# HEMLOCK WOOLLY ADELGID CONTROL STRATEGIES ALONG THE BLUE RIDGE PARKWAY

## Environmental Assessment

## September 2007

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# ACRONYMS AND ABBREVIATIONS

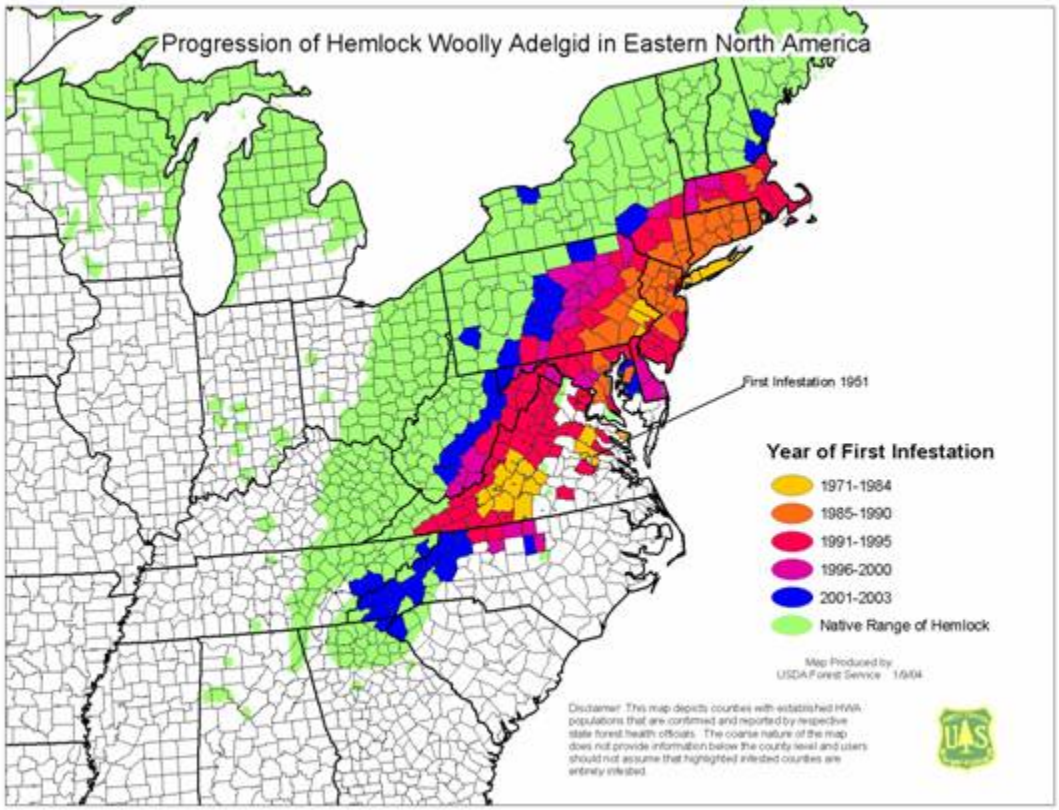
| | |
|---|---|
| BLRI | Blue Ridge Parkway |
| BWA | Balsam Woolly Adelgid |
| CEQ | Council on Environmental Quality |
| CFR | Code of Federal Regulations |
| CLI | Cultural Landscape Inventory |
| DEWA | Delaware Water Gap National Recreation Area |
| DBH | Diameter at Breast Height |
| DO | NPS Director's Order |
| EA | Environmental Assessment |
| EPA | Environmental Protection Agency |
| FIFRA | Federal Insecticide, Fungicide, and Rodenticide Act |
| GMP | General Management Plan |
| GRSM | Great Smoky Mountains National Park |
| HWA | Hemlock Wooly Adelgid |
| IPM | Integrated Pest Management |
| LCS | List of Classified Structures |
| NEPA | National Environmental Policy Act |
| NHPA | National Historic Preservation Act |
| NCDA | North Carolina Department of Administration |
| NCDENR | North Carolina Department of Environment and Natural Resources |
| NCWRC | North Carolina Wildlife Resources Commission |
| NRHP | National Register of Historic Places |
| NC | North Carolina |
| NPCA | National Parks Conservation Association |
| NPS | National Park Service |
| SERO | Southeast Regional Office |
| SHEN | Shenandoah National Park |
| SHPO | State Historic Preservation Officer |
| T&E | Threatened and Endangered |
| USC | United States Code |
| USDA | United States Department of Agriculture |
| USDI | United States Department of Interior |
| USFS | United States Forest Service |
| USFWS | United States Fish and Wildlife Service |
| VA | Virginia |
| VDCR | Virginia Department of Conservation and Recreation |
| VDGIF | Virginia Department of Game and Inland Fisheries |
| WNCA | Western North Carolina Alliance |
| WSP | Water Soluble Powder |

# PURPOSE AND NEED

## PURPOSE AND NEED FOR ACTION

The intent of this initiative is to set forth a long- term management strategy that would preserve hemlock forests by minimizing the impact of hemlock woolly adelgid (HWA) at the Blue Ridge Parkway (BLRI). HWA is a non- native insect pest that is quickly decimating hemlocks in the eastern United States. Since the 1980's HWA has spread north from Virginia (VA) to Maine and as far south as northern Georgia (U.S. Department of Agriculture (USDA) Forest Service 2004). HWA is steadily spreading into the oldest and largest hemlock forests of the Southern Appalachians, threatening a unique forest ecosystem and the aquatic communities it shelters. HWA was discovered at the Parkway in 1984 in northern Virginia. Spread by winds and migratory birds and mammals, the adelgid has decimated most hemlock stands on the Parkway in Virginia and now threatens the old growth hemlock forests of Linville Falls, Moses H. Cone Memorial Park, and Julian Price Memorial Park. Figure 1 shows the progression of HWA in the eastern U.S.

**Figure 1. Progression of HWA in eastern North America. Courtesy USDA Forest Service**



The National Park Service (NPS) is proposing to treat selected hemlock forests at BLRI to suppress HWA infestations and reduce hemlock mortality. HWA populations pose an imminent threat to park resources. The proposed treatments include the use of insecticidal soap, horticultural oil, systemic insecticides, and biological control agents including several species of predatory beetles. This document outlines proposed alternatives that would best protect and preserve hemlock communities in BLRI. The National Park Service is committed to protecting hemlock forests in BRLI, but park managers realize that some mortality is likely to occur due to the remoteness of many hemlock resources, the difficulty of treating thousands of individual trees throughout the park, and the probability of re- infestation from sources outside park boundaries. Managers have prioritized attainable goals for best preserving intact hemlock communities throughout the park.

The purpose of this document is to review the potential environmental impacts of the proposed action and alternatives to this action as required by the National Environmental Policy Act (NEPA) of 1969. This document also provides information necessary to determine if the need exists to develop an environmental impact statement. Comments are being requested from the general public and interested agencies concerning the alternatives presented in this document so that the most appropriate course of action can be selected.

The following specific goals guide the proposed action alternative in this document for consideration:

1. Minimize losses in hemlock old- growth forests

Stands of old growth hemlock occur at Linville Falls, the Moses Cone Estate, and Julian Price Memorial Park. Many of these stands are in excess of 400 years old and have high ecological significance. Old- growth forests of the park have become increasingly important in recent years as harbors of biodiversity, as preferred habitat of neotropical migratory bird species, for research of forest dynamics, and for recreation and aesthetics. Unfortunately, older trees are not as vigorous as younger trees, making them more easily affected by HWA.

2. Protect trees in high- use developed areas

Landscape setting trees are highly valued by the visiting public in campgrounds and picnic areas. If hemlocks are left untreated, decline and mortality are likely to increase creating public safety hazards as well as impacting aesthetics. Hemlocks provide a year-round buffer between campsites, picnic sites, and along roadways. The presence of dying trees along busy roadways and in developed areas increases the risk of injuries, vehicle damage, and facility damage due to falling trees. Hazardous trees are expensive and time- consuming to remove, and many hemlocks in developed sites are very large. Some area and facility closures might be necessary to insure public safety until the removal of hazardous trees could be completed.

3. Minimize losses in hemlock- dominated forests

Vegetation mapping is currently underway and is estimated to be completed by **2008**; but once complete would allow fine resolution of hemlock dominated communities in the park. Forests are considered hemlock- dominated when hemlocks represent 50% or more of total species composition. If hemlock forests are significantly reduced or eliminated in the park, there would likely be a cascade of associated environmental consequences involving species found within these hemlock communities. Both Eastern hemlock (*Tsuga* canadensis) and Carolina hemlock (*Tsuga caroliniana*) are present in the park. Carolina hemlock is considered a rare species in North Carolina (S3 rank: 21- 100 occurrences statewide) and is ranked G3 (21- 100 occurrences worldwide) globally and as such would receive higher priority for protection.

Hemlocks provide numerous benefits including nesting bird habitat, moderation of stream temperatures, and unique habitat for numerous plant and animal species. During the winter, hemlocks offer cover for a variety of wildlife including grouse, turkey, and deer. During the summer, hemlocks provide consistent shade and cooling for a variety of species (**Evans 2002, Snyder et al. 2002**). At a study site at Delaware Water Gap National Recreation Area (DEWA), researchers found that summer temperatures in a stream gradually decreased 3° to 4° C as the stream passed through a hemlock ravine (**Evans et al. 1996**). No other evergreen in the park could fill the critical ecological role of hemlocks in the forest. Hemlocks could also represent an important component of identified cultural landscapes which would be impacted with the loss of hemlocks.

In providing for the protection of natural, cultural, and recreational resources at BLRI, the primary decision to be made is whether to treat hemlocks, either with insecticides or biological- control agents, throughout the park in response to the damage caused to the trees from hemlock woolly adelgid. After the alternatives have been fully evaluated and the public has had the opportunity to review and provide comments on the proposed action, the NPS would issue a decision on how to proceed.

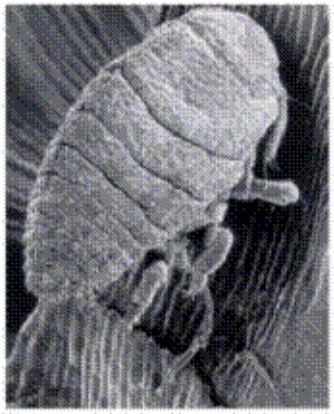
## BACKGROUND

The HWA threat to eastern hemlocks has been recognized since the early 1990s. Resource managers and researchers from state and federal agencies, universities, and special interest groups led by United States Department of Agriculture, Forest Service (USFS) specialists got together and formed the Hemlock Woolly Adelgid Working Group to develop priorities and focus resources. The first HWA review in October 1995 was an assemblage of presentations of known HWA biology, potential controls, impacts, and detection methods. The USFS - Forest Health Protection branch is the leading source of knowledge for forest pests. BLRI relies on the expertise of USFS specialists for knowledge of HWA and its management. The Hemlock Woolly Adelgid Working Group continues to meet to share knowledge and develop united strategies for a pest that affects large areas of eastern forests.

BLRI is mandated to protect the natural and cultural resources in the park. The "fundamental purpose" of the national park system, established by the Organic Act (1916) and reaffirmed by the General Authorities Act, begins with a mandate to conserve park resources and values, provide for the enjoyment of these resources and values by the people, and leave them unimpaired for future generations. As stated in NPS Management Policies (U.S. Department of the Interior (USDI) NPS 2006), "the NPS will strive to understand, maintain, restore, and protect the inherent integrity of the natural resources, processes, systems, and values of the parks." NPS Management Policies (2006) state that management of exotic (nonnative) species, up to and including eradication; will be undertaken whenever such species threatens park resources or public health and when control is prudent and feasible.

***Hemlock Woolly Adelgid Biology and the Decline of Eastern Hemlock Forests***

Hemlock woolly adelgid (*Adelges tsugae* Annand) belongs to the Order: Homoptera Family: Adelgidae. HWA was first reported in North America in Oregon on western hemlock (*T. heterophylla*) in 1924. The non- native insect was likely introduced from Asia on nursery stock of hemlocks (McClure and Cheah 1999). HWA has been known in the eastern U. S. since its discovery in Richmond, VA in 1951 and has spread throughout much of the native range of the eastern hemlock infesting approximately 25% of the 1.3 million hectares of hemlock forests in the eastern United States (Zilahi-Balogh et al. 2002). Periodic HWA observations were reported in several Mid- Atlantic States in the 1960s and 1970s, but it was not until the 1980s that HWA populations began to surge and spread northward to New England at an alarming rate. Unfortunately, by the late 1980s to early 1990s, HWA infestations were reported as the cause of extensive hemlock decline and tree mortality in forests throughout the eastern U. S. (McClure 2001). HWA is known to feed on North American native hemlocks (eastern, Carolina, western, and mountain) as well as hemlock species native to Asia, though it is a relatively minor pest on these species.


HWA Closeup

Unfortunately, eastern and Carolina hemlocks are very vulnerable to the damage caused by adelgids as they feed on the trees. HWA feed at the base of hemlock needles inserting their piercing- sucking mouthparts and removing the nutrients stored in the plant tissues.

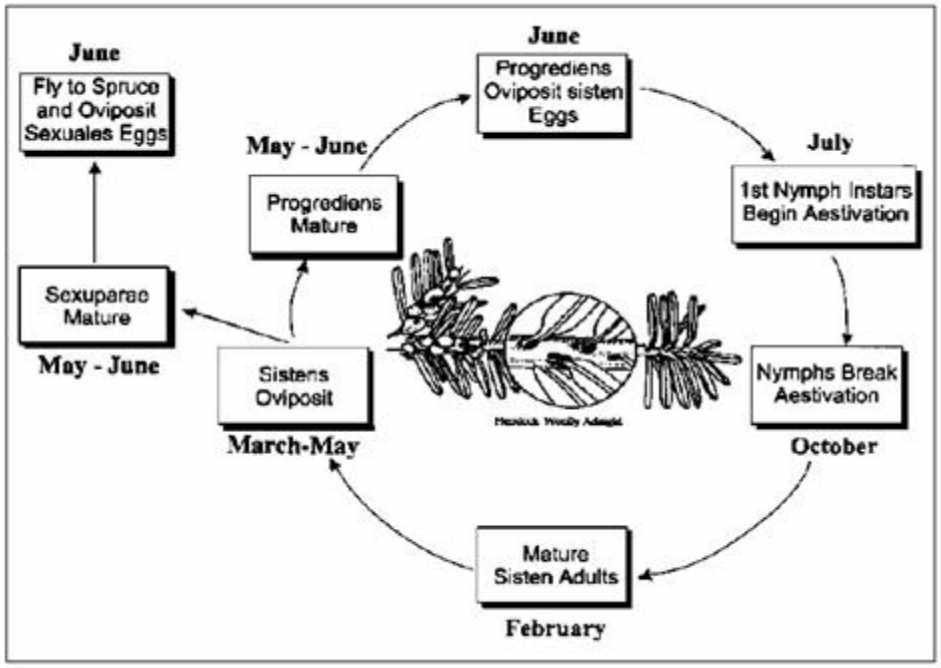
Hemlock woolly adelgids feed on the needles of all sizes of hemlocks from one- year seedlings to 500- year- old, 170 feet tall giants. This feeding action reduces nutrient movement within the tree and eventually needle death occurs. Trees begin to yellow, prematurely lose needles, and stop producing new growth. Tree death could occur within three to five years after infestation (Bonneau et al. 1999). Trees not killed outright by HWA are susceptible to secondary insect pests such as oval, elongate, and

circular hemlock scales; hemlock borers; spider mites; and root pathogens such as *Armillaria* spp. fungi. Secondary invasion by these pests often results in tree death. All sizes of hemlock could be infested by HWA.

The HWA life cycle is complex producing two asexual generations and one sexual generation each year (McClure 1987). The sexual generation requires an alternate plant host (spruce species) to complete its life cycle. No spruce species in the eastern United States, native or non- native, have been shown to support this winged generation of HWA (McClure and Cheah 1999). When the winged nymphs (sexuparae) mature and disperse to find suitable spruce trees, and presumably die which could result in significant mortality depending on how many winged nymphs were produced.

In the southeast, white cottony masses (ovisacs) containing adult HWA appear in October which is followed by egg production in February. Each adult can lay up to 300 eggs if high quality food is available. The next life stage after the egg stage is known as the crawler stage. Crawlers can disperse by crawling short distances, but are more readily transported by birds, mammals, humans or wind (McClure 1990). The winged form (sexuparae) hatches in spring and searches for the alternate host (spruce). All life stages of HWA have been documented being dispersed by wind up to 300 m downwind from an infested stand (McClure 1990). HWA are heat intolerant and enter a resting phase (aestivation) from June through September. See the following illustrated life cycle diagram.

**Figure 2.** Life cycle of Hemlock Woolly Adelgid (McClure et al. 2001)



HWA mortality of 60%- 80% could occur in the egg and first instar (crawler) life stages, but reproduction rates are high enough to ensure species survival (USDA Forest Service 2001). HWA survive the cold temperatures in their home range of the mountainous regions of China and Japan. Significant cold mortality has been observed in the northeastern U.S., but with two generations per year HWA populations rebound quickly. Researchers have found that between 60- 70% of adelgids suffer mortality from cold temperatures in the northeastern United States during a normal winter (McClure and Cheah 1999, Skinner et al. 2003). Unfortunately, temperatures common in the park at lower elevations are not low enough to cause cold- induced mortality. However, HWA do begin to lose their tolerance for cold as the season progresses and late cold spells could induce significant mortality (Skinner et al. 2003). Some researchers suggest that heavy rainfall could limit the spread of HWA by dislodging them and knocking them to the ground where they are vulnerable to many ground predators (Skinner et al. 2003).

HWA surveys have identified infestations at all hemlock stands in BLRI. In other locations infested with HWA, populations of eastern hemlock and the geographically restricted Carolina hemlock have suffered immensely. Foresters warn of a potential disaster comparable to the chestnut blight, which radically changed the composition of southern forests. Impacts in Virginia, New Jersey and Connecticut have been severe, with hemlock mortality ranging from 42 to 90 percent among stands. Shenandoah National Park (SHEN) has lost approximately 80% of its hemlock resources in some locations. Recent reports from DEWA indicate that about 20% of hemlocks in the park are dead, 60% are at various stages of decline, and about 20% are healthy (Lynch 2005). The New Jersey Division of Forestry has reported only two remaining hemlock stands that have not been heavily impacted by HWA (USDI NPS 2000).

Initial outbreaks of exotic species tend to be non- sustainable over time. The action of HWA feeding causes a decline in tree health, which in turn causes a drop in HWA densities. After initial outbreak and subsequent population crash, some trees may sustain populations at lower densities. The HWA would never die out and the infested trees would never regain full vigor as they were before initial infestation. HWA, like many exotic forest pests, have no native predators or parasites capable of bringing populations down to non- damaging levels.

