create snags as potential roost trees than to result in the net loss of roost trees. No foliar herbicide spray will be used on trees over 5 inches dbh or 6 feet tall either, minimizing the potential for direct spray of bats that might be roosting in or near target woody invasive species. Short-term increases in noise or general disturbance near roost trees during treatments could cause individuals to move from one roost to another, but as most Indiana bats use more than one roost tree in normal situations, this is not expected to adversely affect individuals or populations.

Local insect populations may be affected in response to changes in vegetative species distribution and abundance resulting from NNIS removal or control treatments. However, these affects are expected to benefit Indiana bat and other bat species by increasing native plant diversity and abundance and associated insect species. Herbicide applications are not expected to adversely impact insect populations, and in cases where the SERA models or literature review indicate the potential for some adverse impacts to insects (e.g., glyphosate or clopyralid), any impacts are expected to be short-term and localized in the specific treatment areas. Given the variety of foraging habitats that Indiana bats are known to utilize and the relative scale and spatial distribution of proposed NNIS treatment areas, such potential short-term changes to insect populations are not expected to result in measurable impacts to insect prey quantity or quality.

Indiana Bat - Cumulative Effects

Past, present and reasonably foreseeable activities that may cumulatively affect the Indiana bat have previously been discussed in the March 2006 *Biological Assessment for Threatened and Endangered Species on the Monongahela National Forest*. Effects due to white-nose syndrome, which was not recognized as a serious problem for Indiana bat populations until after the 2006 Forest Plan was completed, are not expected to have bearing on the proposed project given the lack of proposed treatment activity at or near cave habitats, and the steps taken to avoid potential impacts to roosting and foraging bats.

As discussed above, direct and indirect impacts from the proposed action are expected to have little to no effect on the Indiana bat and its habitat on the Forest in the short-term and likely no to positive effects on the species in the long-term. Cumulatively, impacts from the proposed action are expected to be small to negligible, and would have little or no incremental effect when combined with the impacts of other past, present, or foreseeable future activities. The Biological Assessment determination for Indiana bat is: *May effect, not likely to adversely affect (NLAA).*

Virginia Big-eared Bat - Direct and Indirect Effects

No NNIS control activities are proposed within or adjacent to VBEB caves (maternity colonies or hibernacula). Because the nearest treatment area is located 0.15 mi. from a VBEB cave, mechanical treatments (mowing, grubbing and hand-pulling) are not expected to have any impact on the cave environments. Where herbicide treatments are proposed, exposure should be limited temporally and spatially to the site treatment and any associated drift zone; because no aerial spraying is proposed, drift zones are expected to be minimal. Thus, no impacts are expected for VBEB hibernacula, roost sites, or maternity colonies.

Potential effects to foraging habitat and bats using those areas are similar to those described for the Indiana bat. As noted above, any potential adverse affects on insect prey populations are expected to be localized and short-term, while long-term effects from NNIS control will be positive for native plant and insect populations and thus for the VBEB.

Virginia Big-eared Bat - Cumulative Effects
Past, present and reasonably foreseeable activities that may cumulatively affect the VBEB have previously been discussed in the March 2006 *Biological Assessment for Threatened and Endangered Species on the Monongahela National Forest*. Cumulatively, impacts from the proposed action are small to negligible, and would have little or no incremental effect when combined with the impacts of other past, present, or foreseeable future activities. The Biological Assessment determination for VBEB is: *May effect, not likely to adversely affect (NLAA).*

White-nose Syndrome - There have been recent discoveries in West Virginia of white-nose syndrome, which is suspected of leading to mortality in bats, including Indiana bats and VBEB. The effects from white-nose syndrome have yet to be determined on the Forest or in West Virginia. However, because the Proposed Action is not likely to adversely affect Indiana bat and VBEB populations, it is not likely to have any measurable contribution to cumulative impacts (including from white-nose syndrome) on bat populations within the project area or beyond.

Cheat Mountain Salamander - Direct and Indirect Effects
One of the proposed NNIS treatment sites, located near the Gaudineer Scenic Area in the Cheat Mountain area of this project is focused on a reed canary grass infestation. Discussions with Dr. Thomas Pauley of Marshall University suggest that this area, which has historically provided habitat for the CMS, has changed greatly over the last ten years, as reed canary grass has invaded the roadside habitats. In addition to vegetative species changes, the soils appear to be much drier, possibly as a result of the dense growth form of the invasive species. Changes in soil moisture content, as well as dense colonies of the invasive grass on and in the root zone below the soil surface, could result in a change from suitable to unsuitable habitat for CMS in this area, and may inhibit movement between existing suitable habitat patches on either side of the disturbed roadway corridor. The no action alternative would result in no change to this situation or a potential worsening which could eventually affect the viability of local populations.

