Appalachian National Scenic Trail
Resource Management Plan

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– September 2008 –

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Foreword: Purpose of the Resource Management Plan

The purpose of this plan – the *Appalachian Trail Resource Management Plan* – is to document the Appalachian National Scenic Trail's natural and cultural resources and describe and set priorities for management, monitoring, and research programs to ensure that these resources are properly protected and cared for. This plan is intended to provide a medium-range, 10-year strategy to guide resource management activities conducted by the Appalachian Trail Park Office and the Appalachian Trail Conservancy (and other partners who wish to participate) for the next decade. It is further intended to establish priorities for funding projects and programs to manage and protect the Trail's natural and cultural resources. In some cases, this plan recognizes and identifies the need for preparation of future action plans to deal with specific resource management issues. These future plans will be tiered to this document.

Management objectives outlined in the *Appalachian Trail Resource Management Plan* are consistent with the *Appalachian Trail Comprehensive Plan* (1981, re-affirmed 1987), the *Appalachian Trail Statement of Significance* (2000), and the *Appalachian Trail Strategic Plan* (2001, updated 2005). These objectives also are based on the resource protection mandates stated in the NPS Organic Act of 1916 and the Trail's enabling legislation, the National Trails System Act.

The *Appalachian Trail Resource Management Plan* also builds upon policy guidelines set by ATC. These policies, which have been developed through an extensive policy analysis process guided by ATC's Board, are contained in the Appalachian Trail Conservancy *Local Management Planning Guide* (updated 1997).

Chapter I describes the legislative and administrative background for the preparation of this plan.

Chapter II describes the resource baseline information available at the time this plan was prepared. To the extent that information is not available, the plan identifies new information that must be gathered in order to provide an adequate scientific basis for decision-making.

Chapter III outlines existing natural and cultural resource management programs, current threats to those resources, resource issues, and program needs. It outlines the most significant issues and urgent problems facing Trail resource managers, and presents current and long-term strategies for addressing these issues.

Chapter IV contains project statements (for project-level work) and program statement (for program-level work) that respond to the needs identified in Chapter III. Many of these projects and programs are described in greater detail in National Park Service Project Management Information System and Operations Formulation System. The plan also identifies monitoring projects and programs that are needed to evaluate trends in resource health and impacts (both positive and negative) associated with implementing the resource management actions outlined in this plan. Lastly, this chapter contains the Appalachian Trail Park Manager's recommendations for project and program priorities (note: priorities have not been set at this time).

It is important to note what this plan has been developed to accomplish. This plan is not a strategic plan, land use plan, land allocation plan, implementation plan, or project plan. It is a *programmatic* plan, intended to examine and analyze issues, conditions, threats, and program strengths, needs, and priorities for management of natural and cultural resources on the Appalachian Trail.

This plan will be updated every five to ten years, or earlier if significant new program needs are identified or new planning direction is issued.

The Planning Process: How the Appalachian Trail Resource Management Plan Was Developed

The planning effort for the *Appalachian Trail Resource Management Plan* began in 2001, when letters were sent to more than 300 key Trail club volunteers and staff, agency representatives, Appalachian Trail Conservancy and Appalachian Trail Park Office staff, and other interested parties inviting their comments and interest in receiving and reviewing a copy of the plan. Over the next two years, Appalachian Trail Conservancy and Appalachian Trail Park Office staff also announced in many public forums – including ATC regional management committee meetings, state agency meetings, Trail club meetings, and ATC general meetings – that the plan was under development, and invited and encouraged participation in the process. In addition, work on the plan was announced in ATC's *The Register* and *The Appalachian Trailway News*, and several other publications and newsletters of broader circulation. More than 200 people responded and expressed an interest.

In the summer of 2001, two scoping meetings were held – one with a team of cultural resource specialists, managers, and other individuals interested in cultural resource management issues along the Trail, and another with a team of natural resource specialists, managers, and other individuals interested in natural resource management issues along the Trail. In these meetings, participants discussed the status of available knowledge of resource conditions, defined resource management issues, selected key natural resources for the A.T. , and outlined resource management program needs.