*Ecology*

Hemlock- dominated forests are most common in riparian areas, coves, and along escarpments in the southern Appalachians, especially north- and east- facing slopes. The conditions in hemlock- dominated stands are so different from those in cove forests that Whittaker (1956), in his classic study of vegetation in Great Smoky Mountains National Park (GRSM), describes them as appearing to be “almost unrelated.” Hemlocks are long- lived and extremely shade tolerant. Some healthy, suppressed

hemlocks have been documented to be over 350 years old (Hough 1960). Hemlock is the only shade tolerant evergreen species in the park. There are no other native evergreens that could fill the ecological role of hemlock.

A variety of birds, mammals, invertebrates, and plants are associated with hemlock and hemlock- dominated communities. Hemlock's dense canopy provides food, shelter, and breeding sites across the seasons. At GRSM, Shriner (2001) found that 16 of 30 species of breeding birds were significantly correlated with hemlock. These 16 species included the dark- eyed junco (*Junco hyemalis*), black- throated blue warbler (*Dendroica caerulescens*), wood thrush (*Hylocichla mustelina*), and Canada warbler (*Wilsonia canadensis*). Specifically, Farnsworth and Simons (1999) reported that 84% of wood thrush nests in GRSM were in small hemlocks. Kellor (2004) found that Acadian flycatchers (*Empidonax virescens*), blue- headed vireos (*Vireo solitarius*), black- throated blue warblers, and black- throated green warblers (*Dendroica virens*) were all positively associated with hemlock forests in GRSM. In New Jersey and Massachusetts, researchers found population declines for black- throated green warblers, Acadian flycatcher, blue- headed vireo, and the hermit thrush due to hemlock mortality (Benzinger 1994, Tingley et al. 2002).

Several species in the aquatic community are also likely to be impacted by hemlock declines. Hemlock has been shown to moderate stream temperatures summer and winter thereby easing heat and cold stress on aquatic organisms. Brook trout are found more commonly in streams associated with hemlock ecosystems because of the shaded cooling effect of the hemlock canopy (Ross et al. 2003). Increased water temperatures, as a result of the loss of hemlocks, may increase populations of such non- native species as brown trout and rainbow trout (Evans et al. 1996). Cool waters created by the shade of hemlocks also provide critical habitat for stoneflies, mayflies, caddisflies, and some salamanders (Walasewicz 1995). In a comparison between invertebrate communities in a hardwood drainage and a hemlock drainage, invertebrates were more diverse in the hemlock drainage with several species exhibiting a strong association with hemlock streams and three species showing an exclusive association with hemlock streams (Snyder et al. 2002).

Many plants are commonly associated with hemlocks throughout their distribution. Several species, including rattlesnake plantains (*Goodyeara* sp.), Canada mayflower (*Maianthemum canadense*), and wood sorrels (*Oxalis sp.*), exhibit close associations with hemlock forests (McClure et al. 1996). Shifts in herbaceous species composition are likely to occur as hemlocks decline. Maples, birches, and oaks have begun to dominate former hemlock stands in other eastern forests following hemlock mortality.

Unfortunately, sites disturbed by loss of the overstory are vulnerable to exotic plant invasions. Non- native plants such as tree of heaven and garlic mustard have invaded forested areas disturbed by gypsy moth- induced oak mortality at SHEN. Similar

invasions are observed in HWA- induced mortality areas at SHEN and DEWA and are likely to occur in BLRI.

*Economics*

BLRI is the most visited unit in the national park system with nearly 21 million visitors per year. Both residents and visitors enjoy recreation in the park, including fishing, camping, hiking, and wildlife viewing, in and near hemlock forests.

High tree mortality in these areas would likely reduce the quality of recreational experiences, therefore reducing recreational use and the associated economic benefits of recreation.

*Aesthetics*

Hemlocks in developed areas (campgrounds, picnic areas, visitor centers) are highly valued by visitors for aesthetics, screening, and shade. Single specimens that have died may add variety to a scene without a noticeable change in visitor perception. Dead groups or stands could negatively alter visitor perception and enjoyment. Roadside overlooks are an important part of the visitor experience in the park. Visitor experiences could be impacted if many dead hemlocks are visible from these overlooks.

Hemlocks are aesthetically important for park visitors throughout the year, but particularly in the summer for those who enjoy the cool shade a hemlock canopy provides. Several BLRI trails, including Linville Fall, Sims Creek, and Trout Lake, traverse stands of large old hemlock. These trails provide visitor experiences that are unique in the park.

*Fuel loading*

Additional fuel loading could occur in these areas of hemlock mortality, making fires more likely and changing fire behavior. Dangerous, unpredictable fires might result from the fuel ladders formed by dead under- and mid- story hemlock.

*Safety*

Standing dead and dying trees pose an unacceptable hazard tree threat in developed areas. Popular recreation areas of DEWA have been closed due to the high number of dead hemlocks and the public safety threat the dead trees pose. Many of BLRI's public use areas contain mature and young hemlock. Closing such areas would be unpopular, but could be a necessary choice to protect public safety. Removal of these large hazardous trees would be expensive.

**PARK PURPOSE AND SIGNIFICANCE**

The legislated purpose of BLRI, under the Act of June 30, 1936, is to link Shenandoah National Park in Virginia and the Great Smoky Mountains National Park in North Carolina and Tennessee by way of a recreation- oriented motor road intended for public use and enjoyment. Under the provisions of the Organic Act approved by Congress on August 25, 1916 (39 Stat. 535) creating the National Park Service, the intended purpose of the BLRI is to provide an elongated park to conserve, interpret, and exhibit the unique natural and cultural resources of the central and southern Appalachian Mountains, as well as provide for leisure motor travel through a variety of scenic environments.

The general interpretation of BLRI's purpose has been further refined into the following more specific purpose statements:

- Connect Shenandoah and Great Smoky Mountains National Parks by way of a "national rural parkway" – a recreational, destination- oriented motor road traveling through a variety of scenic ridge, mountainside, and pastoral farm landscapes.

- Conserve the scenery and preserve the natural and cultural resources of the Parkway's designed and natural area to preserve the integrity of resources and to provide a quality visitor experience.

- Influence the protection of the scenic, natural and cultural resources within the corridor composed of those lands that are visible from the Blue Ridge Parkway and/or situated adjacent to the boundary.

- Provide for public enjoyment and understanding of the natural resources and cultural heritage of the central and southern Appalachian Mountains.

- Provide opportunities for high quality scenic and recreational experiences along the Blue Ridge Parkway and within the corridor through which it passes.

The route of the Blue Ridge Parkway follows mountain and valley landscapes to link Shenandoah and Great Smoky Mountains National Parks. Its location was selected to provide the best in a variety of scenic, historic, and natural features that evoke the regional image of the central and southern Appalachian Mountains. In order to maximize scenic views and give Blue Ridge Parkway visitors the impression that they are in a park with boundaries to the horizon, the Blue Ridge Parkway was located in mountainous terrain that normal roads would have avoided. The Blue Ridge Parkway was the first national rural parkway and is widely recognized as an international example of landscape and engineering design achievements with a roadway that lies easily on the land and blends into the existing scene. The Blue Ridge Parkway also was the first national rural parkway to be conceived, designed, and constructed as a leisure-type driving experience.

The Blue Ridge Parkway follows the crests and ridges of the Blue Ridge, Black, Great Craggy, Great Balsam and Plot Balsam Mountains. These five major mountain ranges are part of the central and southern Appalachian Mountains. The 469 mile Parkway encompasses several geographic and vegetative zones, with altitudes ranging from approximately 650 feet at James River in Virginia to nearly 6,050 feet at Richland Balsam in North Carolina. The Blue Ridge Parkway is known for spectacular mountain and valley vistas, quiet pastoral scenes, sparkling waterfalls, colorful flowers and foliage displays, and interpretation of mountain history and culture. Its varied topography and numerous vista points offer easy public access to views of southern Appalachian rural landscapes and forested mountains. Designed for recreational driving, the Blue Ridge Parkway provides visitors with quiet, leisure travel, free from commercial traffic and the congestion of high- speed highways. As its All- American Road status indicates, it is one of the most diverse and high quality recreational driving experiences in the world.

The Blue Ridge Parkway is the highest and longest continuous route in the Appalachian area. Because of its long length, proximity to large Eastern United States urban areas, numerous access points, quality design and diversity of scenic, natural and cultural resources, the Blue Ridge Parkway is the most visited National Park Service area.

## LAWS, REGULATIONS, POLICIES

This Environmental Assessment (EA) is written under the authority of NPS policies, BLRI policies, state authorities, and federal authorities. The following list details those policies and authorities that provided guidance for the development of this EA, development of the preferred alternative and alternatives, and analysis of impacts.

*NPS Policies*

- The primary responsibility of the National Park Service is established through the National Park Service Organic Act of 1916 and reaffirmed by the General Authorities Act, as amended in 1978. The key management- related decision in the Organic Act states that the fundamental purpose of the national parks is "*to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations*."

- NPS- 77, *Natural Resources Management Guidelines:*
  Integrated Pest Management (IPM): The purpose of this section is to "*provide managers with an overview of the integrated pest management (IPM) concept, of NPS and departmental policies concerning the use of pesticides, of the various laws and regulations which directly or indirectly affect the use of pesticides, and with directions for applying for approval to use pesticides*." IPM combines compatible techniques to maintain pest damage below an unacceptable injury level while ensuring protection from threats to public health and safety and to the natural environment. Control measures for HWA in BLRI should include IPM strategies such as:

  - monitoring the status of pest populations in order to determine the level at which unacceptable damage is occurring and the threshold where management action must be applied;
  - evaluation of the efficacy and environmental effects of treatment actions;
  - resource education through public programs for both children and adults regarding HWA and its consequences.

- Exotic Species Management: This section offers guidelines and recommendations concerning exotic species management. For the management of already established populations of exotic species, this document sets forth guidelines for species evaluation, developing an information base, monitoring, initiation of management action, need for long- term commitment, and management strategies.

- NPS Management Policies (USDI NPS 2006) is the basic service- wide policy document on the National Park Service. This document is the highest of three levels of the NPS Directives System. This system is designed to provide management with clear and current information on NPS policy and required/recommended actions.

The following are relevant sections from the NPS Management Policies:

> 4.4.4 *Management of Exotic Species*: "*Exotic species will not be allowed to displace native species if displacement can be prevented*." BLRI would use integrated pest management techniques to manage HWA.

4.4.4.1 *Introduction or Maintenance of Exotic Species*: In rare instances the introduction and maintenance of exotic species may be permitted. If the introduction is to meet "*specific, identified management needs when all feasible and prudent measures to minimize the risk of harm have been taken, and it is used to control another, already established exotic species*." In the last decade, biological control for HWA using introduced predators has been tested in both laboratory and field settings. Control results are in the early stages, and long- term control effectiveness would take time to evaluate.

4.4.4.2 *Removal of Exotic Species Already Present*: All exotic plant and animal species not targeted for a specific park purpose are to be managed for eradication if it is feasible and the exotic species meets certain criteria. Examples of these criteria are the interference with "*natural processes and the perpetuation of natural features, native species, or natural habitats; disruption of the genetic integrity of native species*;" or creation of a public safety hazard. Programs designed to control nonnative species should not cause significant damage to native species, natural communities, ecological processes, cultural resources and human health and safety.

4.4.5 *Pest Management*
4.4.5.2 *Integrated Pest Management Program*: The Park Service and all park units must use an IPM approach, under which all pesticide use must be reported annually, to manage pest issues.

4.4.5.3 *Pesticide Use*: The decision to use a pesticide in a management strategy must be made by an IPM specialist and determined to be necessary, and no other available option is acceptable or feasible.

4.4.5.5 *Pesticide Purchase and Storage*: All pesticide purchases must be approved and expected to be used within one year from the date of purchase. Storage must comply with all federal and state requirements.

- NPS Director's Order (DO) 12 - *Conservation Planning and Environmental Impact Analysis, and Decision- Making*, 2001. The purpose of this order is to establish the policy and procedures that the NPS will use to comply with NEPA. These procedures will include open evaluation, impact assessment, alternative approaches, peer review, and the use of an interdisciplinary team approach. Under this authority, BLRI is given the guidelines to follow in developing management goals that ensure NEPA compliance.

*Federal Authorities*

- Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) of 1947 (7 USC 136), as amended. This act requires that all pesticides be registered, and that pesticides be used in accordance with the registration. The act restricts the use of certain pesticides. Some pesticides are regulated as toxic pollutants under the Clean Water Act and the Safe Drinking Water Act. All pesticides used in the control of HWA are registered with the Environmental Protection Agency (EPA), and all label uses are followed.

- National Environmental Policy Act of 1969 (P.L. 91- 190; 42 USC 4321, et. seq.). NEPA is the basic national charter for environmental protection. It contains a provision to ensure that federal agencies act according to the letter and spirit of the law. This act declares that it is the policy of the federal government to "*preserve important historic, cultural and natural aspects of our national heritage*." It says that all practicable means should be used to improve federal functions so that the nation may "*attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences*…." NEPA requires an interdisciplinary study of the impacts associated with federal programs.

- Executive Order 11987 *Exotic Organisms*, 1977. This executive order requires federal agencies to "*restrict the introduction of exotic species into the natural ecosystems on lands and waters which they own, lease, or hold for purposes of administration*…" and "*into any natural ecosystem of the United States,: and to " encourage the States, local governments, and private citizens to prevent the introduction of exotic species into natural ecosystems of the United States*" unless the Secretaries of Agriculture and Interior "*find that such introduction or exportation will not have an adverse effect on natural ecosystems*."

- Executive Order 13112, *Invasive Species*, dated February 3, 1999, directs each federal agency to prevent the introduction of invasive species, to detect and respond rapidly to and to control populations of such species in a cost- effective and environmentally sound manner, to monitor invasive species populations accurately and reliably, and to provide for restoration of native species and habitat conditions in ecosystems that have been invaded.

- Executive Order 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*, dated January 10, 2001. This order requires federal agencies to consider impacts to neotropical migratory bird species in all management actions.

- *Cooperative Forestry Assistance Act* of 1978 (P.L. 95- 313). The purpose of this act is to authorize the Secretary of Agriculture to assist in establishing a cooperative federal, state and local forest stewardship program for management of nonfederal forest lands and achieving a number of goals for the use and protection of forest lands. The

forest health protection portion of this act authorizes the Secretary to protect trees, forests, wood products and stored wood on the National Forest System lands and other lands in the U.S. from natural and human threats through the use of an integrated pest management program. This enabling act allows for the U.S. Forest Service to provide funding for forest insect and disease programs to other federal agencies.

*State Authorities*

- *Plant Pest Law* - Article 36, Chapter 106 General Statutes of North Carolina (NC) as amended 1971 defines plant pest, outlines authority to inspect plant products, levy fines and control pests. Authorization is given to adopt regulations to implement and carry out the eradication, suppression and prevention of the spread of plant pests. Authorization is also given to the North Carolina Board of Agriculture to enter into agreements with any agency of the United States or any agency from another state for the eradication, suppression, control and prevention of the spread of plant pests.

**SCOPING**

Scoping is an open process that determines the breadth of environmental issues and alternatives to be addressed in an EA. Scoping involves obtaining internal and external input on project- related issues from resource specialists and the public, respectively. The Park conducted internal scoping with appropriate NPS (BLRI and SERO) staff and external scoping with the public, including interested and affected groups or individuals and non- NPS agency personnel.

An interdisciplinary team comprising BLRI and SERO staff members contributed to the internal scoping process. This process resulted in definition of the purpose and need, identification of potential actions to address the need, and determination of what the likely issues and impact topics would be.

For external scoping, a public scoping letter and a news release (see Figures A- 1 through A- 2 in Appendix A) describing the project and requesting public input on the proposed alternatives was issued to private parties and State, Federal, and local agencies on June 1, 2007. Appendix A provides a list of individual and agencies/organizations that were sent the scoping letter (Table A- 1). The external scoping period ended on July 2, 2007. Comments received during the Scoping period can be found in Figures A- 3 to A- 7 of Appendix A.

## THE ENVIRONMENTAL ASSESSMENT

This EA analyzes the environmental impacts that would result from the alternatives considered, including the No Action Alternative. This EA has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 (42 United States Code (USC) 4321 et seq.), the Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations (CFR) 1500 through 1508) for implementing NEPA, and the NPS NEPA compliance guidance handbook (DO- 12, *Conservation Planning, Environmental Impact Analysis, and Decision- making*).

## IMPACT TOPICS

Impacts to resources were determined using a combination of reference materials and consultation with park staff, subject matter experts in the Forest Health section of the USDA Forest Service, university entomologists, and state agency personnel. The reference materials include manufacturer product information, peer- reviewed journal articles, along with federal and non- profit agency reports and publications.

### *Issues and Impact Topics Analyzed in this Environmental Assessment*

**Insecticide Use on a Park- wide Basis**
The use of insecticides, including insecticidal soap, insecticidal oil, and systemic insecticides, are considered in relation to effects on the surrounding environment and to the visiting public, therefore techniques, chemicals, and impacts are analyzed in this document.

**Non- Native Biocontrol Agents**
Concerns regarding the use of non- native, biocontrol agents in Alternatives C and D are carefully considered to ensure that released insects would not pose a future problem for the park or private landowners. Members of the community in this area are familiar with non- native ladybeetles (*Harmonia axyridis*) in their homes that gather en masse and cause a nuisance. The public does not want another ladybug that becomes a nuisance to be introduced for control of HWA. In addition, the park must consider the chance that the biocontrol insects would eat adelgids other than HWA, native or not, or other native insects.

**Terrestrial Communities**
Terrestrial communities likely to be impacted by HWA and potential treatments, as well as community level effects caused by loss of hemlock due to HWA are analyzed in this document.

**Aquatic Communities**
Aquatic communities likely to be impacted by HWA and potential treatments, as well as community level effects caused by loss of hemlock due to HWA are analyzed in this document.

**Rare, Threatened and Endangered (T&E) Species**
Plants and animals in BLRI that are listed as federally threatened or endangered are analyzed in this document.

**Water Quality**
NPS Management Policies (2006) require protection of water quality consistent with the Clean Water Act of 1972. Loss of hemlock could impact water quality.

**Visitor Use and Park Operations**
Dead hemlocks in heavily visited areas create a public safety hazard. In at least one other NPS unit, Delaware Water Gap National Recreation Area, public use areas with dead hemlock had to be closed until the dead trees could be removed. Treatment operations could cause temporary closures for public safety.

**Cultural Resources**
BLRI was created through acquisition of private land including mountain farm communities. Some of these home sites are still preserved while others have been absorbed into the landscape.