The proposed action alternative could also impact CMS. In the short term, vegetation and soil disturbance associated with mechanical or herbicide treatments could disrupt microhabitats. However, in the long term, a return to native vegetative communities and associated microhabitat conditions probably would benefit the species. In this area, the primary NNIS control treatment method proposed is herbicide application because reed canary grass cannot be effectively treated with mechanical treatments alone. The potential effects of herbicide treatments in these areas are difficult to assess due to the general lack of information regarding the impacts of herbicides on terrestrial herpetofauna as discussed earlier in this document. While there is no evidence that the use of the proposed herbicides would adversely affect CMS, neither is there evidence that there would be no effect. Because of this lack of knowledge and the threatened status of this species, foliar herbicide treatment in areas with known CMS presence will be limited to hand application using a wick, wand, or glove applicator rather than spray. Only aquatic-registered herbicides would be used for any foliar application in known CMS habitat to minimize the potential for adverse impacts to these amphibians, and no treatment of any sort would occur within 5 meters of observed salamanders or eggs. Furthermore, treatment in known CMS habitat during the months of April-October would be limited to the "heat of the day" hours (i.e., 9 AM to 4 PM) to minimize the potential to affect CMS moving about in the area during NNIS treatments.

Potential disturbance of CMS and its habitat will be minimized by the requirement for CMS surveys prior to implementation of ground- or vegetation-disturbing activities per Forest-wide management direction (FP II-26, TE58) in known or potential habitat. In addition, Management Direction calls for avoidance of ground- and vegetation-disturbing activities within occupied habitat and a 300-foot buffer zone around occupied habitat (FP II, TE59) unless analysis can show that the activities would not have an adverse effect on populations or habitats. For the areas proposed for treatment as part of this EA, particularly given the potential adverse impacts of NNIS to CMS habitat and local populations, hand-pulling of invasive species would not be considered to have an adverse impact on the species. Other mechanical measures would be limited to areas outside the 300-foot buffer zone as called for in Plan management direction.

Cheat Mountain Salamander - Cumulative Effects

Cheat Mountain salamanders are endemic to only five counties in the Allegheny Mountains of eastern West Virginia (Pauley 2007). Since 1976, of the 80 sites (out of 1,300 surveyed) that are known to support CMS, at least one population and possibly two others have been extirpated, and two have been reduced in size. Between losses or fragmentation of habitat and competitive stress from other salamanders, many of the disjunct CMS populations could be imperiled (Pauley 2007). Because of the limited territorial size and dispersal distance of CMS, it is unlikely that direct or indirect effects to one local population would impact other disjunct populations. However, given the limited number of known local populations, the loss of individual populations could have a cumulative effect on the overall population across its limited range.

As noted above, current microhabitat conditions for proposed NNIS treatment sites with known CMS populations (e.g., Gaudineer Knob) are not necessarily favorable for this species due in part to encroachment of reed canary grass and other non-natives, and these conditions would be expected to continue or be exacerbated with the no action alternative. Thus, treatment of these areas for NNIS as part of the proposed alternative, with a subsequent return to native vegetative community composition and structure, would likely favor the CMS in the long term. The requirement of protocol-specific surveys for CMS in known or potential habitat prior to implementation of ground or vegetation disturbance, and other spatial and temporal treatment requirements noted above, should reduce the potential for adverse impacts to CMS associated with proposed treatments to a negligible level. As such, cumulative impacts from the proposed action would be small to negligible, and are expected to have little or no incremental effect when combined with the impacts of other past, present, or foreseeable future activities. The Biological Assessment determination for CMS is: *May effect, not likely to adversely affect (NLAA).*

Regional Forester Sensitive Species

West Virginia Northern Flying Squirrel - Direct and Indirect Effects

Mechanical NNIS treatments are not expected to have noticeable adverse effects on WVNFS. No trees over 5 inches dbh will be cut as part of the proposal, and no foliar spraying will occur on woody vegetation over 5 inches dbh (or 6 feet tall), such that no impacts to nesting WVNFS are anticipated. Foraging also is unlikely to be affected since treatment areas are limited to roadsides and wetlands or early successional habitats that are located outside primary foraging habitat for the squirrel.