In addition, staff also brought the matter before the Appalachian Trail Conservancy's Board and committees on a number of occasions, and continue to keep these entities apprised of progress on the plan.

Based on the input received during these forums and meetings, Appalachian Trail Park Office and Appalachian Trail Conservancy staff outlined a timeline for the planning process and began obtaining, analyzing, and synthesizing information about the current condition of natural and cultural resources along the Trail. With assistance and input from a variety of natural and cultural resource experts, staff completed descriptions of current resource conditions, threats, and management programs, outlined potential programs and projects, and prepared a set of electronic maps to illustrate resource conditions. Resource issues, conditions, threats, current

management capabilities, and current management needs were integrated into the programs and projects described in Chapter IV of the plan.

A preliminary draft plan was distributed for review and comment in October 2004. Based on this input, substantial revisions were made, and this final version – the *Appalachian Trail Resource Management Plan* – is now available. Copies of this plan have been placed on the Appalachian National Scenic Trail's and Appalachian Trail Conservancy's websites.

Appalachian National Scenic Trail

Resource Management Plan

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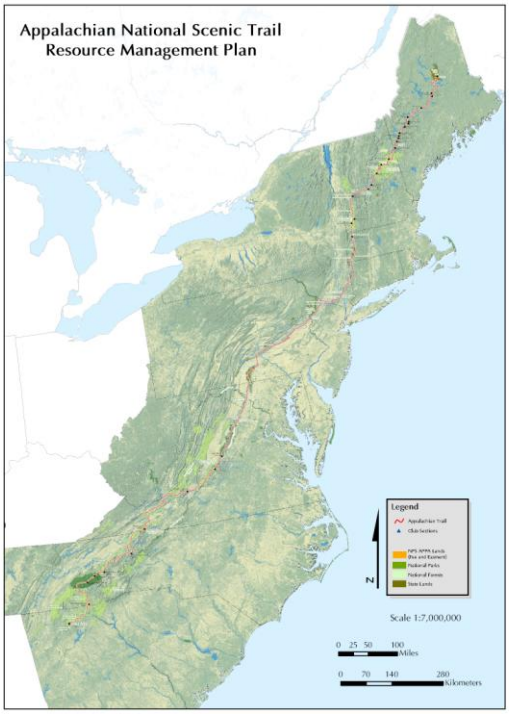
A. Introduction

CHAPTER I: INTRODUCTION

A. Establishment and Purpose of the Appalachian National Scenic Trail

1. Establishment

The **Appalachian National Scenic Trail** is a continuous, marked footpath that traverses the Appalachian Mountain chain from central Maine to northern Georgia, for a distance of approximately 2,175 miles. [See *Map I.A.1, Appalachian National Scenic Trail Resource Management Plan*.]



The Appalachian Trail (or "A.T.," as it is often called) was originally designed, constructed, and marked in the 1920s and 1930s by volunteer hiking clubs joined together under the umbrella of the Appalachian Trail Conference, which is now called the **Appalachian Trail Conservancy (ATC)**, a non-profit organization formed in 1925 and now based in Harpers Ferry, West Virginia. Since its inception, ATC has worked with the National Park Service, the USDA Forest Service, other federal and state agencies, local communities, and its affiliated Trail-maintaining clubs to develop, maintain, and promote use and protection of the Appalachian Trail. Today, the Appalachian Trail Conservancy and the National Park Service's **Appalachian Trail Park Office (APPA)** work as partners with other organizations and agencies to ensure Trail-wide continuity in protection and management of the Trail to the greatest extent possible.