Any actions that could potentially affect the cultural resources of the park must be addressed as outlined in 36 Code of Federal Regulations (CFR) and in regulations issued by the Advisory Council on Historic Preservation implementing Section 106 of the National Historic Preservation Act (NHPA) of 1966. The NPS, in consultation with the North Carolina and Virginia State Historic Preservation Officers (SHPO), would review potential impacts to cultural resources.

**Exotic Plant Management**
Loss of hemlock forest canopy would allow more light to reach the forest floor. Exotic plant species could rapidly colonize this newly open area which has occurred at other NPS units affected by loss of forest canopy.

**Fire**
The fire suppression that occurred in the 20$^{th}$ century changed the composition of BLRI forests. Hemlock survived in areas that would have had naturally ignited fires. Significant loss of hemlock resources would increase fuel loads and, during high fire danger episodes, increased risk of fire danger. Loss of hemlocks would also increase amount of sunlight on understory and ground resulting in drier fuels and easier ignition.

*Impact Topics Dismissed from Further Consideration*

**State Listed Species of Concern**
Some plant and animal state listed species of concern are found in hemlock forests along the BLRI, but they are not exclusive to hemlock forests. Impacts from any of the alternatives would be at a low level of detection (negligible); therefore, this topic was dismissed from further analysis.

**Future Insect and Disease Infestations**
New forest pests are arriving in North America with increasing frequency. Gypsy moth has been present at BLRI for more than a decade. In SHEN heavy gypsy moth defoliation of oak trees may have contributed to the severity of the HWA infestation due to the nitrogen fertilization effect of gypsy moth droppings. HWA thrive in high nitrogen environments.

Other forest pests are expected to arrive in the future. Their arrival is neither guaranteed nor dismissed, but their impact on HWA management in BLRI is not considered here due to the unknown impact of these pests as they relate to HWA.

**Air Quality**
The impact of any of the listed alternatives is not expected to have an impact on the park's air quality. Loss of hemlock under the No Action Alternative would reduce the amount of carbon fixing by hemlock, but replacement vegetation would soak up this deficit.

**Environmental Justice**
Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority and Low- Income Populations*, mandates all federal agencies to determine if a proposed federal action would have an adverse or disproportionate impact on minority and /or low income populations. The proposed project is within the boundary of BLRI where minority or low- income populations do not exist. Visiting members of this demographic group would not be affected any differently than the rest of the visiting public therefore no impact to these demographic groups exists under this project.

**Geologic Resources**
This project does not involve disturbance of geologic resources in any of the alternatives. Extensive loss of hemlock on steep slopes could temporarily contribute to an increase in localized landslides, however, these landslides already occur in the park on slopes with unstable geology whether they are vegetated or not. Replacement vegetation would likely colonize dead hemlock areas by the next growing season which would reduce landslide risk.

# ALTERNATIVES

This section outlines details of each proposed alternative. The National Park Service has considered four alternatives to manage HWA infestations, including the No Action Alternative, Preferred Alternative, two other action alternatives, and two alternatives that were considered and eliminated from further analysis. The alternatives were developed based on currently available management techniques. Specific areas to be treated are not detailed in the alternatives.

## ALTERNATIVE A - NO ACTION

BLRI would continue with current management of HWA and apply no treatments to prevent the spread of HWA throughout the park. HWA populations would be allowed to increase and decrease naturally without intervention. Because HWA has a high reproductive capacity and has demonstrated the ability to rapidly spread in recent years, it is expected that HWA populations would continue to increase throughout the currently infested area and accelerate their spread to currently non- infested areas. Significant losses of hemlock in all associated forest types would be expected with this alternative and HWA populations in the park could affect hemlocks outside the boundary. Population densities would likely fluctuate periodically depending on the severity of winters and quality of hemlock foliage available for HWA reproduction. However, HWA populations could rebound quickly - even after severe winters.

## ALTERNATIVE B - CHEMICAL CONTROL ONLY

BLRI resource managers would use IPM techniques to manage HWA. The IPM process requires decisions to be based on knowledge of pest biology, the environment, unacceptable levels of pest damage, and available control technology that poses the least possible risk to people, resources, and the environment. NPS policy establishes IPM as the preferred method for managing pests in parks and monuments. The development of this program is based on, and directed by, various policies, laws, regulations, executive orders, and a presidential memorandum.

Other NPS units have treated HWA using chemical controls and biocontrol insects. DEWA in Pennsylvania and SHEN in Virginia have had HWA since the 1990s. DEWA has treated a total 125 trees with horticultural oil and 36 trees with imidacloprid. In 2004, SHEN treated 68 acres with insecticidal soap and 18 acres with imidacloprid via stem injection.

BLRI would use insecticidal soap, horticultural oils, and systemic insecticides to control HWA. See Appendices A through L for label information and material safety data sheets for chemicals currently approved for use at BLRI to control HWA. The pesticides proposed for chemical control of HWA in BLRI are the same that have been

used by states, national forests and other national parks that are managing HWA. Insecticidal soap and oils have been used for aphid and adelgid control since the 1980s and their effects on non- target insects and vegetation are well understood.

BLRI technicians would chemically treat hemlocks in culturally significant areas such as the Moses H. Cone Estate using insecticidal soap and horticultural oil sprayed from truck- mounted spray units. High- pressure sprayers greatly increase the ability to reach the upper branches of each tree. Technicians could adequately spray up to 80 feet into the canopy of roadside trees using these sprayers.

The soap and oil have been shown to be 95%- 99% effective at controlling adelgid populations when sprayed on hemlock foliage (Rhea 1996, McClure 1987). However, they control only the insects that are present on the tree at the time of application so any future re- infestation must be treated as well. Adelgids must be present in order to be controlled and coverage must be thorough. Roadside treatment extends only about 50 feet from the pavement so re- infestation from nearby untreated trees would continue. Since HWA has two generations per year, soap and oil applications may be needed up to twice per year. Oil treatment may damage foliage during periods of prolonged high temperature and high relative humidity limiting oil spraying operations to the dormant season.

Under Alternative B, systemic insecticides would be used to treat hemlocks that are not candidates for foliar insecticidal soap or horticultural oil treatments for various reasons. Trees that cannot be treated with foliar spray include hemlocks that are too tall to be adequately reached with the foliar spray, high- value hemlocks that are inaccessible to truck- mounted spray units, and hemlocks near water. Trees that are an adequate distance from water and in suitable soils (i.e. not rocky or boggy) would be treated with a systemic insecticide via soil injection. Imidacloprid is the chemical name of a systemic insecticide used to control HWA in the park. Imidacloprid is a neonicotinoid insecticide in the chloronicotinyl subgroup. Nicotine has historically been used as an insecticide for sucking insects because of it properties as a nerve poison. Imidacloprid is packaged differently for various applications. BLRI technicians would use the water soluble powder (WSP) formulation.

The water soluble powder would be used for soil injecting methods. Imidacloprid, packaged under the brand name Merit®, is currently approved for use in BLRI to treat HWA. The Merit® mixture could be used in a hand- operated soil injecting device that injects the insecticide under low pressure into the soil approximately three inches below the soil surface. This method does not disturb the duff layer. Imidacloprid bonds with soils containing sufficient organic matter, which greatly restricts movement through soil (Cox et al. 1997). Non- target effects of soil treatment include unwanted death of soil invertebrates in the immediate area of application. Scientific studies of soil invertebrate impacts are limited.

The amount of imidacloprid used to soil drench or soil inject a tree is dependent on the tree diameter at breast height (DBH). The treatment lasts up to 2- 3 years (Cowles and Cheah 2002). According to a study in Massachusetts, the chemical takes 8 to 12 weeks to reach the foliage of trees 10 to 18 inches DBH (Tattar et al. 1998). This method shows good control of HWA (Rhea 1996, Cowles et al. 2004) and tree health recovery from infestation (Webb et al. 2003). One study found 98% control of HWA using the soil injection of imidacloprid (Steward et al. 1998).

Other systemic insecticides may be available for HWA control in the future. If these insecticides prove effective, pose an acceptable environmental risk, and are affordable, they may be considered for use in the future. Currently, however, imidacloprid is the only systemic insecticide that has proven useful for HWA control and poses acceptable environmental risk when used according to label directions.

## ALTERNATIVE C - BIOLOGICAL CONTROL ONLY

Under this alternative, BLRI would introduce insect predators of HWA to control HWA populations. Currently two beetle species are available for release into BLRI, with several more expected to be available in the future. Biological control of HWA has been investigated for over a decade, starting with existing native and non- native predators. Researchers found native insects that prey on the adelgid, but none have significantly reduced HWA populations (Montgomery and Lyon 1996, Wallace and Hain 2000). Even though HWA has been reported from Virginia since the 1950s, no effective native or naturalized predators have emerged that are abundant enough to control HWA or prevent tree mortality. Pathogens have been identified and continue to be evaluated, but no active biocontrol program using pathogens is in use. Currently, the only biological control available for treatment is predatory beetles.

Non- native beetles that complete their life cycle using HWA as a food source have been investigated since the early 1990s. Techniques to rear these predators in laboratory settings have been developed for several species. However, lab rearing is a labor intensive process. No artificial diet has been successfully developed to feed these predators so live branches with high densities of healthy HWA must be field collected and brought back to the lab to support rearing activities. As HWA infestations degrade tree health and cause a resultant HWA population crash, the populations of HWA in an area used for predator food would not be suitable for predator food in the future. Costs to produce one species of predator beetle have been estimated at $1- $2 for each individual. This price may seem exorbitant, but, if successful, would be less expensive over the long term than regular application of insecticides. Successful predator insects would be self sustaining once established. Insecticidal operations are costly because of the pesticides, equipment, vehicles, and labor needed to annually. In addition, many stands of old- growth hemlock are remote and difficult to access, making them even more costly, if not, impossible to treat using insecticides.

The ability of predator insects to control HWA on a landscape scale is not well known. The first released predators have been scattered throughout the eastern range of hemlock for only ten years. The monitoring of these predators shows definite promise as they must feed on HWA to complete their life cycles. In the field, many factors conspire to affect HWA and predator populations such as fluctuating winter, warm and cold spells, and minimum low temperatures. Other predators including native and non-native species could also affect HWA- specific predator survival. The species discussed below are the currently known best choices for HWA biocontrol. In their homeland, these predators do not single handedly control HWA populations. Several species of invertebrate predators and diseases, as well as some inherent resistance to HWA, combine to make HWA a minor pest on Asian and western North American hemlock species. One species of non- native HWA predator would not likely save eastern hemlocks. The following predators are potential biocontrol agents for use at BLRI:

***Sasajiscymnus tsugae***

*S. tsugae* (formerly named *Pseudoscymnus tsugae*), a tiny black ladybird beetle (Coccinellidae) about the size of a poppy seed, was imported from Japan to the U.S. and put into quarantine in 1992. Since then *S. tsugae* has been laboratory screened in feeding preference tests and field- testing began in 1995.

*S. tsugae* has been released into forested areas for HWA control since 1997 (McClure 2001). States where releases have occurred include Connecticut, New Jersey, Virginia, Maryland, Rhode Island, Massachusetts, New York, Pennsylvania, North Carolina, West Virginia and Tennessee. Releases were in state and national forests and NPS units, including Delaware Water Gap National Recreation Area. Control results are in the early stages. In Connecticut, a 47%- 87% reduction in HWA densities in five months was reported with a starting population of 2400- 3600 *S. tsugae* which were released at densities of 30 per branch (McClure et al. 2000). Long- term control effectiveness would take time to evaluate. After 4- 7 years of hemlock recovery following heavy infestation in a Connecticut study, recovery rates were variable and were tied to factors such as soil (rocky or shallow), drought stress, and co- infestations of either elongate hemlock scale or hemlock borer (Cheah et al. 2004). A researcher in Connecticut found *S. tsugae* recovery was highest at 6 meters above ground level.

The Connecticut Agricultural Experiment Station has the longest history of evaluations on *S. tsugae*. Dr. Mark McClure imported *S. tsugae* from Japan and studied it for years to determine food preferences, non- target effects, and ability to manage HWA populations. He and his staff found *S. tsugae* to significantly reduce HWA populations in areas near release trees (McClure et al. 2000). These results allowed for the mass rearing that continues today. Effectiveness of *S. tsugae* for HWA control may vary from north to south and from site to site. Ongoing evaluations over years would ultimately show how effective *S. tsugae* is at HWA control.

***Laricobius nigrinus***

*L. nigrinus*, a beetle belonging to the family Derodontidae, is native to British Columbia and the Pacific Northwest, and has been studied as a control for HWA in the eastern U. S. (Zilahi- Balogh et al. 2002, Lamb et al. 2002, Lamb et al. 2005). *L. nigrinus* shows high specificity for HWA and has a synchronous life cycle with HWA becoming active in the fall and winter (Zilahi- Balogh et al. 2003). *L. nigrinus* larvae feed on HWA eggs, while adults feed on immature and adult stages of HWA (Zilahi- Balogh et al. 2002, 2003). A study in Virginia showed significant reductions of adelgid populations with release of *L. nigrinus* (Lamb et al. 2002). *L. nigrinus* has been experimentally released for HWA control in 11 locations in five eastern states since 2003, including one location in GRSM in 2004. Efficacy evaluations are ongoing.

***Others***

Other biocontrol insects are being evaluated and rearing procedures are being developed. Three species of *Scymnus* beetles (*S. ningshanensis, S. sinuanodulus* and *S. camtodromus*) from China are being evaluated. Managers at Coweeta Hydrological Lab in North Carolina experimentally released *S. sinuanodulus* in a caged study and researchers think it is more suitable for southern areas, while *S. ningshanensis* might be more suitable for northern areas. All three *Scymnus* species beetles prefer to feed on adelgids but have fed on some aphid species. *S. sinuanodulus* feeds on all life stages of HWA and requires HWA to complete its life cycle (Cheah et al. 2004). *Scymnus* beetles are available for release in limited supplies on an experimental basis and have been released in 2005 in the Pisgah National Forest. All three species have potential to control HWA and would be considered for release at BLRI.

Both *S. tsugae* and *L. nigrinus* show no undesirable traits that would cause them to be a nuisance or otherwise poor candidate for release. *S. tsugae* is expected to attack only HWA and other adelgids such as the balsam woolly adelgid (a non- native pest of Fraser fir that occurs at BLRI), pine bark adelgid, and Cooley spruce gall adelgid. *S. tsugae* cannot reproduce unless it consumes HWA eggs. Therefore, if HWA populations were to drop, *S. tsugae* populations would also decline. HWA would not be eliminated by *S. tsugae* or *L. nigrinus*, but would rather be suppressed to the point of allowing hemlocks to survive and hopefully reproduce. A total of 12,500 *S. tsugae* predator beetles have been released at BLRI since 2002.

Currently HWA predator rearing facilities exist in New Jersey (Department of Agriculture), Pennsylvania (Eco- Scientific Solutions- a private company), NC (Department of Agriculture), South Carolina (Clemson University) and in Tennessee (The University of Tennessee- Knoxville). None of the predator beetles could presently be raised using an artificial diet. The need for constant supplies of healthy HWA for food as well as precise climate control in the rearing facility contribute to the expense and difficulty of production.

Due to the limited availability of beetles, sites for treatment in the park would be prioritized based on HWA density, hemlock density, presence of threatened and endangered species, old- growth stands, and watershed protection values. There is no guarantee that sufficient numbers of biological control agents could be released, or that they would successfully reproduce to levels adequate to control HWA. While the predator beetles were released in many areas of the Mid- Atlantic states, HWA was already well established and the trees already beginning to decline. Long- term monitoring has begun in some of those areas, but no comprehensive results are available. However, biological control remains the only feasible alternative for the extensive remote hemlock stands.

Problems could arise in biological control when the introduced agent is a generalist, i.e. preys on a range of hosts, some of which may be beneficial. The multicolored Asian lady beetle *Harmonia axyridis,* introduced in the late 1970s for control of various crop pests, has become a nuisance pest in houses. *S. tsugae* does not aggregate in large numbers prior to overwintering as was the case with the nonnative *H. axyridis*. *S. tsugae* does not leave the forest to overwinter and observations suggest that this species hibernates in the leaf litter. *S. tsugae* is incapable of transferring to non- adelgid prey and populations are expected to decrease as HWA densities decline. In contrast, *H. axyridis*, a generalist predator, maintains high densities by switching over to other more abundant prey. *H. axyridis* would consume HWA when it comes across it, but it would eat many other insects as well, including HWA biocontrol insects. The beetles used to control HWA are host specific on HWA, do not mass congregate and are, therefore, unlikely to become a pest themselves. However, some of the general public remains confused about the identity of various ladybeetles and complains about the park and/or national forest having introduced the pesky *Harmonia*.

## ALTERNATIVE D - BOTH CHEMICAL AND BIOLOGICAL CONTROL (NPS PREFERRED ALTERNATIVE)

BLRI managers have identified Alternative D - Chemical and Biological Control as the preferred alternative. Under this alternative BLRI would use a combination of chemical and biological controls to best fit individual hemlock sites throughout the park.

Using a combination of chemical and biological controls would allow more areas throughout the park to be treated. The use of biological controls allows the treatment of trees in the backcountry and trees along waterways. The use of chemical controls allows the treatment of trees in areas accessible from the road. While some chemical controls could be done in the backcountry, it is not feasible for widespread use. By using a combination of treatments, park managers could more effectively use limited funds and resources to treat a greater area across the landscape.

If this action alternative is selected, BLRI would use a combination of IPM strategies. Park technicians would scout BLRI for HWA on roads, trails, and off- trail in areas identified as having a significant hemlock component. Scouting surveys would be prioritized according to HWA infestation potential, hemlock dominance, and old-growth hemlock component. Treatment decisions would be made accordingly. High priority areas would be scouted annually, while the remainder would be scouted biennially. Scouting information would greatly enhance our ability to plan and prioritize treatment of hemlocks throughout the park. Management of HWA would be conducted everywhere that is technically and financially feasible. A combination of insecticides and biocontrol options are listed below for hemlock stands depending on forest condition and location.

**High- Use Developed Areas**

Technicians would chemically treat infested hemlocks in high- use developed areas using insecticidal soap and horticultural oil. Generally, high- use areas are easily accessible by vehicles allowing for the use of high pressure sprayers.

High- value trees that are either too tall to be adequately treated with foliar spray or are near water would be treated with systemic chemicals. Imidacloprid would be applied either through soil treatment or stem injection depending on soil condition and proximity of the site to water.