Our assessment of potential impacts to WVNFS from herbicide treatments are based on SERA model run results (e.g., HQ for small mammals), literature reviews, field knowledge, and discussions with FS and other biologists, as well as ancillary data reported to the Forest by the public regarding a recent observation of WVNFS in the vicinity of a timber herbicide treatment area. In October 2008, hunters observed several distressed flying squirrels in the vicinity of Middle Mountain, in or near areas that had recently undergone herbicide application in association with timber harvest. They noted that they were able to pick up and hold the squirrels, which were alive but appeared to be experiencing severe respiratory problems. It is unknown whether these were northern or southern flying squirrels, however, the event is probably relevant in either case. Further investigation of this incident indicated that the area in question was treated with an herbicide solution containing sulfometuron methyl, glyphosate, imazapyr and a surfactant, applied at a maximum rate of ~2.6 oz/ac, 2.6 qu/acre, and 2.6 oz/ac for the herbicides, respectively. Of the herbicides used near the distressed flying squirrels, sulfometuron methyl is not proposed for use in the project. The proposed NNIS treatment application rate for glyphosate is approximately the same as that noted above, and the proposed application rate for imazapyr is ~ 1 oz/ac (~40% of the amount noted above).

SERA worksheet for glyphosate and imazapyr both indicated hazard quotients $\leq$ 1.0 for an acute/accidental direct spray scenario for small mammals; the highest HQ was for glyphosate at 0.7 (Appendix C). However, the glyphosate model runs (with and without surfactant) indicated an increased risk (HQ = 2.0) for small mammals feeding on contaminated insects. The only other small mammal scenario run with the SERA model resulting in a HQ > 1.0 was for Picloram (HQ=1.3), also associated with ingesting contaminated insects. Unfortunately, there is no SERA scenario representative of small mammals feeding on lichens and fungi (like the WVNFS), nor were we able to find relevant toxicological studies in the literature. As such, it is impossible to accurately assess the risks from ingesting that food type with available data. Furthermore, while the information gained from the SERA modeling exercises provides valuable information regarding potential effects of individual herbicides on flora and fauna, it does not address potential synergistic effects from herbicide mixtures such as that used in the vicinity of the distressed squirrel observations noted above. In addition, it should be noted that the technique used in association with the timber harvest in the situation noted here used heavy equipment to apply the herbicide across very broad areas. That type of equipment is not proposed for use as part of the proposed NNIS control treatments.

Based on the available information regarding the potential effects of individual herbicides proposed for use as part of this project on small mammals, and the application techniques proposed, it is unlikely that the herbicide application will have adverse impacts on WVNFS. However, sites with known WVNFS, and a subset of other sites that overlap with mapped suitable WVNFS habitat, will be monitored following herbicide application to ensure that no unforeseen impacts occur. Should distressed WVNFS be found in the vicinity of these sites within a month following herbicide application, herbicide treatments will stop within known or mapped WVNFS habitat pending further investigation of the potential causes.

As noted previously, the USFWS has determined that threats to *G. s. fuscus* have diminished to the point that removal of the subspecies from the federal endangered species list was warranted. However, a post-delisting monitoring plan will be implemented to ensure that the WVNFS population does not decline or that no new information comes to light indicating increased threats to the species.

West Virginia Northern Flying Squirrel - Cumulative Effects

Because no adverse direct or indirect impacts are anticipated for the species as a result of the proposed action, no cumulative impacts are expected. Should adverse impacts occur in association with herbicide application, they should be quickly detected based on proposed monitoring, and herbicide application activities would be halted as noted above to minimize potential impacts to individuals until a further analysis could be made. Any unanticipated adverse effects would be limited and short-term, and are expected to have little or no incremental effect when combined with the impacts of other past, present, or foreseeable future activities. *Therefore the determination for this species is "May impact individuals but not likely to cause a trend to renewed federal listing or a loss of viability".*

Eastern Small-footed Myotis - Direct and Indirect Effects

The Eastern small-footed bat spends the winter in hibernacula caves, often the same caves used by Indiana and Virginia big-eared bats. As noted previously for those species, no impacts are expected for known hibernacula on the Forest. *M. leibii* summer roosts and maternity colonies may occur in caves, like the VBEB; however, this species also is known to use a broader range of habitat features (e.g., buildings, bridges, rock wall crevices). Given the location of proposed treatments however, no impacts to these habitats features are expected in association with proposed treatments either. Potential impacts to foraging habitat of *M. leibii* are similar to those described for the Indiana and Virginia big-eared bats (potential short-term, localized impacts to insect populations, but likely long-term benefits to native vegetative diversity and insect prey populations in the same treatment areas).