The A.T. evolved from the 1921 proposal of regional planner Benton MacKaye, who conceived of the Trail as a means of preserving the crest line of the Appalachian Mountains for a wilderness retreat from eastern urban life. (Read MacKaye's Article: An Appalachian Trail: A Project in Regional Planning) Under the leadership of Myron Avery, ATC's chairman from 1931 to 1952, ATC and its affiliated Trail clubs concentrated initially on the hiking aspects of MacKaye's vision. The Trail clubs, with assistance from their federal and state agency partners and the Depression-era Civilian Conservation Corps, succeeded in opening a continuous Appalachian Trail by August 1937. Unfortunately, hurricanes, highway construction, and the demands of World War II undid those efforts for much of the next decade. Finally, in 1951, the Trail was reopened again from end to end. But by the 1960's, growth and new developments again threatened the Trail.

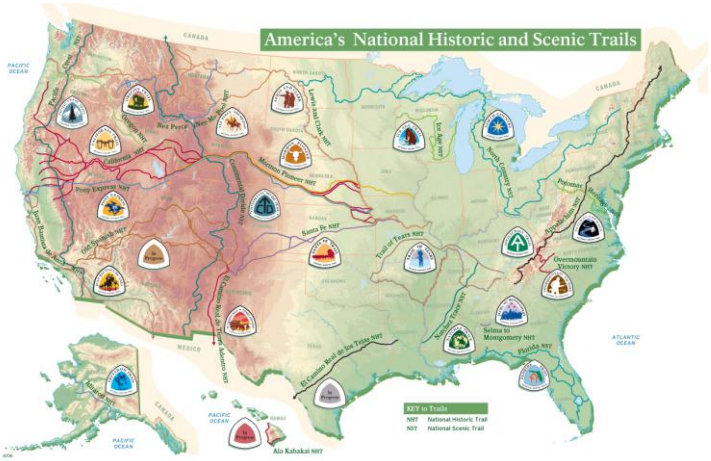
Early in the 1960s, concerted efforts to provide federal and state protection for the Trail began, and the era of Federal assistance was ushered in. The most significant event occurred on October 2, 1968, when President Lyndon Johnson signed the **National Trails System Act** (Public Law 90-543; 16 U.S.C. 1241-1251), designating the Appalachian Trail as the nation's first national scenic trail.

The National Trails System Act

The National Trails System Act, dated October 2, 1968 (Public Law 90-543), established the Appalachian National Scenic Trail and directed the Secretary of the Interior, in cooperation with the Secretary of Agriculture, state and local governments, and private citizens, to protect and administer the Trail. The Act provided the Secretaries of Interior and Agriculture with the authority to relocate the Trail; administer use of and access to the Trail; regulate incompatible uses, including motorized uses, bicycles, and horses; and enter into agreements with state agencies and non-governmental organizations to protect, manage, maintain, and develop the Trail. It also encouraged state agencies to pass similar legislation and take active steps to protect the Trail; and authorized federal land acquisition as necessary to establish a permanent route and protective corridor surrounding the footpath. [See *Map I.A.2, America's National Historic and Scenic Trails*.]

On March 21, 1978, President Carter signed a significant amendment to the National Trails System Act. This law re-authorized the Appalachian National Scenic Trail Advisory Council, required a comprehensive management plan for the Trail, and increased the amount of funding for land acquisition available for protection of the Trail to $90 million. The authority for acquisition of lands by eminent domain was increased to an average of 125 acres per mile, and the Secretaries of Interior and Agriculture were directed to substantially protect the Trail within three years.

On March 28, 1983, President Reagan signed an Act of Congress to Amend the National Trails System Act (Public Law 98-11). This amendment strengthened support for volunteers and volunteer-based organizations, refined the process for designating side and connecting trails, provided authority for administrative transfers of land, authorized whole tract acquisition with the consent of the landowner, defined trail uses, and clarified that donated easements qualify as conservation tax exemptions.



During the next 35 years, the National Park Service, the USDA Forest Service, and many state agencies purchased

more than 180,000 acres to protect the Appalachian Trail. More than 99% of the Trail now lies within a protective corridor of land that averages approximately 1,000 feet in width, and negotiations to secure the remaining lands are in progress.