**Old Growth Hemlock Forests or Backcountry Hemlock- Dominated Forests**

BLRI would treat backcountry hemlock- dominated sites or old- growth hemlock forests with a combination of biological controls and systemic chemicals. Predatory beetles or eggs would be released throughout the park at these inaccessible sites depending on beetle availability. Some stands not selected for biological release would be treated chemically as funding allows. A subset of trees at these priority sites would be selected for chemical treatment. Soil injection would be used to treat these trees with imidacloprid. Trees of all size classes would be treated to maintain structural diversity for birds, lichens, invertebrates, etc. By treating a wide range of tree sizes, more genetic material would be maintained throughout the site.

## ALTERNATIVES CONSIDERED BUT DISMISSED

CEQ regulations for implementing NEPA require that Federal agencies explore and objectively evaluate all reasonable alternatives, and briefly discuss the rationale for eliminating any alternatives that were not considered in detail. This section describes two alternatives that were considered and eliminated from further study. The rationale for elimination is given below.

### *Foliar Application of broad- spectrum pesticides*

Using pesticides that injure or kill a broad variety of insects would pose an unacceptable risk to the protection of natural resources at BLRI.

### *Silvicultural Alternative*

Cutting infested trees or using fire in an attempt to slow or halt the spread of HWA is not an effective control method and would merely reduce the available hemlock gene pool. HWA are wind and animal dispersed and move easily from one tree to another. Since HWA attacks all sizes of hemlock, replanting native hemlocks with existing HWA populations in the area would not preserve the park's hemlock resources. Additionally, the gene pool of the park's existing hemlock would change if seeds or seedlings from other locations were planted in the park. Non- native or hybrid species of hemlock may be resistant to HWA but they would change the park's hemlock forest the same way. Preservation of existing resources is mandated by the Organic Act of 1916, which allowed for the creation of the NPS, and is part of NPS management policy.

## ENVIRONMENTALLY PREFERRED ALTERNATIVE

In accordance with DO- 12, the NPS is required to identify the "environmentally preferred alternative" in all environmental documents, including EAs. The environmentally preferred alternative is determined by applying the criteria suggested in NEPA, which is guided by the CEQ. As stated in Section 2.7 (D) of the NPS DO- 12 Handbook, "*The environmentally preferred alternative is the alternative that will best promote the national environmental policy expressed in NEPA (Section 101(b))*." This alternative would have the minimum environmental consequences of the alternatives under consideration, including the No Action Alternative.

This environmental policy is stated in six goal statements, which include:

1. Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
2. Assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings;
3. Attain the widest range of beneficial uses of the environment without degradation, risk to health and safety, or other undesirable and unintended consequences;
4. Preserve important historic, cultural, and natural aspects of our national heritage, and maintain wherever possible, an environment which supports diversity and variety of individual choice;
5. Achieve a balance between population and resource use which would permit high standards of living and a wide sharing of life's amenities; and
6. Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources (NEPA, 42 USC 4321- 4347).

In sum, the environmentally- preferred alternative is the alternative that, not only results in the least damage to the biological and physical environment, but also that best protects, preserves, and enhances historic, cultural, and natural resources.

As evaluated against the CEQ regulations, Alternative D is the Environmentally Preferred Alternative. Under this alternative BLRI would use a combination of chemical and biological controls to best fit individual hemlock sites throughout the park. This environmentally preferred alternative promotes the national environmental policy by meeting the following criteria:

- Alternative D best protects park resources for future generations. More hemlock communities could be safely treated following Alternative D, including those forests found in the backcountry, in high- use areas, areas near water, and old-growth communities. By using a combination of techniques, managers have the flexibility to best address specific habitat concerns by individual site allowing the treatment of diverse communities across the park protecting a wide array of sites for the future.

- Alternative D best ensures that park employees and visitors enjoy a safe, healthful, productive, and esthetically and culturally pleasing surrounding. Being able to use both chemical and biological controls assures that heavily used areas would be treated as aggressively as possible while still protecting the safety of employee applicators.

- Biological and chemical control, used in combination as described in Alternative D, allow managers to tailor treatments to areas that best protect water resources, non- target species, and T&E species.

- The impending loss of hemlocks without treatment threatens the unique cultural and natural resources at BLRI. Alternative D best allows protection of our natural heritage and hemlock environments that support diversity throughout the park.

- Alternative D ensures that the visiting public would be able to continue to enjoy park campgrounds, overlooks, roads, and picnic areas with little disruption.

- Hemlock dominated forests and the communities that have developed within them would be best protected under Alternative D. Specific site treatments could be developed ensuring that the maximum number of hemlocks are treated across the park. By using environmentally sensitive chemicals and biocontrol agents, the quality of resources within hemlock forests would be best protected and enhanced for future generations.

## COMPARISON OF ALTERNATIVES

Table 1 compares actions associated with the alternatives.

**Table 1. Summary Comparison of Alternatives**

| Activity | **Alternative A** | **Alternative B** | **Alternative C** | **Alternative D** |
|---|---|---|---|---|
| | *No Action* | *Chemical Control Only* | *Biological Control Only* | *Both Chemical and Biological Control (Preferred Alternative)* |
| No Action | Yes | No | No | No |
| **Use insecticidal soap and oil and systemic insecticides** | No | Yes | No | Yes |
| **Use biological controls** | No | No | Yes | Yes |
| **Use both insecticides and biological controls** | No | No | No | Yes |

None of the action alternatives would require mitigation activities. The No Action Alternative could result in the need of restoration in devastated habitats, although reintroducing hemlocks into the natural environment would be futile without HWA control measures in place. In addition, potential impacts to cultural resources under the No Action Alternative would be subject to review under Section 106 of the National Historic Preservation Act.

# AFFECTED ENVIRONMENT

In accordance with CEQ regulations (40 CFR 1502.15), this section describes the existing conditions of the area(s) to be affected by the alternatives under consideration in this EA. As stated in DO- 12, the NPS NEPA compliance guidance handbook, only those resources that may experience impact or be affected by alternatives under consideration are described in this section.

The Parkway intersects four mountain provinces (ridge, plateau, highlands, and pisgah), fourteen watershed basins, and a dozen municipal watersheds, providing a mosaic of interesting landforms and natural resource features. The natural resources include 1400 vascular plants species, more than 50 rare or endangered plant species, at least 100 exotic plants, six rare or endangered animals, a variety of slopes (mostly steep) and exposures, possibly 100 different soil types, and an elevation change of 5,700 vertical feet. The Parkway also bisects 47 natural heritage areas that include more than half of the high-elevation wetlands known in North Carolina.

## VEGETATION

Forest types in the park are generally classified as Appalachian oak forest, southeastern spruce- fir forest, and northern hardwoods. The predominant vegetation form is montane cold- deciduous broad- leaved forest dominated by the genus *Quercus* (Oak). The oak forest type consists of black, white, and chestnut oaks that dominate dry mountain slopes; pitch pine is often a component along ridge tops. Mesophytic species such as yellow- poplar, red maple, northern red oak, and sweet birch dominate the valleys and moist slopes. Smaller areas of cold- deciduous broad- leaved forest with evergreen needle- leaved trees are present in the intermontane basins, with the hardwood- pine cover type of scarlet, white, blackjack, and post oaks and Virginia pine. Table Mountain pine, a fire- dependent species with serotinous cones, occurs on xeric ridge tops where fire was historically more common. Eastern white pine dominates small areas of coarse- textured soils and parts of the Blue Ridge escarpment joining the Southern Appalachian Piedmont Section. Mesic sites at higher elevations (4,500 ft, 1,360 m) are occupied by northern hardwoods (e.g., sugar maple, basswood, and buckeye); drier sites are dominated by northern red oak. The broad- leaved forest changes to evergreen needle- leaved forest with conical crowns (e.g., red spruce, Fraser fir) above altitudes of about 5,000 to 6,000 ft (1,800 m). While plant inventories are currently underway, there is currently 1,400 species of vascular plants that are known to occur in the park.

The rare plant communities included in Table 2 occur throughout the park and across environmental conditions. Protection of these communities involves protecting all of the components of the community.

**Table 2. List of rare communities that occur within Blue Ridge Parkway lands**

| COMMUNITY NAME |
|---|
| BOULDERFIELD FOREST |
| CAROLINA HEMLOCK BLUFF |
| FRASER FIR FOREST |
| GRASSY BALD |
| HIGH ELEVATION GRANITIC DOME |
| HIGH ELEVATION ROCKY SUMMIT |
| HIGH ELEVATION SEEP |
| MONTANE ALLUVIAL FOREST |
| MONTANE MAFIC CLIFF |
| NORTHERN HARDWOOD FOREST (BEECH GAP SUBTYPE) |
| RED SPRUCE- - FRASER FIR FOREST |
| SOUTHERN APPALACHIAN BOG (NORTHERN SUBTYPE) |
| SOUTHERN APPALACHIAN BOG (SOUTHERN SUBTYPE) |
| SPRAY CLIFF |
| SWAMP FOREST- BOG COMPLEX (TYPIC SUBTYPE) |

## TERRESTRIAL WILDLIFE

The Parkway supports a variety of wildlife species. Most commonly observed are whitetail deer, squirrels, rabbits, groundhogs and songbirds. Dozens of less visible species are found throughout Parkway lands including approximately 74 species of mammals, 44 of amphibians, 35 reptile species, 57 species of fish and more than 300 types of birds.

Executive Order 13186 directs each Federal agency taking actions having or likely to have a negative impact on nearctic- neotropical migratory bird populations to work with the U.S. Fish and Wildlife Service (USFWS) to develop an agreement to conserve those birds. The protocols developed by this consultation are intended to guide future agency regulatory actions and policy decisions; renewal of permits, contracts or other agreements; and the creation of or revisions to land management plans. In addition to avoiding or minimizing impacts to migratory bird populations, agencies are expected to take reasonable steps that include restoring and enhancing habitat, preventing or abating pollution affecting birds, and incorporating migratory bird conservation into agency planning processes whenever possible.

Waves of migratory songbirds travel along BLRI during the spring and fall migrations and about 115 species have been identified as breeding here during the summer months. Nesting birds take advantage of the various vegetation communities and breeding birds could be found the length of the Parkway in virtually all habitats.

## AQUATIC WILDLIFE

The Blue Ridge Parkway contains numerous headwaters and tributaries, many of which contain pristine wild brook trout fishery. Six hundred miles of streams occur within fourteen watersheds, including twelve municipal watersheds. There are more than 250 acres of wetlands and miles of floodplains along creeks and rivers.

The 1972 Federal Water Pollution Control Act, as amended by the Clean Water Act of 1977, establishes a national policy to restore and maintain the physical, chemical, and biological integrity of the Nation's waters; to enhance the quality of water resources; and to prevent, control, and abate water pollution. In general, the maintenance of forested riparian areas comprised of a diversity of species would help maintain the desired characteristics of a high quality stream. Most actions that reduce the diversity of plant species in the riparian zone would lead to a reduction in some aspect of the desired aquatic system.

## THREATENED AND ENDANGERED SPECIES

### *Plants*

There are five plants species that occur at BLRI and are listed under the authority of the Endangered Species Act of 1973 as federally endangered or threatened; these are:

- Heller's Blazing Star (*Liatris helleri*) Threatened
- Rock Gnome Lichen (*Gymnoderma lineare*) Endangered
- Spreading Avens (*Geum radiatum*) Endangered
- Swamp Pink (*Helonias bullata*) Threatened
- Small- Whorled Pogonia (*Isotria medeoloides*) Threatened

There are an additional 85 plants that are rare in either North Carolina or Virginia and that occur on Blue Ridge Parkway lands.

### *Animals*

There are three animal species that occur at BLRI and are listed under the authority of the Endangered Species Act of 1973 as federally endangered or threatened; these are:

- Carolina Northern Flying Squirrel (*Glaucomys sabrinus coloratus*) Endangered
- Bog Turtle (*Glyptemys muhlenbergii*) Threatened
- Virginia Big- eared Bat (*Corynorhinus townsendii virginianus*) Endangered

There are an additional 30 animals that are rare in either North Carolina or Virginia and that occur on Blue Ridge Parkway lands.

## CULTURAL RESOURCES

### *Archaeological Resources*

Humans have been a part of the southern Appalachian ecosystem for the past 15,000 years (USDI NPS 1982). Archaeological evidence of people utilizing the abundant natural resources of the Parkway begins 8,000 years ago and continues today as local farmers lease Parkway lands for cattle and hay production. On the Parkway, archaeological resources consist of several sites that contain archaic components. Although two sites appear to be stratified, the archaic components of all sites are generally represented as surface expressions of lithic materials. Several sites contain woodland period components, and very little has been uncovered in the Mississippian period. A number of historic sites related to mountain culture and the Park way development period are known to the park.

### *Historic Structures*

There are 274 structures listed on the park's List of Classified Structures (LCS). These structures include historic buildings and early park infrastructure including maintenance areas, roads, bridges, overlooks, restaurants, lodges, gas stations, and visitor contact stations. Brinegar Cabin is the only structure listed on the National Register of Historic Places (NRHP) for the Parkway, and no hemlock are associated with its NRHP values.

### *Cultural Landscapes*

The National Park Service maintains a database of historically significant landscapes in the National Park Service known as the Cultural Landscape Inventory (CLI). The park contains 12 landscapes and component landscapes listed on the CLI. These include both landscapes that are documented or certified as cultural landscapes and those that have been identified for further study as cultural landscapes. Some of these landscapes have a hemlock component, but to date the hemlock component has not been determined to be significant. The one exception to this is the hemlock hedge at the Moses H. Cone Memorial Park. Although the hedgerow has been fragmented by the construction of roads on and off the park, the remaining hedge has been determined to be a contributing element to the overall landscape.

### *Ethnographic Resources*

Ethnographic resources related to the park are only now beginning to be identified and studied. Physical elements strongly tied to ethnographic resources are cemeteries. There are at least 65 cemeteries in the park, some of which are also considered to be component cultural landscapes on the CLI. Some of these cemeteries are located in areas where hemlock trees predominate. While it has not been documented, it is possible that some hemlock trees associated with cemeteries were planted by descendants of those buried in park cemeteries.

Many of these cemeteries in the park are adjacent to agricultural lands and do not have a hemlock component. Some are bounded by forest cover and, in some cases, by stands of hemlock. The hemlock component of most of these cemeteries in Virginia has already been lost to HWA incursion in the 1990s and early 2000s when efficacious control techniques were not available. It is unknown at this time the extent of these resources in North Carolina where hemlocks are still living.

## VISITOR USE AND EXPERIENCE

### *Recreational Resources*

The broad management goals of the park are to preserve the park's diverse resources while providing for public benefit and enjoyment. BLRI is the most frequently visited unit of the National Park Service with more than 21 million visitors annually. Most visitors to the park travel in private automobiles with motorcycle use increasing at a steady annual rate. In addition to roads providing access to and within the park, numerous foot and horse trails provide access at recreation areas to the park's backcountry. The principal use of the Parkway is for recreational activities which include viewing scenery and wildlife, recreational driving, hiking, biking, camping, and horseback riding.

Park visitation rates vary seasonally, peaking between June and October. Visitation tends to be heavier during weekends and holidays, and trails and picnic grounds see high use during college and secondary school breaks. The park's breathtaking vistas are the main attraction for visitors, with most activities restricted to driving through the park, camping in developed campgrounds or picnicking. The park has 9 developed campgrounds, over 1,000 campsites and was host to over 84,000 visitors in 2006. The Parkway has over 180 miles of trail which is predominantly utilized by hikers. Horse use is limited to the carriage roads within the Moses H. Cone Memorial Park and within the Roanoke Basin. The BLRI is noted for its outstanding views from both overlooks and roadside vistas.

### *Visual Resources*

The most valued recreational opportunity on the Parkway, scenic viewing, could be lost and changed in areas without a treatment of exotic pests and vegetation which threaten the parks native vegetation.

Overlooks were provided along the Parkway at strategic points to allow motorists to park and enjoy the view. There are now 264 overlooks along the 470- mile road, an average of one every 1.78 miles. These overlooks were carefully located with due regard to safe access, suitable topography and interesting views. The overlook provides the greatest opportunity for the visitor to enjoy the scenic resources of the Parkway. Most overlooks are cyclically cleared of vegetation to maintain scenic vistas and provide the visitor with the opportunity to enjoy a scene for a long duration of time. Many cleared vistas along the roadway provide only fleeting views of the scenic landscape. A viewshed that is observable in detail for a longer period of time would substantially increase the scenic importance of that viewshed or landscape. Observation times from Parkway overlooks offer viewers the most leisurely amount of time to view a landscape depending only on the discretion of the viewer. Along the roadway, cleared scenic

vistas provide the greatest duration of viewing opportunity to the motorist who is traveling along the Parkway at an average speed of 45 miles per hour. Currently, the park cyclically clears vegetation from 706 vistas areas along the Parkway.

# ENVIRONMENTAL CONSEQUENCES

This section describes the affected environment and environmental consequences associated with the alternatives. It is organized by impact topic, which distills the issues and concerns into distinct topics for discussion analysis. These topics focus on the presentation of the affected environment and environmental consequences and allow a standardized comparison between alternatives based on the most relevant topics.

## METHODOLOGY

NEPA requires consideration of context, intensity, and duration of impacts, direct or indirect impacts, cumulative impacts, and measures to mitigate for impacts. NPS policy also requires that "impairment" of resources be evaluated in all environmental documents.

Overall, the NPS based the following impact analyses and conclusions on the review of existing literature and Blue Ridge Parkway studies, information provided by experts within the NPS and other agencies, professional judgments and park staff insights, and public input.

### *General Impact Definitions*

Potential impacts are described in terms of type (beneficial or adverse), context, duration, intensity, and impairment. The following general definitions were used to evaluate the context, intensity, duration, and cumulative nature of impacts associated with project alternatives. Impairment is discussed below.

**Context of Impact**
Context is the setting within which an impact is analyzed, such as local, park- wide, or regional. CEQ requires that impact analysis include discussions of context. Localized impacts are those that affect the resource area only on the project site or its immediate surroundings, and would not extend park- wide or into the region.

**Intensity of Impact**
Impact intensity is the degree to which a resource would be beneficially or adversely affected by an action. Impact intensities are quantified as negligible, minor, moderate, or major and are further defined as follows:

*Negligible*: Impacts occur, but are barely detectable. Impacts are so minute that they have no observable effects on plants and animals and the ecosystems supporting them.

*Minor*: Impacts are slight, but detectable. Population numbers, population structure, genetic variability, and other demographic factors for species may have small, short- term changes, but long- term characteristics remain stable.

*Moderate*: Impacts are readily detectable and apparent. Population numbers, population structure, genetic variability, and other demographic factors for species may have small to moderate, short- term declines, but rebound to pre-impact numbers. Species are not at risk of being extirpated from the park and habitats for all species remains functional.