Eastern Small-footed Myotis - Cumulative Effects

As with other bat species discussed here or present on the MNF, cumulative impacts from the proposed action are expected to be small to negligible, and would have little or no incremental effect when combined with the impacts of other past, present, or foreseeable future activities. *Therefore the determination for this species is "May impact individuals but not likely to cause a trend to federal listing or a loss of viability".*

Southern Rock Vole - Direct and Indirect Effects

Because areas near the proposed treatment sites may provide habitat for the southern rock vole, modifications to the herbaceous component in existing habitat could indirectly affect the species. However, the long-term affect of NNS control (increased native species vegetative diversity) should benefit the vole. While no direct impacts to the southern rock vole are expected as a result of the proposed action, any unforeseen negative effects to the species from NNIS control efforts would likely be small to negligible and short-term in nature.

Southern Rock Vole - Cumulative Effects

Cumulative impacts from the proposed action are expected to be small to negligible, and would have little or no incremental effect when combined with the impacts of other past, present, or foreseeable future activities. *Therefore the determination for this species is "May impact individuals but not likely to cause a trend to federal listing or a loss of viability"*.

Southern Water Shrew - Direct, Indirect, and Cumulative Effects

The only area considered to have some risk to the southern water shrew as a result of NNIS control efforts is the Blister Run Botanical Area, where bush honeysuckle is proposed for treatment. The proposed treatment in this area is herbicide application, including aquatic glyphosate and/or triclopyr. While the aquatic form of glyphosate has been shown to have a much smaller risk to aquatic species than the more toxic form (with surfactant), the SERA model runs for this herbicide still show a risk over NOEL (HQ = 2.0) for small mammalian insectivores given the proposed application rates. The hazard quotient for the same acute scenario using triclopyr acid or BEE (at the low modeled application rate proposed for aquatic use of 1 lb/ac) is 0.7 (Table 6, Appendix C). Because of the increased risk from glyphosate indicated by these models, application of glyphosate in the Blister Run Botanical Area will occur only by hand (cut suface, weed wand or swiper application, wick, or glove) rather than by foliar or basal spray to minimize risk to this sensitive shrew species. Based on that application type, the risk to the southern water shrew is considered small and unlikely to contribute to any adverse effects to the population in that area. Long-term benefits to this shrew species and other fauna in the area are expected from NNIS control as a result of increased native vegetative species diversity and abundance in this botanical area. *Therefore the determination for this species is "May impact individuals but not likely to cause a trend to federal listing or a loss of viability"*.

Allegheny Woodrat - Direct and Indirect Effects

No NNIS treatments are proposed for rocky outcrops or other rock habitats with known RFSS, and no direct impacts are expected for the woodrat from the proposed action. However, surveys will be conducted at rocky outcrops, talus slopes, caves, ledges or similar habitats located within 100 meters of proposed treatment areas. If sensitive species are found (e.g., Allegheny woodrat, eastern small-footed myotis, timber rattlesnake, or green salamander), no treatments other than hand pulling or mowing with a string trimmer will occur within 50 meters of those habitat features to minimize the potential for direct or indirect effects to RFSS. Adjacent forested habitats used by the woodrat for foraging are not targeted by NNIS control measures, and the buffer applied to the rocky habitats is expected to minimize effects to any potential NNIS target areas that may be used by the species for movement between rocky and forested habitats.

SERA model runs for herbicides proposed for NNIS treatment did not show any hazard quotients > 1.0 for small mammals, with the exception of insectivores. Since the woodrat's diet is primarily vegetarian, no direct impacts to the species are expected as a result of any of the proposed herbicide treatments. However, a change in herbaceous vegetation or fungi could have some short-term effect on the woodrat's diet locally, with any long-term effects expected to be positive as native vegetation returns.