Today, the Appalachian Trail is considered a premiere example of a public-private partnership engaged in the conservation and management of a nationally significant resource. Approximately 270,000 acres have been acquired or designated through management agreements for protection of the Appalachian Trail. This protected corridor now forms a slender greenway from Georgia to Maine, connecting more than seventy-five public land areas in 14 states. The responsibility for managing these lands, the Trail footpath, Trail facilities, and the vast array of natural and cultural resources that exist on these lands falls to ATC, its 30 Trail clubs , and their agency partners in a complex cooperative relationship referred to as the "Appalachian Trail Cooperative Management System." [see Chapter I.B for a more detailed description of the "Cooperative Management System" and *Map I.A.3, Appalachian Trail Conservancy Trail Maintaining Clubs*.]

The end result of this public-private partnership is the Appalachian National Scenic Trail, a 2,175-mile long unit of the National Park System that provides countless opportunities for visitors to traverse and experience a wide variety of wild, scenic, natural, and pastoral settings that represent the landscape of the Appalachian Mountains. The Trail affords opportunities for backcountry recreation and long-distance hiking that are among the best in the world. Millions of visitors come to the Trail each year, for hikes as short as an afternoon's walk and as long as a five-month trek from Georgia to Maine. Equally important, however, is the protection the Trail's narrow corridor of land provides for an exceptional legacy of natural and cultural resources. From the standpoint of protecting natural resources, the Trail's vast geographic expanse and location atop the crest of the Appalachian Mountains provide a unique opportunity to study and measure the effects of anthropogenic and natural change agents. And from a cultural resource perspective, the Trail not only protects a narrow slice of our nation's pre-history and history: it is, in and of itself, a significant historical place that is in all likelihood eligible for the National Register of Historic Places. The challenge for Appalachian Trail managers is to protect these resources, so that opportunities remain available for future generations to enjoy and experience them.

2. Purpose

Purpose: *The Appalachian National Scenic Trail will be administered primarily as a footpath by the National Park Service in cooperation with the United States Forest Service and the 14 States encompassing the Trail, to provide for maximum outdoor recreation potential as an extended trail and for the conservation and enjoyment of the nationally significant scenic, historic, natural, or cultural qualities of the areas through which the Trail passes.*

-- Mission, Purpose, and Significance of the Appalachian Trail
"Appalachian Trail Strategic Plan" (2000)

Significance: *The Appalachian Trail is a way, continuous from Maine to Georgia, for travel on foot through the wild, scenic, wooded, pastoral, and culturally significant lands of the Appalachian Mountains. It is a means of sojourning among these lands, such that visitors may experience them by their own unaided efforts.*

In practice, the Trail is usually a simple footpath, purposeful in direction and concept, favoring the heights of land, and located for minimum reliance on construction for protecting the resource. The body of the Trail is provided by the lands it traverses, and its soul is in the living stewardship of the volunteers and partners of the Appalachian Trail Cooperative Management System.

-- Definition of the Appalachian Trail, from the
"Appalachian Trail Management Principles" (1977)

Legislative Intent: In addition to the language of the National Trails System Act itself, the legislative history of the Act (which includes the House and Senate reports and the Congressional Record) clarify Congress's intent for the following elements of the Appalachian National Scenic Trail's mission, purpose, and significance statements:

1. "Primarily as a footpath" – The Appalachian Trail was conceived, designed, and constructed to be a footpath for pedestrian use. The only recognized divergences from use as a footpath are along three sections where horseback riding was permitted as an accepted and customary or traditional use at the time of the Act's passage. These sections are a 30-mile section of the Trail in Great Smoky Mountains National Park, a three-mile section of the Appalachian Trail that coincides with the C&O Canal National Historical Park in Maryland, and a three-mile section of the Trail that coincides with the Virginia Creeper Trail in Virginia.

2. "Maximum Outdoor Recreation Potential" – This phrase is used only in the context of the Trail's length and location as an extended trail, rather than types of use. All references to this phrase throughout the legislative history are in the context of the Trail's location to urban areas or in reference to the duration of use, such as: "…a few hours at a time, or on

one day jaunts, overnight treks, or expeditions lasting a week or more." There is even reference to volunteer work as a recreational activity: "Their work on the trail has been as important an outdoor recreation activity to them as the enjoyment of hiking and camping along the trail."