*Major*: Impacts are readily detectable and produce severe changes. Population numbers, population structure, genetic variability, and other demographic factors for species may have large, short- term declines with long- term population numbers considerably depressed. In extreme cases, species may be extirpated from the park and habitats for any species could be rendered not functional.

**Duration of Impact**

The duration of impact is analyzed independently for each resource because impact duration is dependent on the resource being analyzed. Depending on the resource, impacts may last as long as construction takes place, or a single year or growing season, or longer. For purposes of analysis, impact duration is measured in short- term and long-term and is further defined as follows:

*Short- term*: An impact limited to the treatment period that is *not* expected to extend more than two years.

*Long- term*: An impact that extends past the treatment period and is expected to extend more than two years.

**Direct verses Indirect Impacts**

Direct effects are impacts caused by the alternative(s) at the same time and in the same location as the action. Indirect effects are impacts caused by the alternative(s) that occur later in time or farther in distance than the action, but still reasonably foreseeable. An indirect impact could occur because of a change to another resource or impact topic.

*Cumulative Impact Scenario*

CEQ regulations (40 CFR 1508.7) require the assessment of cumulative impacts in the decision- making process for Federal projects. A cumulative impact is an impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of which agency (Federal or non- Federal), organization, or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time. Cumulative impacts are considered for all alternatives and are presented at the end of each impact topic discussion analysis.

**IMPAIRMENT OF PARK RESOURCES**

In addition to determining the environmental consequences of the Proposed Action and other alternatives, the NPS Management Policies 2006 and DO- 12 require analysis of potential effects to determine if actions would impair a park's resources.

The fundamental purpose of the National Park System, established by the Organic Act and reaffirmed by the General Authorities Act, as amended, begins with a mandate to conserve park resources and values. NPS managers must always seek ways to avoid or minimize to the greatest degree practicable adverse impacts on park resources and values. However, the laws do give NPS management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park, as long as the impact does not constitute impairment of the affected resources and values. Although Congress has given NPS management discretion to allow certain impacts within parks, that discretion is limited by statutory requirement that the NPS must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise. The prohibited impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values, including opportunities that otherwise would be present for the enjoyment of those resources or values. An impact to any park resource or value may constitute an impairment. However, an impact would more likely constitute an impairment to the extent it affects a resource or value whose conservation is:

- Necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park;
- Key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or
- Identified as a goal in the park's Master Plan or General Management Plan (GMP) or other relevant NPS planning documents.

Impairment may result from NPS activities in managing the park, visitor activities, or activities undertaken by concessionaires, contractors, and others operating in the park. In this section, a determination on impairment is made in the conclusion statement of

each resource area for each alternative. The NPS does not analyze the potential for impairment of recreational values/visitor experience (unless impacts are resource based), socioeconomic values, or park operations.

## VEGETATION

### *Alternative A - No Action*

**Impacts**

Without a viable method for long- term control of HWA, there would likely be long-term, major impacts to hemlock- dominated communities as eastern hemlocks are lost across the park. It could be assumed that, along with hemlock genotypes, some flora and fauna that depend on hemlock- dominated communities would also be lost. Canopy openings would allow increased light to fall in these stands, decreasing soil moisture. Solar drying of soil would occur until the gaps are replaced by other vegetation. Plant species composition would likely shift, as has been documented in areas with Fraser fir and beech mortality dominance.

Invasive, non- native vegetation is expected to move into the sunnier areas created by dying hemlocks as the structure of the vegetation community changes. Non- native plant species affect areas by altering species composition and diversity. In Delaware Water Gap National Recreation Area, healthy hemlock- dominated stands are relatively free of invasive alien plants, but declining stands are being invaded by alien species such as Japanese stilt- grass, Japanese barberry, garlic mustard, and tree- of- heaven (Lynch 2005). Additionally, moss, lichen and other bryophyte species that are associated with hemlock, especially old growth hemlock, would likely suffer reduced populations.

**Cumulative Impacts**

As hemlocks decline increased solar radiation would dry soils and shade- dependent flora, particularly bryophytes, would suffer. Cumulatively, these impacts would likely be far- reaching. Dry site species that require light would invade, including aggressive, non- native flora. Hardwoods and invasive species would likely colonize habitats now dominated by hemlock forests.

**Conclusion**

Under Alternative A, long- term, major adverse impacts would occur in hemlock-dominated communities throughout the park. Eastern hemlock forests would continue to decline with resulting ecological changes to the forests.

**Impairment**

There would be no impairment to the park's vegetation resources under this alternative.

*Alternative B - Chemical Control Only*

**Impacts**

No direct impacts causing plant injury would occur from using imidacloprid as a soil injection. Imidacloprid is not toxic to plants. Trees injected with imidacloprid might be injured from repeated stem injections due to damage in the cambium layer. Repeated tree wounding would cause localized minor injury that could accumulate over time. This injury could allow fungal rot agents to enter the tree, however this type of injury is common in trees and compartmentalization of damage is a standard wound response in healthy trees. Injections would occur no more frequent than annually. This impact would be, therefore, minor in nature.

Trees treated with imidacloprid through an injection might be more susceptible to secondary pests. This would be a short term impact that could have moderate impacts to tree health. Researchers (Raupp et al. 2004) found that hemlocks treated with imidacloprid suffered more injury from spruce spider mites and hemlock rust mites than non- treated hemlock trees. In addition, their research found that terminal needles on imidacloprid- treated hemlocks were approximately nine times more likely to have severe needle damage than untreated trees. Unfortunately, some pesticide applications for a primary pest such as HWA may contribute to the development of a secondary pest. In some instances, it might be worthwhile to treat secondary pests, but another set of impacts would require evaluation.

Foliage on trees treated with horticultural oil could be damaged during periods of prolonged high temperature and high relative humidity (Sunoco, Inc. 2000). However, this threat would be completely avoided at BLRI as trees would only be treated with oil during the dormant season.

Researchers did not find phytotoxic effects (injurious or lethal effects) on Fraser firs after treating trees with a 1.5% insecticidal soap solution (Hastings et al. 1984). Insecticidal soap caused some foliar discoloration in a study done on a Fraser fir plantation indicating that succulent foliage (June growth) may be sensitive to soap treatments. However, multiple sprays of either high or low concentrations could be used with little discoloration at times later than June (Hastings et al. 1986). Appropriately timed spray operations of either insecticidal soap or horticultural oil should not cause any foliage injury to hemlocks. Therefore, these impacts could be avoided. Further, hemlocks would not be treated when suffering from drought stress or under excessive heat and humidity conditions.

In general, non- target vegetation sprayed incidentally should not suffer foliage damage according to the label of the horticultural oil (Sunoco, Inc. 2000) and insecticidal soap (Southern Agricultural Insecticides, Inc. 2005) used in the park. However, plant species have different sensitivities to chemicals and special care would be taken to avoid directly spraying in rare plant communities. Some plants are sensitive to oils. Plant sensitivity

could be influenced by environmental conditions, plant vigor, spray concentration, and spraying repetition (Southern Agricultural Insecticides, Inc. 2005). These impacts to non- target vegetation would be short term and minor to moderate in nature. Of course, all incidental spray reaching non- target plants would be the result of minimal drift and dripping from the hemlocks foliage. Treatments would be timed to avoid hot, dry conditions when foliage is most susceptible to damage.

**Cumulative Impacts**
Repeated tree wounding would cause localized minor injury that could accumulate over time. This injury could allow fungal rot agents to enter the tree, however this type of injury is common in trees and compartmentalization of damage is a standard wound response in healthy trees. Injections would occur no more frequent than annually. This impact therefore, would be minor in nature.

Short term increases in secondary pests could occur but would not continue for years.

**Conclusion**
With Alternative B, some direct minor to moderate impacts could occur to hemlock trees. Systemic pesticides could make trees more susceptible to secondary pests. Minor, short- term impacts could affect sensitive, non- target vegetation as a result of contact with drift from insecticidal soap applications.

**Impairment**
There would be no impairment to the park's vegetation resources under this alternative.

***Alternative C - Biological Control Only***

**Impacts**
There would be no anticipated impacts to the vegetative community as these beetles do not feed on vegetation. Further, their feeding behavior and habits do not cause harm to vegetation.

**Cumulative Impacts**
If predatory beetle releases are successful, hemlock mortality would be reduced. Hemlock stands occur on both private and public lands bordering the park. Thus, if predatory beetles become established, they would likely attack HWA infestations on other public and private lands.

**Conclusion**
With Alternative C, no impacts to the park's vegetation resources are anticipated other than the expected beneficial impact to hemlocks.

**Impairment**
There would be no impairment to the park's vegetation resources under this alternative.

*Alternative D - Both Chemical and Biological Control*

**Impacts**
Insecticidal soap and horticultural oil treatments would be timed for cooler periods during the year when the risk of potential injury to hemlocks and non- target vegetation is avoided. As mentioned in Alternative C, there would be no anticipated impacts to the vegetative community as these beetles do not feed on vegetation. Further, their feeding behavior and habits do not cause harm to vegetation.

**Cumulative Impacts**
Over time, chemical controls would have a minor localized impact to park resources. This impact would be negligible since application timing would be adopted and used as standard operating procedure. No impacts to vegetation resources are expected from biological controls.

**Conclusion**
With Alternative D, there would be short- term, minor to moderate impacts to the park's vegetation community from the use of chemical controls. No impacts would result from the use of biological controls.

**Impairment**
There would be no impairment to the park's vegetation resources under this alternative.

**TERRESTRIAL WILDLIFE**

*Alternative A - No Action*

**Impacts**
Over time, the effects of the increasing number of declining and dying hemlocks throughout the park would magnify. All hemlocks of all age and size classes are vulnerable to HWA. Some terrestrial wildlife would be directly impacted through loss of habitat. Particularly impacted would be species that have close associations with hemlock such as several species of neotropical migratory birds and certain arthropod species. Additionally, certain mammals could move out of hemlock habitat into other hardwood forests. Some bats such as the endangered Indiana bat could temporarily benefit from the increase in dead hemlock that still have attached bark, though there is no evidence that these animals are affected by a shortage of dead trees or shaggy bark. Some bats nest under loose bark in the summer.

As more trees die, fewer birds would nest in what live trees remain unless they switch to another species of tree to nest. It is expected that, of those birds that prefer to nest in hemlock, fewer bird offspring would be produced. More dead trees would be available for cavity nesting birds and bats. Invertebrate diversity in hemlock is significant (Buck 2003) and these species would not find a similar substitute tree species in all habitats.

Large- scale dying of hemlocks would allow in more sunlight, increasing soil temperatures and eliminating shade- dependent and moisture loving ground cover. Some animals in hemlock forests are more dependent on the rhododendron understory than on the hemlocks themselves. Changes in the environmental conditions and plant communities could cause many animals, notably terrestrial amphibians and other moisture- dependent species, to leave or die out.

Some species that use dead trees would benefit in the short term until the dead hemlocks break apart and fall. Insects that live in and feed on dead trees would benefit in the short term. Species that use hemlock for food and cover, especially winter cover, would decline. Neotropical migratory birds that are associated with hemlock would suffer.

Hemlock provides direct cover and food for a variety of wildlife species and hemlock forest type provides habitat for many associated plants and invertebrates that these wildlife species depend on. The No Action Alternative would provide no protection of these hemlock resources with a resultant health decline and mortality of hemlock. Yamasaki et al. (2000) reported 96 species of birds and 47 species of mammals are associated with hemlock forests in the northeastern U.S., though none of those species is limited to these forests. The hemlock forests of BLRI include these species. In Massachusetts, researchers found population declines for black- throated green warbler, Acadian flycatcher, blue- headed vireo, and hermit thrush due to hemlock mortality (Tingley et al. 2002). Farnsworth and Simons (1999) reported that 84% of wood thrush nests at GRSM were in small hemlocks. Full impacts of hemlock decline and mortality are still being studied in northeastern areas affected by HWA.

The distribution and abundance of some bird species would likely decline. Those neotropical migratory birds that nest in hemlock stands would likely decline or continue their decline at a faster rate. Terrestrial arthropod species that are dependent upon hemlocks would be lost or decline in numbers. Mammal species that use hemlocks for food and cover would likely find other food sources, although the quality of these resources might decline and negatively affect their populations.

**Cumulative Impacts**

Vertebrate and invertebrate populations that have close associations with hemlocks and hemlock forest communities would be impacted at a moderate to major extent over the long term. Bat populations, woodpeckers, wood boring insects and wood decay fungi could receive a temporary beneficial impact as the number of dead hemlocks increases. Invasive plants would become more prevalent in some areas.

**Conclusion**

Under Alternative A, terrestrial wildlife resources would suffer long- term moderate to major impacts as hemlock forests decline and die.

**Impairment**
There would be no impairment to the park's terrestrial wildlife resources under this alternative.

*Alternative B - Chemical Control Only*

**Impacts**
Impacts to non- target invertebrates would occur with chemical treatments. Soft bodied insects contacted by the spray of either insecticidal soap or horticultural oil would be affected. Both sprays dry within hours and recolonization from adjacent untreated trees could occur with no impact. Non- target insects feeding on hemlock roots, stems or foliage would be affected by systemic insecticides. Soil dwelling arthropods would be affected by systemic insecticides administered into the soil for several weeks until concentrations of the insecticides diminished. Stem injected insecticides would not affect soil arthropods.

**Cumulative Impacts**
Impacts to non- target insects that feed on hemlock or are present on foliage at time of foliar treatment would occur every time treatment was done. Insecticidal soap is used one to two times per year- once during the dormant season- and oil is used once during the dormant season, usually in place of one soap treatment. Imidacloprid treatments are much less frequent with no less than two years between treatments.

**Conclusion**
Short- term minor to moderate impacts to terrestrial insects would occur under Alternative C.

**Impairment**
There would be no impairment to the park's terrestrial wildlife resources under this alternative.

*Alternative C - Biological Control Only*

**Impacts**
Biological control insects considered for release to control HWA would have been screened for other possible food preferences. This includes no- choice food tests of other adelgids and aphids. *S. tsugae* and *L. nigrinus* do not feed upon or attack other arthropod fauna known to be associated with hemlock. *S. tsugae* was found to try balsam woolly adelgid (BWA), a non native species that has killed much of the Fraser fir in the southern Appalachians. *S. tsugae* was shown to prefer HWA in these tests but could feed incidentally on BWA. Other biological control agents may incidentally feed on pine bark adelgid, a native but not threatened pest of pines. Other aphid species may be tried by biological control agents but the control insects cannot survive and

reproduce unless they have the eggs of HWA to feed on. Based on these considerations, in the event that either beetle attacks other adelgids, any indirect or cumulative impacts would likely be beneficial. Therefore impacts to non- target insects would be minor.

Recently, potential competition between *L. nigrinus* and a native beetle, *L. rubidus*, was examined to determine if the introduction of *L. nigrinus* would pose any threat to the native population of beetles. *L. rubidus* is native to the eastern United States and feeds primarily on the native pine bark adelgid *Pineus strobi*. In various trials, *L. nigrinus* was unable to complete its life cycle feeding only on *P. strobi* (Zilahi- Balogh et al. 2002) indicating that the two congeners would not compete for native resources. Further, *L. rubidus* showed distinct preference for feeding on *P. strobi* rather than HWA. Unfortunately, this native predator would not likely contribute much to reducing HWA populations, but it also would not face competition from the introduced predator, *L. nigrinus* (Zilahi- Balogh et al. 2002).

**Cumulative Impacts**
Biological control agents could feed on non- target insects infrequently at any time, but they require HWA to thrive and reproduce so this impact would be negligible.

**Conclusion**
With Alternative C, impacts would be negligible due to host specificity of the predator insects on HWA.

**Impairment**
There would be no impairment to the park's terrestrial wildlife resources under this alternative.

***Alternative D - Both Chemical and Biological Control***

**Impacts**
Short term impacts to soft bodied insects on hemlock foliage could result from foliar sprays of insecticidal soap or horticultural oil. Soil arthropods would experience short term impacts in the small area around soil treated trees. No impacts from biological controls.

No permanent impact would be anticipated to the terrestrial wildlife community from the use of biological or chemical controls. As discussed earlier, all of the predator beetles considered for release have restricted diets. These beetles only feed on HWA in our area. Chemical controls would impact all soft- bodied insects that are exposed to the treatment. The park does not contain any terrestrial wildlife species that is dependent on hemlock for its survival and are likely found on several other woody species. Untreated trees in the vicinity of treated areas would serve as a reservoir for non- target species.

**Cumulative Impacts**
No permanent impacts to terrestrial wildlife would be expected under Alternative D.

**Conclusion**
Chemical control would have short- term minor to moderate impacts to terrestrial insects under Alternative D. There would be no other terrestrial wildlife impacts as a result of chemical use. Biological control would have negligible impacts to terrestrial insects and no impacts to other terrestrial wildlife.

**Impairment**
There would be no impairment to the park's terrestrial wildlife resources under this alternative.

## AQUATIC WILDLIFE

### *ALTERNATIVE A - No Action*

**Impacts**
Soil erosion and increased surface runoff of rainfall could occur if all the hemlocks were to die. Year- round shading of streams would be reduced. The loss of streamside hemlock- dominated communities would impact the entire aquatic system. Temperature and hydrologic regimes of streams would become more variable and less stable (Evans 2002). This could result in a decline in brook trout. Rates of nitrogen mineralization and nitrification would increase, with some depletion of soil nutrients (Evans 2002).

The heavy shade that hemlock provides along streams keeps those streams cooler. In a stream temperature monitoring study at Delaware Water Gap National Recreation Area, a several degree Fahrenheit decrease in summer stream temperature was documented as the stream flowed through a hemlock- dominated section of the stream. Stream temperature directly affects dissolved oxygen content, with cooler waters having a higher concentration of dissolved oxygen. Certain vertebrate and invertebrate species are very sensitive to dissolved oxygen content and could be lost as hemlocks along streams lose needles, thereby allowing more sunlight to fall on streams.

Under the No Action Alternative, changes in stream quality could occur as a result of hemlock loss. Likely changes to the aquatic community include increased water temperatures, altered species composition, and changes in biotic densities and diversity.

**Cumulative Impacts**
Permanent changes in aquatic wildlife resources could occur as the result of extensive loss of hemlock. Water and soil chemistry changes could also occur.