Allegheny Woodrat - Cumulative Effects
Because no direct impacts are expected and indirect impacts would be small to negligible given the restrictions noted above, no cumulative effects are anticipated for Allegheny woodrat populations within the Forest. *Therefore the determination for this species is "May impact individuals but not likely to cause a trend to federal listing or a loss of viability".*

Timber Rattlesnake - Direct, Indirect, and Cumulative Effects
No NNIS treatments are proposed for rocky outcrops or other rock habitats with known RFSS. As noted previously, surveys will be conducted at rocky outcrops, talus slopes, caves, ledges or similar habitats located within 100 meters of proposed treatment areas. If sensitive species are found, no treatments other than hand pulling will occur within 50 meters of those habitat features to minimize the potential for direct or indirect effects to RFSS. Adjacent forested habitats used by *C. horridus* for foraging are not targeted by NNIS control measures, and the buffer applied to rocky habitats inhabited by individual rattlesnakes is expected to minimize effects to any potential NNIS target areas that may be used by the species for movement between rocky den sites and foraging habitats.

The timber rattlesnake is often observed sunning on roadways and adjacent cutbanks, which makes it more likely to come into contact with proposed treatment areas than other species discussed in this document that are associated primarily with rocky habitats. Mechanical controls along roadway right-of-ways have some inherent risk to both the rattlesnake (e.g., mowing) and personnel who may be working at these sites (e.g., hand-pulling or grubbing). The risk to rattlesnake populations from this work is considered small however, particularly given the protections provided potential den sites. Herbicide application in these areas may also expose rattlesnakes to the potential for direct spray. Unfortunately, as discussed previously, there is virtually no data regarding the potential effects of the proposed herbicides (or any others) on reptiles. As such, it is possible, though unlikely, that herbicide treatments in disturbed areas frequented by the timber rattlesnake could result in adverse impacts to individuals. However, given the relatively small area of specific treatments and the widespread distribution of the rattlesnake across the Forest, any potential impacts to individuals are not expected to affect overall population levels. *Therefore the determination for this species is "May impact individuals but not likely to cause a trend to federal listing or a loss of viability".*

Green Salamander - Direct and Indirect Effects
No NNIS treatments are proposed for rocky outcrops or other rock habitats with known RFSS. As noted previously, surveys will be conducted at rocky outcrops, talus slopes, caves, ledges or similar habitats located within 100 meters of proposed treatment areas. If sensitive species are found, no treatments other than hand pulling will occur within 50 meters of those habitat features to minimize the potential for direct or indirect effects to RFSS. Forested habitats adjacent to potential rocky outcrop habitats used by this species are not targeted by NNIS control measures, and the buffer applied to the rocky habitats is expected to minimize effects to any potential NNIS target areas that may be used by the species for movement between suitable rock habitats and adjacent arboreal habitat. Given the relatively small home range size of this species, and the buffer applied to known or probably rocky habitats, the proposed action is expected to have no direct effect on *A. aeneus* and indirect effects would likely be small to negligible.

Green Salamander - Cumulative Effects

Because no direct impacts are expected and the likelihood of indirect impacts is small to negligible given the restrictions noted above, no cumulative effects are anticipated for green salamander populations within the Forest. *Therefore the determination for this species is "May impact individuals but not likely to cause a trend to federal listing or a loss of viability".*

Northern Goshawk - Direct, Indirect, and Cumulative Effects

While northern goshawks may move through proposed NNIS treatment sites, the primary habitat for this species is not targeted for treatment, nor are any direct or indirect impacts expected for those breeding habitats. The SERA models did not indicate any elevated risk to predatory birds as a result of herbicide application at the proposed rates, so that indirect impacts to potential prey species also are not expected. Since the proposed action is not expected to have either direct or indirect impacts to the northern goshawk, despite the potential for it to move through treatment areas within individual territories, no adverse cumulative effects are anticipated either. *Therefore the determination for this species is "No Impact" expected from the proposed action.*

Golden-winged Warbler - Direct, Indirect, and Cumulative Effects

The golden-winged warbler is an insectivorous species which nests on the ground in early successional habitats. As such, breeding birds may be adversely affected, on a short-term basis, by both mechanical NNIS control methods (e.g., pulling, grubbing, and mowing) and herbicide treatments. In addition to the potential for direct impacts to nesting sites and young, noise associated with treatments could disturb individuals feeding, nesting or sheltering in the area. To minimize the potential for impacts to breeding individuals and young in areas with known populations, mechanical treatments such as mowing and grubbing would be restricted to August 15-March 15, avoiding the nesting season for these species and other breeding birds in the area.