3. "Volunteers and private nonprofit trail groups" – As referenced in the National Trails System Act, these groups are recognized for purposes of the Appalachian National Scenic Trail as the ATC and its member trail maintaining clubs. "The (House of Representatives Subcommittee on Parks and Forests) recognizes that ATC has pioneered the way for this legislation by its long-time personal stewardship of the Trail, and believes that its stewardship – in partnership with the Secretary of the Interior – should be continued and expanded."

B. Appalachian Trail Cooperative Management System

The Appalachian Trail is recognized around the world for its success in fostering and promoting partnerships among private citizen groups and public land-managing agencies. This success is due in part to its historical development in the 1920s and 1930s as a largely volunteer-driven, private civilian effort in the public interest. Since the earliest days of the Trail's construction, volunteers affiliated with ATC and its 30 member Trail clubs have devoted millions of hours to construct, reconstruct, and maintain the Trail footpath, as well as managing a system of more than 260 Trail shelters and associated facilities.

The 1960 National Trails System Act offered a greatly expanded role and increased responsibilities for ATC and its affiliated Trail clubs. Congress directly recognized the contributions of ATC and the Trail clubs, and provided for their active participation in management of the Trail in Sections 7 and 11 of the Act. As a result, the Trail continues to be maintained, developed, and managed by volunteer-based organizations under the leadership of ATC in close cooperation with their agency partners through the "**Appalachian Trail Cooperative Management System**."

Today, actual operations affecting use of the Trail are shared responsibilities between these volunteer organizations and their agency partners. Responsibilities of each partner are described in memorandums of understanding. The National Park Service, USDA Forest Service, and most of the 14 states have entered into management agreements that further this intent.

Perhaps the most important of these agreements are the agreements between the National Park Service and ATC. Recognizing the historical role of ATC and the Trail clubs in creation and perpetuation of the Trail, the National Park Service in 1984 delegated to ATC the day-to-day responsibilities for managing NPS lands that have been acquired to protect the Trail. This landmark "**delegation agreement**" (which was renewed in 2004 for another ten-year period) and many other similar agreements between ATC, its Trail clubs, and other federal and state agencies, define the roles and responsibilities for each partner in the Cooperative Management System.

The two partners with trail-wide management responsibilities are the **Appalachian Trail Conservancy (ATC)** and the National Park Service's **Appalachian Trail Park Office (APPA)**, both are based in Harpers Ferry, West Virginia. ATC, with a 15-member Board of Directors and a staff of approximately 55, serves as a membership organization to its approximately 36,000 members, as an umbrella organization coordinating the efforts of its 30 affiliated Trail-maintaining clubs, and as the primary partner to the National Park Service's Appalachian Trail Park Office. For the past 20 years, ATC and its 30 affiliated Trail clubs have steadily increased their contributions to maintenance, management, and protection of the Trail, now averaging close to 200,000 hours and $4,000,000 annually. APPA, with a staff of ten employees, is the responsible National Park Service office for all matters pertaining to administration of the Appalachian National Scenic Trail. Although APPA has delegated most land-management responsibilities for the Appalachian Trail to ATC, it retains responsibilities for land acquisition, survey, issuance of permits, compliance with the National Environmental Policy Act and other resource protection laws, law enforcement, and over-all administration of the Appalachian National Scenic Trail.

C. Legislation and Policies Applicable to Management of Natural and Cultural Resources along the Appalachian Trail

Management direction is derived from *NPS Management Policies (2006)* and various laws and executive orders related to resource management, including the National Environmental Policy Act, the Endangered Species Act, the National Historic Preservation Act, the Clean Air Act, the Clean Water Act, the Antiquities Act, the Archaeological Protection Act, and the Wilderness Act.

Relevant portions of these acts and highlights of policies pertaining to management of these resources are provided below.