**Conclusion**
Aquatic wildlife would experience long term moderate to major impacts.

**Impairment**
There would be no impairment to the park's aquatic wildlife resources under this alternative.

*Alternative B - Chemical Control Only*

**Impacts**
Imidacloprid, horticultural oil, and insecticidal soap are toxic to aquatic invertebrates and precautions would be taken to avoid contamination of waterways. Foliar and soil treatments would not be administered within 20m of a waterway and spray operations would be stopped in windy conditions likely to cause drift. Mature riparian hemlocks could be stem injected and, thereby, avoid water contamination. BLRI would not conduct any soil injections within 20 meters of ground surface water. The risk of run-off from treated areas into water sources is largely eliminated due to the properties of imidacloprid which readily bind the chemical to organic matter and most soils (USDA 2002). Monitoring data collected in 2001 by the Asian Longhorned Beetle eradication program in a pond in Corona Park, Flushing, New York, indicates no measurable run-off from nearby treatments. Groundwater monitoring studies conducted in a variety of sites have shown that imidacloprid does not significantly leach under actual field- use conditions, although, leaching could occur in areas with sandy soils (USDA 2002).
If directly introduced into water systems, the pesticide is slightly toxic to many fish species, while toxicity for aquatic invertebrates varies by species (USDA 2002). The toxicity of imidacloprid to fish is moderately low. The 96- hour LC50 (lethal concentration required to kill 50% of the test population) of imidacloprid is 211 mg/l for rainbow trout, while the 48- hour EC50 (effective concentration to cause toxicity in 50% of the test organisms) was 85 mg/l for the aquatic invertebrate Daphnia (Kidd and James 1991).

The recommended application of imidacloprid in the park would occur in a nearly closed treatment system (trunk injection) which greatly reduces the risk of introduction of the chemical into water systems. All chemical mixing would occur at least 20 m away from any water resource. The USDA completed a formal risk assessment (2002) for imidacloprid and concluded that the likelihood of exposure to the chemical during and following treatment is minimal and indicates no risk to human health or the environment.

**Cumulative Impacts**
Proposed chemical controls would not be expected to accumulate in the aquatic environment, therefore, no short term or long term impacts are expected.

**Conclusion**
Under Alternative B impacts to aquatic wildlife resources would be negligible.

**Impairment**
There would be no impairment to the park's aquatic wildlife resources under this alternative.

*Alternative C - Biological Control Only*

**Impacts**
None of the biocontrol insects have known associations with aquatic insects or aquatic vertebrates. No impacts to aquatic resources would be expected as biological controls are predators of terrestrial adelgids.

**Cumulative Impacts**
No cumulative impacts to aquatic wildlife would occur under Alternative C.

**Conclusion**
No impacts to aquatic wildlife would occur under Alternative C.

**Impairment**
There would be no impairment to the park's aquatic wildlife resources under this alternative.

*Alternative D - Both Chemical and Biological Control*

**Impacts**
Chemical treatments would not be conducted near aquatic areas unless in a closed system (trunk injection). Predator beetles would have no impact on the aquatic community as they are terrestrial and feed only on terrestrial prey.

**Cumulative Impacts**
No cumulative impacts to aquatic wildlife resources would occur under Alternative D.

**Conclusion**
No impacts to aquatic wildlife resources would occur under Alternative D.

**Impairment**
There would be no impairment to the park's aquatic wildlife resources under this alternative.

## THREATENED AND ENDANGERED SPECIES

Section 7 of the Endangered Species Act requires that a Federal agency consult with the USFWS or the National Marine Fisheries Service on any action that may affect endangered, threatened, or candidate species, or that may result in adverse modifications of critical habitat. Implementing regulations that describe procedures for interagency cooperation and consultation with regards to effects on threatened, endangered, or proposed species are contained in 50 CFR 402. The USFWS, the VDCR, VDGIF, and the NCWRC were contacted in June 2007 regarding potential impacts of the project on natural heritage resources, including rare, threatened, or endangered plant and animal species.

### *Alternative A - No Action*

#### Impacts

Federal T&E species are listed on page 30. Some of these species are found in hemlock forests, but are not exclusive to hemlock forests. The No Action Alternative could have implications for species in hemlock communities. As hemlocks die, more light would reach the forest floor resulting in drier soils.

T&E plant species would be only slightly impacted by the loss of hemlock as very few of these species occur in hemlock communities. The rock gnome lichen could suffer under the drier conditions. The T&E animal species that utilized dead trees could benefit under this alternative, while the other species would not likely suffer any impacts.

#### *Plants and Lichens*

The endangered rock gnome lichen, *Gymnoderma lineare*, is found on boulders in areas of high moisture and low solar radiation (USFWS 1997). This habitat occurs at high elevations where fog bathes the landscape, and in deep gorges at lower elevations. Hemlocks could be found in deep gorges, therefore, *G. lineare* could be found in some hemlock areas of the park. Under the No Action Alternative loss of hemlock in these areas could allow more light to reach the ground making the habitat for *G. lineare* less suitable.

Spreading avens (*Geum radiatum*), is an endangered high elevation flowering plant that is not likely to be in areas of hemlock resources, therefore there would be no impacts under the No Action Alternative.

Small- Whorled Pogonia (*Isotria medeoloides*) is a threatened orchid that lives in acidic soil of dry, open deciduous woods. There would be no impacts on *I. medeoloides*.

Heller's Blazing Star (*Liatris helleri*) is a threatened plant that occurs at high elevation dry rock outcrops where hemlock is not commonly found, therefore, there would be no impacts under this alternative.

Swamp Pink (*Helonias bullata*) is a threatened plant that occurs in acidic wetlands. Hemlock is not present at any of the swamp pink locations at BLRI; therefore, there would be no impacts under this alternative.

***Animals***

The Carolina northern flying squirrel (*Glaucomys sabrinus coloratus)* is an endangered squirrel of high elevations and is generally found in spruce- fir forests, though it also uses hemlocks when spruce and fir are not available. Loss of hemlocks in these areas would decrease habitat available to the squirrels and would likely impact young squirrels that have been forced out of the prime, spruce- fir forests.

The gray bat (*Myotis grisescens*) and Virginia big- eared bat (*Corynorhinus townsendii virginianus*) are both endangered bats. Impacts would likely be minimal as they are primarily cave dwelling species. Forest habitat around caves is important for avoiding predators (owls) and for flying insect habitat. Loss of hemlock would decrease habitat for hemlock- associated night flying insects but could increase populations of other flying insects that prefer sunnier open areas.

Dead hemlocks could benefit cavity nesting bird species and the federally endangered Indiana bat, *Myotis sodalis* is known to seek shelter under bark of dead trees during the summer and could benefit from increased numbers of dead hemlock trees, though there is no evidence that Indiana bats are affected by a shortage of places for roosting or for maternity colonies.

Bog turtles (*Glyptemys muhlenbergii*) are found in wetlands and generally there are few, if any, hemlocks present. The trees that are there are typically small (less than 10m) and their root masses create refuges where the turtles could hide from predators and hibernacula where they could over- winter. Loss of these trees would be insignificant as there would be other tree species that provide the same benefits.

**Cumulative Impacts**

No T&E species are known to exclusively inhabit hemlock forest resources. Impacts to T&E species that may be found in hemlock habitat would be variable depending on species.

**Conclusion**

Under the No Action Alternative, the impacts on T&E species could be mixed. Some of these species are found in hemlock forests, but are not exclusive to hemlock forests. Some of these species could be able to shift to another habitat, while others could not. Dying hemlocks would allow more light to reach the forest floor, causing drier soils.

Species that are now in the shade of hemlock which require more light would benefit. Overall, impacts would likely be negligible to minor.

**Impairment**
There would be no impairment to the park's threatened and endangered species under the No Action Alternative.

*Alternative B - Chemical Control Only*

**Impacts**
No T&E species of non- target invertebrates are known to occur on hemlock. There are no arthropod species federally or state- listed as endangered or threatened that utilizes HWA as a food source. In addition, there are no T&E soil- dwelling invertebrates identified in the park.

Except for Carolina northern flying squirrels, chemical treatments would not impact T&E species due to lack of T&E species on hemlock trees or in the soil around hemlocks. While bog turtles are often found in wetlands under hemlock trees these areas would not be treated with chemicals. Hemlock trees should not be sprayed with chemicals in potential flying squirrel habitat unless it could be determined that the tree is not being used by northern flying squirrels.

**Cumulative Impacts**
No cumulative impacts to T&E species would occur under Alternative B.

**Conclusion**
Under Alternative B, there would be no impacts to T&E species. There are no soft bodied, hemlock- feeding T&E species that would be impacted by either chemical or biocontrol treatments. Presumably, by actively protecting hemlock forests, species found within these communities would benefit by remaining in an intact forest system.

**Impairment**
There would be no impairment to the park's threatened and endangered species under this alternative.

*Alternative C - Biological Control Only*

**Impacts**
None of the invertebrate species that *S. tsugae* or *L. nigrinus* are known to feed on are threatened or endangered. No impacts to T&E species would occur.

**Cumulative Impacts**
No cumulative impacts to T&E species would occur under Alternative C.

**Conclusion**
Under Alternative C, there would be no impacts to T&E species.

**Impairment**
There would be no impairment to the park's threatened and endangered species under this alternative.

***Alternative D - Both Chemical and Biological Control***

**Impacts**
No T&E species of non- target invertebrates are known to occur on hemlock. Further, none of the invertebrate species that *S. tsugae* or *L. nigrinus* are known to feed on are threatened or endangered. No impacts to T&E species would occur, except as mentioned under Alternative B above.

**Cumulative Impacts**
No cumulative impacts to T&E species would occur under Alternative D.

**Conclusion**
No impacts to T&E species would occur under Alternative D.

**Impairment**
There would be no impairment to the park's threatened and endangered species under this alternative.

**CULTURAL RESOURCES**

In coordination with Section 106 of the NHPA, the NPS initiated consultation with the North Carolina and Virginia SHPO regarding effects to cultural and historic resources from the proposed alternatives.

***Alternative A - No Action***

**Impacts**
***Archaeological Resources***
Loss of hemlock would not affect archaeological resources. No disturbance of archaeological sites would occur. If hemlocks are removed after they have died, roots and cut boles would be left in place.

***Historic Structures***
Hemlock trees do not figure as prominently in BLRI historic landscapes. Hemlock is found at some historic structures and loss due to HWA would be evident until other trees replaced it. Although there are no known historic structures where hemlock trees are linked to the structure, if this were the case then moderate impacts would occur.

*Cultural Landscapes*
The hemlock hedge at Moses H. Cone Memorial Park would be adversely affected if not treated. Loss of the remaining remnants of the hemlock hedge would change the visitor experience by eliminating the screening of Highway 221 in some locations and altering the cultural landscape design. Although a replacement hedge could be replanted and maintained over time, the cost and time this would take is currently greater than the present budget or staff could afford.

*Ethnographic Resources*
Since no hemlocks are directly tied to cemeteries, there should be no impacts due to loss of hemlock trees on site. Should hemlock be determined to be important, seedlings could be planted and managed for the long- term.

**Cumulative Impacts**
Impacts would depend on the location of the cultural resource and period of the resource. For example, impacts would occur to a cultural resource tied to park development where forest re- establishment was part of the development and views and appreciation of the forest are important to the design and development. In this case cumulative impacts would include decline and loss of hemlocks with replacement by other tree species, primarily hardwood species. In some areas hemlock loss would allow non- native vegetation to invade.

If a cultural resource exists in an altered landscape where the resource has changed because of reforestation (i.e. farmstead formerly surrounded by open field), the impacts occurring due to the loss of hemlocks in these areas would be negligible as these forests already do not represent the appropriate cultural landscape.

**Conclusion**
If cultural resources are located in a forest dominated by hemlock and forested conditions could be tied to the actual resource, these resources would suffer moderate impacts with the loss of hemlocks.

**Impairment**
There would be no impairment to the park's cultural resources under this alternative.

*Alternative B - Chemical Control Only*

**Impacts**
The only disturbance to surface soil involves the soil drench method under the chemical control alternative. In that method, surface organic matter including leaves and twigs are temporarily moved to allow pouring of the *imidacloprid* mixture onto the soil in the area around the base of the tree. This material is then replaced in the same area that it was moved from. This would not affect BLRI archaeological resources, historic properties, cultural landscapes, or ethnographic resources.

**Cumulative Impacts**
No cumulative impacts would occur under this alternative.

**Conclusion**
No impacts to cultural resources would occur under Alternative B.

**Impairment**
There would be no impairment to the park's cultural resources under this alternative.

*Alternative C - Biological Control Only*

**Impacts**
Release of bio- control organisms would not affect BLRI's cultural resources, including archeology, historic properties, cultural landscapes, or ethnographic resources. No impacts to cultural resources would occur.

**Cumulative Impacts**
No cumulative impacts to cultural resources would occur under Alternative C.

**Conclusion**
There would be no impacts to cultural resources under Alternative C.

**Impairment**
There would be no impairment to the park's cultural resources under this alternative.

*Alternative D - Both Chemical and Biological Control*

**Impacts**
The only disturbance to surface soil involves the soil drench method under the chemical control alternative. In that method, surface organic matter including leaves and twigs are temporarily moved to allow pouring of the *imidacloprid* mixture onto the soil in the area around the base of the tree. This material is then replaced in the same area that it was moved from. Release of bio- control organisms would not affect BLRI's cultural resources. No impacts to cultural resources would occur.

**Cumulative Impacts**
No cumulative impacts to cultural resources would occur.

**Conclusion**
No impacts to cultural resources would occur under Alternative D.

**Impairment**
There would be no impairment to the park's cultural resources under this alternative.

## VISITOR USE AND EXPERIENCE

### *Recreational/Visual Resources*

### *Alternative A - No Action*

**Impacts**

Under the No Action Alternative, impacted areas with stands of dying hemlocks would lose recreational and aesthetic value. Large blocks of dead and dying Hemlocks would detract from the aesthetics and visitor attraction to areas where they are the predominate species. Outdoor recreation use that is linked to the ecologic, aesthetic, and/or wildlife habitat benefits of Hemlock would be displaced to lower quality sites or lost altogether. Loss of hemlock in the headwaters of streams would likely reduce fish habitat and fish populations; angler success and satisfaction would, therefore, also be reduced.

Hazardous trees would become very common in developed areas such as campgrounds and roadsides. Increased numbers of dead trees would create more tree hazards in areas where hemlocks are near trails, picnic sites and within developed areas. Dead and dying hemlock trees add significantly to the challenges of managing hazard trees. Dead standing trees would compromise safety and negatively impact aesthetics in front country situations. Dead hemlocks in high- use areas would become unacceptable safety hazards. Removing hazard trees would place an additional burden on the park maintenance division in order to remove these trees in a timely fashion. In addition, park management may decide that the threat from hazard trees warrants facility closures due to safety concerns.

Visitors could experience area closures until hazard trees could be removed. More dead trees and limbs would fall on backcountry trails and need to be removed which would increase trail maintenance workloads.

The BLRI contributes substantially to local economies through visitor travel expenditures. Local tourism industries that depend on visitors to view or recreate in and near hemlock forests could suffer. Loss of popular hemlock dominated recreation areas could contribute to a decrease in local economies, but the full potential of such losses has not been studied in detail.

**Cumulative Impacts**

Short term to long term, minor to major impacts would occur to recreational resources under Alternative A. These impacts would be variable depending on the area and density of hemlocks. Short term impacts could include indefinite closure of popular recreation areas due to the parks ability to treat hazard trees. Areas would also see a long term reduction in the visual quality of an area until dead and standing trees are replaced

through succession. Dependent on the species replacing hemlock stands impacts could include reduced visual variety.

**Conclusion**

Under Alternative A, impacts to recreational resources would be long term and would vary in scale from minimal to major depending on the amount of hemlock resource in the particular recreation area. Mortality due to the HWA could quickly change and alter the scenic mosaic from the parks overlooks, trails and roadside vistas. Hemlocks greatly contribute to the visual variety of a scene because of their size, texture, and color differs from other evergreen species. Hemlock stands predominantly occur in coves and riparian areas where visitors are attracted to the parks many streams, rivers, and waterfalls. Mortality of the evergreen vegetation would change the nature of the fall color display by reducing visual variety and increasing the presence of large stands of dead and standing snags.

**Impairment**

There would be no impairment to the park's recreational resources under this alternative.

***Alternative B - Chemical Control Only***

**Impacts**

Temporary impacts to recreational activities could occur in some areas where foliar treatments are being conducted due to area closures for visitor safety. In order to conduct spray operations, some heavily visited areas could need to be temporarily closed to allow technicians unobstructed access to trees. Area closures should never be in excess of 24 hours. These inconveniences are infrequent as treatments are planned to minimize such interference. Closing spray- treatment areas is done primarily to protect employees and visitors from potential vehicle accidents as the spray truck and operators may be blocking normal driving lanes. Potential visitor contact with foliar sprays is less of a concern, but still a consideration in area closure. While not harmful to humans, the dilute solutions could cause eye or nasal irritation. When feasible, areas would remain open to visitors and traffic control would be used to prevent visitor's exposure to soap or oil.

Foliar treatments could be done in the late fall and winter during low visitation times. Soil injection, soil drenching, and stem injection should have no impact on recreation. Treatments could be done in developed areas when closures are in effect and backcountry treatments could be done when visitors are not nearby.

**Cumulative Impacts**

For reasons of public safety users could experience short term area closures for treatment in developed areas where foliar treatments are occurring. These treatments would be planned to minimize area closures.

**Conclusion**
Short- term, negligible impacts to recreational resources would occur under Alternative B.

**Impairment**
There would be no impairment to the park's recreational resources under this alternative.

*Alternative C - Biological Control Only*

**Impacts**
Predator beetles would not likely have impacts on visitors. Biocontrol insects for HWA are small and feed specifically on HWA. The insects currently released are both small beetles that stay on or near hemlock trees and do not congregate as some other beetles do. Visitors could encounter NPS employees releasing these insects and may ask questions, but otherwise no impact to the visitor experience would occur.

**Cumulative Impacts**
No cumulative impacts to recreational resources would occur under Alternative C.

**Conclusion**
No impacts to recreational resources would occur under this alternative.

**Impairment**
Under Alternative C, there would be no impairment to the park's recreational resources.

*Alternative D - Both Chemical and Biological Control*

**Impacts**
Occasional, temporary closures of campgrounds, picnic areas, and roads could be necessary to facilitate spraying operations. Predator beetles would not likely have impacts on visitors.

**Cumulative Impacts**
For reasons of public safety in chemical treatment areas users could experience short term area closures for treatment in developed areas where foliar treatments are occurring. These treatments would be planned to minimize area closures. Biological controls would likely have no impact to recreational resources.

**Conclusion**
In chemical treatment areas, short- term, negligible impacts, in the form of area closures, would occur with Alternative D. The severity of these impacts (area closures) would be dependent on the individual visitor and their willingness to visit an alternative area.

Biological treatments would likely have no impact to recreational resources under Alternative D.

**Impairment**

There would be no impairment to the park's recreational resources under this alternative.