None of the SERA models indicated an elevated risk (HQ > 1.0) for small birds resulting from use of the proposed herbicides and application rates, nor did a literature review indicate high risks to these species. Thus, the proposed herbicide application is not expected to adversely affect individuals of these species. However, to avoid potential risk to breeding birds and nestlings, it is recommended that known nest sites be avoided during the breeding season noted above (i.e., known nest sites should be flagged, and no herbicide application within a radius of 50 meters around known nest sites during the breeding season). Hand pulling is not expected to result in adverse impacts to these species. Given the restrictions noted above, the proposed action is not expected to have direct, indirect, or cumulative adverse effects on the golden-winged warbler. *Therefore the determination for this species is "May impact individuals but not likely to cause a trend to federal listing or a loss of viability".*

Vesper Sparrow and Henslow's Sparrow - Direct and Indirect Effects

Because of similarities in their life histories and habitat requirements, effects on the vesper sparrow and Henslow's sparrow will be discussed together below. Both of these species nest on or near the ground in open grassland habitats and forage on the ground for invertebrates and seeds. Long-term indirect impacts to both species, and other grassland birds, would be improved as a result of NNIS control and a subsequent return of these habitats to a more diverse native vegetative community. However, in the short term they are vulnerable to adverse impacts from both mechanical NNIS control methods (e.g., pulling, grubbing, and mowing) and herbicide treatments. In addition to the potential for direct impacts to nesting sites and young, noise associated with treatments could disturb individuals feeding, nesting or sheltering in the area.

To minimize the potential for impacts to breeding individuals and young in areas with known populations, mechanical treatments such as mowing and grubbing would be restricted to August 15-March 15, avoiding the nesting season for these species and other breeding birds in the area. None of the SERA models indicated an elevated risk (HQ > 1.0) for small birds resulting from use of the proposed herbicides and application rates, nor did a literature review indicate high risks to these species. Thus, the proposed herbicide application is not expected to adversely affect individuals of these species. However, to avoid potential risk to breeding birds and nestlings, it is recommended that known nest sites be avoided during the breeding season noted above (i.e., known nest sites should be flagged, and no herbicide application within a radius of 50 meters around known nest sites during the breeding season). Hand pulling is not expected to result in adverse impacts to these species. Given the restrictions noted above, the proposed action is not expected to adversely affect the Henslow's sparrow or vesper sparrow.

Vesper Sparrow and Henslow's Sparrow - Cumulative Effects
Since no direct impacts are expected and the likelihood of indirect impacts is small to negligible, no adverse cumulative effects are anticipated. *Therefore the determination for these species is "May impact individuals but not likely to cause a trend to federal listing or a loss of viability".*

Red-headed woodpecker - Direct, Indirect, and Cumulative Effects
No trees over 5 inches dbh will be cut as part of the NNIS control treatments, nor will foliar application of herbicides be sprayed on woody vegetation over 5 inches dbh or 6 feet in height. In addition, none of the SERA models indicated an elevated risk (HQ > 1.0) for small birds resulting from use of the proposed herbicides and application rates, nor did a literature review indicate high risks to these species. Thus, the proposed herbicide application is not expected to adversely affect individuals. However, to avoid potential risk to breeding birds and nestlings, it is recommended that known nest sites be avoided during the breeding season noted above (i.e., known nest sites should be flagged, and no herbicide application within a radius of 50 meters around known nest sites during the breeding season). Hand pulling is not expected to result in adverse impacts to these species. Given the restrictions noted above, the proposed action is not expected to directly affect the red-headed woodpecker, and any indirect impacts would be expected to be small to negligible and short-term, with no cumulative impacts expected. *Therefore the determination for these species is "May impact individuals but not likely to cause a trend to federal listing or a loss of viability".*

Olive-sided Flycatcher - Direct, Indirect, and Cumulative Effects
Mechanical control treatments are not expected to have any direct effects to this species. None of the SERA models indicated an elevated risk (HQ > 1.0) for small birds resulting from use of the proposed herbicides and application rates, nor did a literature review indicate high risks to these species. Thus, the proposed herbicide application is not expected to adversely affect individuals. However, the restrictions associated with herbicide application in the Blister Run Botanical Area for the southern water shrew would also minimize any potential risk to the olive-sided flycatcher nesting in this area. Herbicide application in this area will occur only by hand (cut suface, weed wand or swiper, wick, or glove application) rather than by foliar or basal spray.

As with the shrew and bird species noted above, long-term benefits to fauna in the area are expected from the proposed action as native vegetative species diversity and abundance returns to the area.

Given the restrictions noted above, the proposed action is not expected to directly affect the olive-sided flycatcher, and any indirect impacts would be expected to be small to negligible and short-term, with no cumulative impacts. *Therefore the determination for this species is "May impact individuals but not likely to cause a trend to federal listing or a loss of viability".*

Invertebrate RFSS Species - Direct and Indirect Effects

If unknown populations do exist in these areas, individuals may come in direct or indirect contact with herbicides. Based on the SERA models, only the glyphosate run (acute, direct spray) was shown to result in an HQ > 1.0 (1.5). The results of one study described in the Herbicide Application section of this analysis indicated that clopyralid may be toxic to some insects (i.e., a ladybug, pirate bug and lacewing); however the modeled hazard quotient results for clopyralid using the proposed application rate was under the NOEL (HQ = 0.1). Because of the generally low toxicity of the proposed herbicides to insects, potential adverse impacts to these species are expected to be small to negligible, and no direct impacts from mechanical control methods are anticipated.

Short term changes in abundance of herbaceous vegetation may result in indirect affects to these species, but given the limited spatial extent of treatment areas, this is not expected to adversely affect individuals. Long-term changes in herbaceous vegetative communities following removal of NNIS should have a beneficial effect, if any, for these insect species.

Invertebrate RFSS Species - Cumulative Effects

Cumulatively, potential adverse impacts from this project would be small or nonexistent, long-term impacts would be positive, and the project would have no incremental adverse effect when combined with the impacts of other past, present, or foreseeable future activities. *Therefore the determination for these R9 Sensitive invertebrate species is "May impact individuals but not likely to cause a trend to federal listing or a loss of viability".*

Unavoidable Adverse Impacts

Alternative 1 would take no action; therefore it would not directly cause any unavoidable adverse impacts to RFSS or T&E wildlife species.

The Proposed Action (Alternative 2) could unavoidably harm a number of individual species, as disclosed in the effects analyses above. Any unavoidable adverse impacts would be minimized from application of the mitigation measures described in Chapter 2 of this EA. Habitat capacity would not be damaged, and in many cases would be improved.

Irreversible Or Irretrievable Commitment of Resources

Alternative 1 would take no action; therefore it would not cause any irreversible or irretrievable commitment of resources related to threatened and endangered or RFSS plants.

The Proposed Action (Alternative 2) could irreversibly kill a number of individual species, as disclosed in the effects analyses above. However, habitat capacity would not be damaged, and in many cases would be improved, so the Proposed Action would not make any irreversible or irretrievable commitments of TES, BCC, or MIS habitat.

3.8.4 - Consistency with the Forest Plan

The No Action alternative would take no action. While lack of action would not make progress toward goals and objectives for TES animal conservation, it would not violate Forest Plan standards and guidelines for TES animals.

The Proposed Action contains design criteria and mitigation to limit adverse effects to wildlife species of concern. The design criteria and mitigation measures would not avoid all adverse impacts, but would limit them such that population level impacts would not occur. In addition, NNIS treatments would generally improve wildlife habitat for many species over the long term. Therefore, the Proposed Action would be consistent with Forest Plan direction to provide habitat diversity to support viable populations of native populations of wildlife species, including MIS, RFSS, and BCC (see Forest Plan Goal WF01, p. II-29 and Goal WF05, p. II-30).

3.8.5 - Consistency with Laws, Regulations, and Handbooks

The No Action alternative would take no action that would have a direct effect on TES, MIS, or BCC animal species; therefore, it would be consistent with the Endangered Species Act, the Migratory Bird Act, the National Forest Management Act, and their implementing regulations.

The Proposed Action is not expected to adversely affect T&E animals; therefore, this alternative would be consistent with the Endangered Species Act, its implementing regulations, and Forest Service directives for T&E species. Although effects to MIS, RFSS, and BCC species may occur, such effects would be limited and would not result in loss of viability or a trend toward federal listing. Because of this maintenance of viability, the Proposed Action would be consistent with requirements in the Migratory Bird Act and the National Forest Management Act and its implementing regulations related to maintenance of biological diversity.