**Table 3. Summary Impact Table**

| | **Alternative A**<br>**No- Action Alternative** | **Alternative B**<br>**Chemical Control Only** | **Alternative C**<br>**Biological Control Only** | **Alternative D**<br>**Both Chemical & Biological Control**<br>***(Preferred Alternative)*** |
|---|---|---|---|---|
| Botanical Resources | Increasing damage and death of hemlock from HWA across the park. Eventual loss of hemlock from the majority of the park. | Reduced damage and death of hemlocks from HWA across the park. | Reduced damage and death of hemlocks from HWA across the park. | Reduced damage and death of hemlocks from HWA across the park. |
| Terrestrial Wildlife | Hemlock associated wildlife (birds, invertebrates) would suffer. | Short term minor to moderate impacts to non target insects feeding on hemlock (systemic treatments) or on other insects while on hemlock (foliar treatment only). | Negligible impacts due to predator's host specificity. | Short term minor to moderate impacts to invertebrates from chemical controls and negligible impact from biological controls. |
| Aquatic Wildlife | Long- term moderate to major impacts due to loss of hemlock. | Negligible impacts expected as chemical treatments are not labeled for use near water. | No impacts expected. | Negligible impacts from chemical controls and no impact expected from biocontrols. |
| Threatened & Endangered Species | Impacts would be mixed depending on species. Slight impacts to the rock gnome lichen due to drier conditions resulting from light reaching the forest floor as hemlocks die. No T&E species are dependent on hemlock. | No impacts expected- except for Northern Flying Squirrel. | No impacts expected- no T&E species are dependent on hemlock. | No impacts expected- no T&E species are dependent on hemlock. |
| Cultural Resources | Moderate impacts to resource if resource could be historically linked with hemlock. | No impacts | No impacts | No impacts |
| Recreational & Visual Resources | Area closures due to hazard dead hemlocks. Loss of hemlock aesthetic value. Negative impacts to viewing scenery and possible impacts to fishing. | Foliar treated areas could have temporary closures. | No significant impacts expected. | Temporary area closures for foliar treatments, otherwise no impacts from biological controls expected. |

# CONSULTATION AND COORDINATION

## PUBLIC INVOLVEMENT

The purpose of the scoping process, as outlined in CEQ's regulations for implementing NEPA (40 CFR 1501.7), is to determine the scope of issues to be addressed in the EA and to identify significant issues relating to the Proposed Action. The lead agency is required to invite input from Federal, State, and local agencies, affected Native American tribes, project proponents, and other interested parties (Section 1501.7 (a)(1)). To satisfy scoping requirements for this project, scoping letters were mailed out requesting public and agency input on issues to be addressed in the EA. Table A- 1 in Appendix A lists all persons, agencies/organizations to whom the scoping letters were sent. The scoping letter is presented as Figure A- 1 and the news release that announces that the Parkway was seeking public input as Figure A- 2.

The public scoping period for the project began on June 1, 2007 and ended on July 2, 2007. Twenty- nine comments were received from the public during this period. The NPS also underwent consultations with several State and Federal agencies regarding the project. These consultation letters are presented in Figures A- 3 through A- 7 in Appendix A.

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# APPENDIX A: PUBLIC SCOPING AND AGENCY COORDINATION

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**Figure A- 1. Scoping Letter**

United States Department of the Interior

National Park Service
Blue Ridge Parkway
199 Hemphill Knob Road
Asheville, North Carolina 28803

IN REPLY REFER TO:

L7617
PIN 18306

June 1, 2007

Dear Interested Party:

The Blue Ridge Parkway (BLRI) is proposing to set forth a long- term management strategy that would preserve hemlock forests by minimizing the impact of hemlock woolly adelgid (HWA) at BLRI. HWA is a non- native insect pest that is quickly decimating hemlocks in the eastern United States.

The National Park Service is proposing to treat selected hemlock forests at BLRI to suppress HWA infestations and reduce hemlock mortality. HWA populations pose an imminent threat to park resources.

Project Background
Since the 1980's HWA has spread north from Virginia to Maine and as far south as northern Georgia (USDA Forest Service 2004). HWA is steadily spreading into the oldest and largest hemlock forests of the Southern Appalachians, threatening a unique forest ecosystem and the aquatic communities it shelters. HWA was discovered at the Parkway in 1984 in northern Virginia. Spread by winds and migratory birds and mammals, the adelgid has decimated most hemlock stands on the Parkway in Virginia and now threatens the old growth hemlock forests of Linville Falls, Moses H. Cone Memorial Park, and Julian Price Memorial Park.

Project Alternatives
The proposed treatment alternatives that are currently being considered by BLRI include the use of insecticidal soap, horticultural oil, systemic insecticides, and biological control agents including several species of predatory beetles.

Four alternatives for the proposed project are currently being considered by BLRI. These include:

1. Alternative A (No Action): BLRI would apply no treatments to prevent the spread of HWA throughout the park.
2. Alternative B (Chemical Control Only): BLRI resource managers would use integrated pest management (IPM) techniques to manage HWA.

3. Alternative C (Biological Control Only): BLRI would introduce insect predators of HWA to control HWA populations.
4. Alternative D (Both Chemical and Biological Control): BLRI would use a combination of chemical and biological controls to best fit individual hemlock sites throughout the park.

Public Scoping

Pursuant to the National Environmental Policy Act (NEPA) of 1969, the Council on Environmental Quality (CEQ) NEPA regulations, (40 Code of Federal Regulations (CFR) 1500 to 1508), and the National Park Service (NPS) NEPA compliance guidelines (DO- 12), the NPS is presently conducting an Environmental Assessment (EA) for this project. The EA will investigate the potential for effects on any environmental resources resulting from this proposal. We welcome your comments, suggestions, or other inputs concerning this project to help us identify issues of concern and interest and ensure that the EA thoroughly addresses potential effects of the proposal. Your participation will aid BLRI in making a well- informed decision about whether and how to proceed with this project.

If you would like to provide comments on this project or request a copy of the EA, you may do so using the NPS Planning, Environment, and Public Comment (PEPC) Internet- based system. Persons wishing to provide comments on the proposed project are asked to please submit all comments by **July 2, 2007**. Comments can be made directly online by going to the following link: *http://parkplanning.nps.gov/projectHome.cfm?parkId=355&projectId=18306*.

Written comments may also be submitted to:

Blue Ridge Parkway
**Attn: Suzette Molling**
199 Hemphill Knob Road
Asheville, North Carolina 28803- 8686

It is the practice of the NPS to make all comments, including the names and addresses of respondents who provide the comments, available for public review following the conclusion of the scoping process. Individuals may request that the NPS withhold their name and/or address from public disclosure. If you wish to do this, you must state this prominently at the beginning of your comment. Commentators using the PEPC website can make such a request by checking the box "keep my contact information private." The NPS will honor such requests to the extent allowable by law, but you should be aware that the NPS may still be required to disclose your name and address pursuant to the Freedom of Information Act.

Sincerely,

*/signed/*

Philip A. Francis, Jr.
Superintendent

SMolling:sm:5- 29- 07
(NEPA/EA/PIN 18306- Public Scoping Letter.doc)

**Figure A- 2. News Release**

National Park Service
U.S. Department of the Interior
Blue Ridge Parkway
www.nps.gov/blri
199 Hemphill Knob Road
Asheville, NC 28803

**Blue Ridge Parkway News Release**

June 1, 2007

For Immediate Release

Contact: Chris Ulrey (828) 271- 4779 ext. 271; email chris_ulrey@nps.gov or
Suzette Molling (828) 271- 4779 ext. 219; email suzette_molling@nps.gov

**Parkway Seeks Input for Control of Hemlock Wooly Adelgid**

(Asheville)—The Blue Ridge Parkway is seeking public input, through July 2, to identify issues and additional study that will be needed to develop an Environmental Assessment for control strategies of Hemlock Wooly Adelgid (HWA) along the Blue Ridge Parkway in Virginia and North Carolina.

Parkway officials said that a long- term management strategy that would preserve hemlock forests by minimizing the impact of hemlock woolly adelgid at the Blue Ridge Parkway is needed. HWA is a non- native insect pest that is quickly decimating hemlocks in the eastern United States.

The project scoping phase, now underway, is the initial step in the development of an Environmental Assessment that will analyze alternatives and their potential impacts.

Those who wish to review and comment on this document may do so by visiting the Internet site *http://parkplanning.nps.gov*. Select Blue Ridge Parkway, "Plans/Documents Open for Comment" then click on the document link. (Direct link is: *http://parkplanning.nps.gov/projectHome.cfm?parkId=355&projectId=18306* ) Even though using this website is recommended, written comments may also be submitted to: Blue Ridge Parkway, **ATTN: Suzette Molling**, 199 Hemphill Knob Road, Asheville, NC 28803. Comments must be postmarked or entered via the Internet by **July 2**. Ideas and concerns expressed by those who comment will be used to prepare the final proposal and impact analysis.

Comments are typically treated as a public record and made available for public review. Individuals may request that the National Park Service withhold their name and address from disclosure. Such requests will be honored to the extent allowable by law.

###

| Table A- 1. Persons Who Received the Scoping Letter | | |
|---|---|---|
| Mr. Steve Chapin<br>US Army Corps of Engineers<br>Asheville Field Office<br>Asheville Federal Center<br>151 Patton Avenue<br>Asheville, North Carolina 28801 | USDA Natural Resources Conservation Service<br>Federal Building<br>110 New Bern Avenue<br>Raleigh, North Carolina 27601 | Mr. Brian P. Cole, Supervisor<br>U.S. Fish and Wildlife Service<br>Asheville Field Office<br>160 Zillicoa Street<br>Asheville, North Carolina 28801 |
| Ms. Mari Sue Hilliard<br>Forest Supervisor<br>National Forests in North Carolina<br>160A Zillicoa Street<br>Asheville, North Carolina 28801 | Mr. Curtis Smalling<br>Audubon North Carolina<br>Mountain Office<br>667 George Moretz Lane<br>Boone, North Carolina 28607 | Mr. Dave McHenry<br>Mountain Region Reviewer<br>Habitat Conservation Program<br>North Carolina Wildlife Resources Commission<br>20830 Great Smoky Mountain Expressway<br>Waynesville, North Carolina 28786 |
| Mr. Peter Sandbeck<br>Administrator, State Historic Preservation Office<br>Deputy State Historic Preservation Officer<br>4617 Mail Service Center<br>Raleigh North Carolina 27699- 4617 | Ms. Chrys Baggett<br>Environmental Policy Act Coordinator<br>State Clearinghouse<br>1301 Mail Service Center<br>Raleigh, North Carolina 27699-1301 | Ms. Renee Gledhill- Earley<br>Environmental Review Coordinator<br>NC Dept. of Cultural Resources<br>109 East Jones Street<br>Raleigh, North Carolina 27601-2807 |
| Ms. Nann Guthrie<br>Senior Field Officer, Western Region<br>NC Department of Environment, Health & Natural Resources<br>59 Woodfin Place<br>Asheville, North Carolina 28801 | Ms. Linda Pearsall<br>North Carolina Natural Heritage Program<br>Post Office Box 27687<br>Raleigh, North Carolina 27699-1615 | Mr. Joe Mickey<br>NC Wildlife Resources Commission<br>155 Timberbrook Trail<br>State Road, North Carolina 28676 |
| Mr. Ron Holland<br>Regional Supervisor<br>Division of Archives & History<br>North Carolina Department of Cultural Resources<br>1 Village Lane, Suite 3<br>Asheville, North Carolina 28803 | Owen Anderson<br>Mountain Region Coordinator<br>Habitat Conservation Program<br>NC Wildlife Resources Commission<br>1721 Mail Service Center<br>Raleigh, North Carolina 27699-1721 | North Carolina Division of Environmental Management<br>Post Office Box 29535<br>Raleigh, North Carolina 27605 |
| Mr. Jim Borawa<br>Regional Fishery Biologist<br>North Carolina Wildlife Resource Commission<br>37 New Cross North<br>Asheville, North Carolina 28805-9213 | Plant Conservation Program<br>North Carolina Department of Agriculture<br>Post Office Box 27647<br>Raleigh, North Carolina 27611-7647 | Mr. Andy Moser<br>Chesapeake Bay Field Office<br>US Fish and Wildlife Service<br>177 Admiral Cochrane Drive<br>Annapolis, Maryland 21401 |
| Mr. Ernie Aschenbach<br>EIR Coordinator<br>VA Dept of Environmental Quality<br>Office of Environmental Impact Review<br>Post Office Box 1105<br>Richmond, Virginia 23218 | District Ranger Patricia Egan<br>Glenwood & Pedlar Ranger Districts<br>Post Office Box 10<br>27 Ranger Lane<br>Natural Bridge Station, Virginia 24579 | Mr. Erik Davis<br>US Fish and Wildlife Service<br>Ecological Services<br>Virginia Field Office<br>6669 Short Lane<br>Gloucester, Virginia 23061 |
| | | |

| | | |
|---|---|---|
| Ms. Tonia Woods Horton<br>Office of Review and Compliance<br>Department of Historic Resources<br>Commonwealth of Virginia<br>2801 Kensington Ave.<br>Richmond, Virginia 23221 | Mr. David Barrett<br>Mt. Rogers Planning District Commission<br>1021 Terrace Drive<br>Marion, Virginia 24354 | Mr. David W. Rundgren<br>New River Valley Planning District Commission<br>6580 Valley Center Drive, Suite 124<br>Radford, Virginia 24141 |
| Mr. Wayne G. Strickland<br>Roanoke Valley- Alleghany Regional Commission<br>Post Office Box 2569<br>Roanoke, Virginia 24010 | Mr. A. Ray Griffin, Jr.<br>Central Shenandoah Planning District Commission<br>112 MacTanly Place<br>Staunton, Virginia 24401 | Mr. Stephen W. Kerr<br>Northern Shenandoah Valley Regional Commission |
| Mr. Jeffrey Walker<br>Rappahannock- Rapidan Planning District Commission<br>420 Southridge Parkway, Suite 106<br>Culpeper, Virginia 22701 | Mr. Harrison B. Rue<br>Thomas Jefferson Planning District Commission<br>401 East Water Street<br>Post Office Box 1505<br>Charlottesville, Virginia 22902-1505 | Mr. Gary F. Christie<br>Virginia's Region 2000 Local Gov't Commission<br>828 Main Street, 12th Floor<br>Lynchburg, Virginia 24504 |
| Mr. Thomas A. Faha<br>VA Dept. of Environmental Quality<br>Northern Virginia Regional Office<br>13901 Crown Court<br>Woodbridge, Virginia 22193 | Mr. Andrew K. Zadnik<br>VA Department of Game and Inland Fisheries<br>4010 West Broad Street,<br>Richmond, Virginia 23230 | Mr. Robert S. Munson<br>VA Dept. of Conservation and Recreation<br>203 Governor Street<br>Richmond, Virginia 23219- 2094 |
| Mr. Todd A. Groh<br>VA Department of Forestry<br>900 Natural Resources Drive<br>Charlottesville, Virginia 22903 | Mr. Keith R. Tignor<br>VA Dept. of Agriculture and Consumer Services<br>102 Governor Street<br>Richmond, Virginia 23219 | Mr. Ronald D. Phillips<br>VA Dept. of Environmental Quality<br>Valley Regional Office<br>Post Office Box 3000<br>Harrisonburg, Virginia 22801 |
| Mr. Kevin A. Harlow<br>VA Dept. of Environmental Quality<br>West Central Regional Office<br>3019 Peters Creek Road<br>Roanoke, Virginia 24019 | Ms. Amanda Gray<br>VA Dept. of Environmental Quality<br>South Central Regional Office<br>7705 Timberlake Road<br>Lynchburg, Virginia 24502 | Mr. Allen J. Newman<br>VA Dept. of Environmental Quality<br>West Central Regional Office<br>3019 Peters Creek Road<br>Roanoke, Virginia 24019 |
| Mr. Robert W. Dowd<br>West Piedmont Planning District Commission<br>Post Office Box 5268<br>Martinsville, Virginia 24115 | Ms. Cathryn Gilliam<br>National Parks Conservation Association<br>Post Office Box 1003<br>Staunton, Virginia 24402 | Mr. Greg Kidd<br>Senior Program Manager<br>Blue Ridge Field Office<br>National Parks Conservation Association<br>One Page Avenue, Suite 109<br>Asheville, North Carolina 28801 |

**Figure A- 3. USFWS Comment Letter**

# United States Department of the Interior

FISH AND WILDLIFE SERVICE
Asheville Field Office
160 Zillicoa Street
Asheville, North Carolina 28801

June 25, 2007

Ms. Suzette Molling
National Park Service
Blue Ridge Parkway
199 Hemphill Knob Road
Asheville, North Carolina 28803

Dear Ms. Molling:

Subject: Scoping Comments on Proposed Hemlock Wooly Adelgid Control Strategies along the Blue Ridge Parkway in North Carolina

We received a letter dated June 1, 2007, from Superintendent Philip A. Francis, Jr., requesting our comments on the subject project. The following comments are provided in accordance with the provisions of the National Environmental Policy Act; the Migratory Bird Treaty Act (16 U.S.C. 703-711); and section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1543) (Act).

According to Mr. Francis's letter, the Blue Ridge Parkway (Parkway) is in the process of preparing an Environmental Assessment to evaluate the possible impacts of various methods currently being considered to reduce damage to the Parkway by the nonnative hemlock wooly adelgid (HWA). Since the 1980s, the HWA has spread north from Virginia to Maine and as far south as northern Georgia and is steadily spreading into the oldest and largest hemlock forests of the Southern Appalachians, threatening a unique forest ecosystem and the aquatic communities it shelters. The HWA was discovered on the Parkway in 1984 in northern Virginia. Spread by winds and migratory birds and mammals, the HWA has decimated most hemlock stands on the Parkway in Virginia and now threatens the old-growth hemlock forests of Linville Falls, Moses H. Cone Memorial Park, and Julian Price Memorial Park. The purpose of the proposed action is to set forth a long-term management strategy that would preserve hemlock forests by minimizing the impact of the HWA on the Parkway.

The proposed action would treat selected hemlock forests on the Parkway to suppress HWA infestations and reduce hemlock mortality. The proposed treatment alternatives that are currently

being considered by the Parkway include the use of insecticidal soap, horticultural oil, systemic insecticides, and biological control agents, including several species of predatory beetles.

As we have stated in other letters regarding similar HWA-control efforts (including efforts by the National Park Service in the Great Smoky Mountains National Park), given the damage caused by the HWA in the eastern United States and the imminent threat of the elimination of hemlocks throughout their natural range (including Western North Carolina), we support the proposed project. We believe the loss of large numbers of hemlock trees and eastern hemlock forests would have a negative effect on overall ecosystem processes; specifically, we believe the loss would significantly affect the microclimate, soil conditions, and streams within these unique habitats. Furthermore, we believe the calculated risks of introducing these specific exotic predatory insects are worth the potential benefits the species may have for controlling the HWA.

Though we support the proposed project, because so many federally listed and other rare species are known to occur on the Parkway, we recommend surveying treatment areas for these species prior to any on-the-ground activities to ensure that no rare species are inadvertently lost. Enclosed is a list of species from Alleghany, Ashe, Avery, Buncombe, Burke, Caldwell, Haywood, Henderson, Jackson, McDowell, Mitchell, Surry, Swain, Transylvania, Watauga, Wilkes, and Yancey Counties, North Carolina, that are on the *Federal List of Endangered and Threatened Wildlife and Plants* and federal species of concern that may occur on the Parkway. Federal species of concern are not legally protected under the Act and are not subject to any of its provisions, including section 7, unless they are formally proposed or listed as endangered or threatened. We are including these species in our response to give you advance notification.

We applaud the Parkway for taking action against this invasive and destructive pest. In any future correspondence pertaining to this matter, please reference our Log Number 4-2-07-236. Questions regarding our comments should be directed to Mr. Allen Ratzlaff of our staff at 828/258-3939, Ext. 229.

Sincerely,

for

Brian P. Cole
Field Supervisor

Enclosure

cc:
Mr. David McHenry, Mountain Region Reviewer, North Carolina Wildlife Resources Commission, 20830 Great Smoky Mtn. Expressway, Waynesville, NC 28786

*(Note: Attached list of species provided from FWS is available in park files)*

**Figure A- 4. NCDA Comment Letter**

# North Carolina
# Department of Administration

Michael F. Easley, Governor

Britt Cobb, Secretary

July 10, 2007

Ms. Suzette Molling
US Dept of Interior-National Pk Service
199 Hemphill Knob Rd - Blue Ridge Pkwy
Asheville, NC 28803

Dear Ms. Molling:

Re: SCH File # 07-E-0000-0371; Scoping; Proposal to develop alternative strategies to suppress Hemlock Woolly Adelgid infestations & reduce hemlock mortality along the Blue Ridge Parkway

The above referenced environmental impact information has been submitted to the State Clearinghouse under the provisions of the National Environmental Policy Act. According to G.S. 113A-10, when a state agency is required to prepare an environmental document under the provisions of federal law, the environmental document meets the provisions of the State Environmental Policy Act. Attached to this letter for your consideration are the comments made by agencies in the course of this review.

If any further environmental review documents are prepared for this project, they should be forwarded to this office for intergovernmental review.

Should you have any questions, please do not hesitate to call.

Sincerely,
Chrys Baggett/STC

Ms. Chrys Baggett
Environmental Policy Act Coordinator

Attachments

cc: Region D

*Mailing Address:*
1301 Mail Service Center
Raleigh, NC 27699-1301

*Telephone: (919)807-2425*
Fax (919)733-9571
State Courier #51-01-00
*e-mail Chrys.Baggett@ncmail.net*

*Location Address:*
116 West Jones Street
Raleigh, North Carolina

NCDENR

North Carolina Department of Environment and Natural Resources

Michael F. Easley, Governor

William G. Ross Jr., Secretary

MEMORANDUM

TO: Chrys Baggett
State Clearinghouse

FROM: Melba McGee
Environmental Review Coordinator

SUBJECT: 07-0371 EA of Hemlock Wooly Adelgid Control Strategies for the Blue Ridge Parkway

DATE: July 9, 2007

The Department of Environment and Natural Resources has reviewed the proposed information. The attached comments are for the applicant's information.

Thank you for the opportunity to review.

Attachments

1601 Mail Service Center, Raleigh, North Carolina 27699-1601
Phone: 919-733-4984 \ FAX: 919-715-3060 \ Internet: www.enr.state.nc.us/ENR/



One North Carolina Naturally

# North Carolina Wildlife Resources Commission

Richard B. Hamilton, Executive Director

MEMORANDUM

TO: Melba McGee, Legislative and Intergovernmental Affairs
Dept. of Environment and Natural Resources

FROM: Ron Linville, Regional Coordinator
Habitat Conservation Program

DATE: June 12, 2007

SUBJECT: Proposed Environmental Assessment of Hemlock Wooly Adelgid Control Strategies for the
Blue Ridge Parkway, **OLIA Number 07-0371**

The National Park Service, Blue Ridge Parkway (BRP) is proposing to prepare an Environmental Assessment (EA) for Hemlock Wooly Adelgid (HWA) control strategies. Comments provided herein by the NC Wildlife Resources Commission (Commission) is in accordance with the provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-667d.) and the National Environmental Policy Act (42 U.S.C. 4332(2)(c)).

The BRP is evaluating long-term strategies to preserve hemlock forests by minimizing the impact of HWA, a non-native insect pest. Activities under consideration are using insecticidal soap, horticultural oil, systemic insecticides and biological control agents including various predatory beetles. HWA is decimating hemlock forests and associated habitats in eastern USA.

For the EA, the BRP should evaluate no action, chemical control, biological control, and combined chemical and biological control alternatives. Chemical control evaluations should include foliar applications of insecticidal soaps and oils and trenching or direct injection treatments with Imidacloprid. Trenching and spraying should not occur near waters because of diminished buffer concerns and the toxicity of chemicals to aquatic life. Water soluble chemicals have been known to move (subsurface) to mountain streams with devastating consequences. Biological controls could involve releases of predatory beetles that may include *Sasajiscymnus tsugae*, *Laricobius nigrinus*, and/or other species. Experimental beetle releases may have been conducted in the Great Smokey Mountains National Park (GSMNP).

**Mailing Address:** Division of Inland Fisheries • 1721 Mail Service Center • Raleigh, NC 27699-1721
**Telephone:** (919) 707-0220 • **Fax:** (919) 707-0028

Previously, the Commission has expressed reservations regarding the intentional introduction of non-native insects into the State. Although these concerns remain, any EA should describe how predatory beetles specifically target HWA or need them as prey for successful reproduction. Can the future abundance of predatory beetles be correspondingly linked to that of HWA populations?

The result of not controlling the spread of HWA in the Appalachians is believed to be dire. The Commission is very concerned about changes in cold water stream communities that can occur following extensive loss of eastern hemlock environments. Therefore, the Commission does not anticipate objecting to well-managed and evaluated HWA control measures. It is our understanding that the US Forest Service (USFS) has been involved in controlling HWA in North Carolina. Accordingly, we recommend that the BRP coordinate with the USFS to determine if USFS EAs can be useful in quickly evaluating and proceeding with HWA control measures along the BRP.

Thank you for the opportunity to comment on the proposed BRP project. Please contact me at 336-769-9453 if I can be of further assistance.

Cc: Suzette Molling, Blue Ridge Parkway, 199 Hemphill Knob Road, Asheville, North Carolina 28803

**Figure A- 5. VADEQ Comment Letter**

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY
*Street address:* 629 East Main Street, Richmond, Virginia 23219
*Mailing address:* P.O. Box 1105, Richmond, Virginia 23218
Fax (804) 698-4500 TDD (804) 698-4021
www.deq.virginia.gov

L. Preston Bryant, Jr.
Secretary of Natural Resources

David K. Paylor
Director

(804) 698-4000
1-800-592-5482

June 7, 2007

Blue Ridge Parkway
National Park Service
Attn: Ms. Suzette Molling
199 Hemphill Knob Road
Asheville, North Carolina 28803

RE: Hemlock Woolly Adelgid Control Strategies along the Blue Ridge Parkway (Reference L7617, Pin 18306)

Dear Ms. Molling:

Thank you for your June 1, 2007 letter to Ernie Aschenbach of this Office concerning the National Park Service's decision to prepare an environmental assessment (EA) for the above subject. You indicate that the Park Service, taking account of the damaging spread of the hemlock woolly adelgid (HWA) along the Blue Ridge Parkway in Virginia and North Carolina as well as points north and south, intends to treat selected hemlock forests along the Parkway to suppress HWA infestations and, it is hoped, to reduce hemlock tree mortality. The alternatives under consideration include insecticidal soap, horticultural oil, systemic insecticides, and biological control agents including several species of predatory beetles. However, it is not clear in your letter whether the HWA control strategies would apply to Shenandoah National Park as well as to the Blue Ridge Parkway, although you indicate that HWA has spread as far north as Maine.

The Department of Environmental Quality's Office of Environmental Impact Review coordinates Virginia's review of federal NEPA documents and responds to appropriate federal officials on behalf of the Commonwealth.

We are sharing your letter with Virginia state agencies and regional planning district commissions which are likely to have responsibilities affected by, or affecting the proposed undertaking. Reviewing agencies are likely to include the following:

Ms. Suzette Molling
Page 2

Department of Environmental Quality, including:
- Office of Environmental Impact Review
- Northern Virginia Regional Office
- Valley Regional Office
- South Central Regional Office
- West Central Regional Office
- Southwest Regional Office

Department of Game and Inland Fisheries
Department of Agriculture and Consumer Services
Department of Conservation and Recreation, including:
- Division of Planning and Recreation Resources
- Division of Natural Heritage

Department of Forestry.

Planning district commissions include:

Mount Rogers Planning District Commission
New River Valley Planning District Commission
Roanoke Valley-Alleghany Regional Commission
Central Shenandoah Planning District Commission
Northern Shenandoah Valley Regional Commission
Rappahannock-Rapidan Planning District Commission
Thomas Jefferson Planning District Commission
Virginia's Region 2000 Local Government Council
West Piedmont Planning District Commission.

In order to ensure an effective coordinated review of the Environmental Assessment and the consistency determination, we will require 13 copies of the document for state agencies and 9 copies for the planning district commissions (22 copies in all). While this Office does not participate in scoping efforts beyond the advice given herein, other agencies are free to provide scoping comments concerning the NEPA documents for the proposed project.

If you have questions about the environmental review process, please feel free to call me (telephone 698-4325) or Charles Ellis of this Office (telephone 698-4488).

Ms. Suzette Molling
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I hope this information is helpful to you.

Sincerely,

Ellie L. Irons
Program Manager
Office of Environmental Impact Review

cc: Thomas A. Faha, DEQ-NVRO
Andrew K. Zadnik, DGIF
Robert S. Munson, DCR
Todd A.Groh, DOF
Keith R. Tignor, VDACS
Ronald D. Phillips, DEQ-VRO
Kevin A. Harlow, DEQ-WCRO
Amanda Gray, DEQ-SCRO
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David Barrett, Mount Rogers PDC
David W. Rundgren, New River Valley PDC
Wayne G. Strickland, RVARC
A. Ray Griffin, Jr., Central Shenandoah PDC
Stephen W. Kerr, NSVRC
Jeffrey Walker, Rappahannock-Rapidan PDC
Harrison B. Rue, Thomas Jefferson PDC
Gary F. Christie, VR2000LGC
Robert W. Dowd, West Piedmont PDC

**Figure A- 6. NPCA Comment Letter**

National Parks Conservation Association®
*Protecting Our National Parks for Future Generations®*

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Blue Ridge Field Office

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June 11, 2007

To: Suzzette Molling

From: Gregory S. Kidd, Senior Program Manager, National Parks Conservation Association

Subject: Scoping Comments for Hemlock Wooly Adelgid Management Strategy Environmental Assessment.

The decline of Eastern Hemlock (*Tsuga canadensis*) throughout much of its range as the result of Hemlock Wooly Adelgid (*Adelges tsugae*), (HWA) is well documented. The National Parks Conservation Association (NPCA) strongly encourages the Blue Ridge Parkway (BLRI) to adopt a long-term management strategy that utilizes all environmentally responsible approaches of Integrated Pest Management (IPM) to control HWA. NPCA supports the adoption of Alternative D. Alternative D, as defined by BLRI, would use a combination of chemical and biological controls to best fit individual hemlock sites throughout the parkway. NPCA opposes the use of any broad-spectrum, petrochemical pesticides as part of an IPM program to control HWA.

The importance of Eastern Hemlocks is well established. The trees play a vital role in moderating the temperature of mountain streams, keeping them cool in the summer and ice-free in winter. That is critical for healthy, riparian ecosystems. Many species of birds find shelter in hemlocks with some warbler species nesting only in hemlocks.

In addition, hemlocks are an important part of the visual beauty of our Appalachian mountains. Visitors from around the world come to enjoy the incredible vistas from the parkway. Stands of dead and dying hemlocks have an obvious impact on the quality of the visitor experience.

For these reasons it is critical that NPS develop and implement a HWA Management Strategy that protects both the hemlocks and the overall integrity of the parkway.

Integrated Pest Management

The national park service (NPS) has an obligation to utilize the most ecologically benign approaches to pest management in the IPM arsenal. All sound IPM programs use an array of complimentary methods. In the case of HWA those methods should include repeated pre and post treatment surveys

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to catalog the range of HWA, level of infestation, and efficacy of treatment. Appropriate treatments for HWA include both chemical and biological control methods. As new ecological approaches become available, for example mechanical controls such as traps, the HWA Management Strategy should be flexible enough to incorporate them.

*Chemical Control*

The use of insecticidal soap, horticultural oil and systemic pesticides are all appropriate techniques for the control of HWA along the parkway. Topically applied soaps and oils are effective on soft-bodied insects like adelgids. They are appropriate for use within a national park due to the limited range of insects killed and relatively low toxicity to non-target species. Use of soaps and oils is useful only in areas accessible by road or short hike due to the high-pressure ground based spray systems necessary for application. Logistically, soaps and oils are appropriate only in frontcountry applications. Fortunately, due to the nature of the BLRI a significantly percentage of the parkway's acreage is accessible by road.

Imidacloprid is a systemic, chloronicotinyl insecticide used for the control of sucking insects such as adelgids. Used as directed on the label and applied either on the soil around hemlocks, the "trench and drench" method, or injected into the tree is appropriate. The application of imidacloprid is labor intensive and is therefore useful in only limited areas due to the parkway's finite resources.

Using imidacloprid as a systemic has less potential for impacts of non-target species as only insects sucking a meal out of the hemlocks will be killed. NPCA absolutely opposes foliar application of imidacloprid or any other broad-range petrochemical pesticide on hemlocks as part of a HWA management strategy because of their impact on non-target species. Death and injury to non-target species must be given great weight when developing and implementing a control strategy for HWA.

Biological Control

Biological control of insects utilizes natural enemies, whether predators or parasitoids (typically insects), fungi or other pathogens. The importance of biological control as an IPM method is that it is designed to be host specific and self sustaining, providing long-term control of the pest throughout the pest's range. Biological control is the only method that provides promise for control of HWA on stands of hemlocks well removed from road or trail. NPCA strongly supports the use of biological control as part of the IPM program to control HWA.

There have been important advances in the biological control of HWA. NPS should consider all of the current biological control agents for HWA and provide enough flexibility in the HWA Management Strategy to allow for additional biological control agents as future research provides them.

Use of insects as agents of biological control tends to be the most ecologically benign approach as these natural enemies are chosen for their host specificity. There are currently a variety of species of beetles that are being utilized or researched as biological control agents of HWA. There are a number of species of coccinellid beetles including: *Sasajiscymnus tsugae*; *Scymnus camptodromus*, *S. sinuanodulus*, and *S. ning-shanensis*. Research in Canada has turned up *Laricobius nigrinus* (Coleoptera: Derodontidae), which consistently feeds on HWA.

In addition to these insects there are a number of promising species of entomopathogenic fungi that are being researched for control of HWA. Fungal pathogens, like broad-spectrum synthetic pesticides, may kill a wide range of insect species. NPS needs to weigh the ecological impacts of using fungal pathogens against HWA and use only those that are the most ecologically benign and have a narrow range of hosts.

Establishment of Hemlock Conservation Areas

BLRI needs to establish a significant number of well-defined hemlock conservation areas as part of the HWA Management Strategy. These stands of hemlocks, dispersed along the parkway, would receive greater attention, monitoring and all types of acceptable treatments to maintain them as seed stock for future use.

In addition, NPS should identify stands of hemlock that are important to the quality of visitor experience. Those hemlocks may be particularly large and breathtaking or located in places that make them particular important to the aesthetic quality of the parkway. These individual trees or stands should also receive the greater level of attention to ensure their viability.

Conclusion

NPCA strongly endorses the development and implementation of a long-term HWA Management Strategy that utilizes the most ecological benign approaches in the IPM arsenal. Those approaches include use of insecticidal soaps, horticultural oils, systemic insecticides (imidacloprid) and biological control. The management strategy should provide enough flexibility to allow NPS to incorporate additional appropriate control techniques as they become available. Establishment of hemlock conservation areas should ensure a viable future stock of hemlocks and protect key scenic qualities of the parkway for visitor enjoyment.

**Figure A-7. WNCA Comment Letter**

WESTERN NORTH CAROLINA ALLIANCE
*A grassroots conservation organization*

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July 2, 2007

Philip A. Francis, Jr., Superintendent
Blue Ridge Parkway
199 Hemphill Knob Road
Asheville, NC 28803

Dear Superintendent Francis,

Thank you for the request for public comment and notice of intent to prepare an Environmental Assessment (EA) regarding a long term strategy to minimize the impact of hemlock woolly adelgids (HWA) at the Blue Ridge Parkway.

The Western North Carolina Alliance has over 1200 members who live in the counties of North Carolina and Virginia through which the Parkway passes and who are very interested in the scenic, historic and ecologic resources within the Blue Ridge Parkway corridor.

Our organization commends the Parkway for addressing this issue and urges that control activities be initiated immediately upon completion of this NEPA process. The HWA has appeared extensively in the western North Carolina mountains over the last several years and in many areas, significant numbers of hemlock trees have already been lost. In these areas, it is likely already too late for control efforts to achieve any degree of success. The situation is critical and time is of the essence for areas where control is still an option.

WNCA fully supports the Parkway proposal, and specifically supports Alternative D: Use of a combination of both Chemical and Biological controls to best fit the individual hemlock sites throughout the Park.

In the long run, we feel that the best hope for the Southern Appalachian region is biological control via several predator species that are determined to be selective for adelgids. Two species offering the most hope thus far are *Sasajiscymnus tsugae* and *Laricobius nigrinus*. Others are being studied, as is a fungal control approach, and hopefully, some of these can be integrated into a long-term approach.

But clearly, the only way to save certain hemlocks particularly desirable because of their age, size, location, genetic contribution and/or aesthetics, will be to use chemical control in a properly administered manner involving appropriate consideration of site conditions. This short term approach is

likely the only way to save at least a remnant hemlock population to ensure a seed supply for future restoration efforts once long term biological controls become realized.

Thank you again for this opportunity to offer comments. Please keep us informed as this proposal moves forward.

Sincerely,

Bob Gale

Ecologist
Western North Carolina Alliance

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