Legislation and Policy Guidance for Management of Air Resources - The purpose of the Appalachian National Scenic Trail, according to its enabling legislation is to:

> "provide for maximum outdoor recreation potential and for conservation and enjoyment of the nationally significant scenic, historic, natural, or cultural qualities of the areas through which such trails may pass."
>
> -- Section 3(a), National Trails System Act, as amended, 82 Stat. 919 *et seq.*

Inherent in this purpose are: (1) clean air, so that visitors can enjoy a healthy outdoor recreation experience, (2) scenic vistas unimpaired by poor visibility, and (3) natural and cultural resources unaffected by air pollution. In fact, the 1981 *Comprehensive Plan for the Appalachian Trail* recognized air quality as a Trailway value, and expressed concerns about potential future air quality degradation. Unfortunately, those concerns were well founded,

because many parts of the Trail corridor today have high concentrations of a number of air pollutants.

To facilitate implementation of the air quality provisions of the 1977 Clean Air Act amendments, Congress established a classification scheme for the entire United States, classifying areas as Class I, II, or III air quality areas.

Class I areas receive the highest degree of protection, with only a small amount of certain kinds of additional air pollution allowed. Mandatory Class I areas are designated by Congress, and include international parks, national wilderness areas or national memorial parks larger than 5,000 acres, or national parks larger than 6,000 acres, that were in existence (or authorized) on August 7, 1977. The Appalachian National Scenic Trail passes through five mandatory Class I areas: Great Smoky Mountains and Shenandoah National Parks (which are managed by the National Park Service), and the James River Face, Lye Brook, Great Gulf Wilderness Areas (which are managed by the USDA Forest Service), and is immediately adjacent to the Presidential Range-Dry River in New Hampshire.

All other National Park Service, Forest Service, state, municipal, and privately owned lands along the Trail are designated Class II and are allowed a moderate increase in certain air pollutants.

No Class III areas, where a large amount of new air pollution would be allowed, were initially designated by Congress, but a process was established for redesignating Class II areas to the more protective Class I or the less protective Class III status. Only states or Native American governing bodies have authority to redesignate these areas. No Class II areas along the Trail have been redesignated as Class I or Class III areas.

In the 1916 National Park Service Organic Act, Congress declared that the fundamental mission of the National Park Service would be "…to conserve the scenery and the natural and historic objects and the wildlife 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…" That mandate includes the protection of air quality in all units of the National Park System. Accordingly, the NPS *Natural Resources Reference Manual (RM-77)* makes no distinction in the level of air quality protection afforded to Class I versus Class II NPS units.

> "Air is a resource in all NPS units, and many park resources and values are dependent on good air quality. Air pollution can impair visibility, injure vegetation, erode buildings and monuments, acidify water, leach nutrients from soil, and affect visitors' health and enjoyment. In order to prevent or remedy these harmful effects, the NPS will carefully manage air resources of NPS units."

The NPS *Management Policies 2006* also declares that:

> "…the Service will seek to perpetuate the best possible air quality in parks to (1) preserve natural resources and systems; (2) preserve cultural resources; and (3) sustain visitor enjoyment, human health, and scenic vistas.... The Service will actively promote and pursue measures to protect these values from the adverse impacts of air pollution. In cases of doubt as to the impacts of existing or potential air pollution on park resources, the Service will err on the side of protecting air quality and related values for future generations. (4.7.1)"
>
> *-- NPS Management Policies 2006, page 52*

The NPS *Management Policies 2006* further states that the National Park Service will:

- Inventory the air quality related values associated with each park;
- Monitor and document the condition of air quality and related values;
- Evaluate air pollution impacts and identify causes;
- Minimize air pollution emissions associated with park operations, including the use of prescribed fire and visitor use activities; and
- Ensure healthful indoor air quality in NPS facilities. (4.7.1)

-- NPS Management Policies 2006, page 52.

These management policies are intended to guide the National Park Service and its partners in managing lands administered by the Appalachian Trail Park Office and within the six units of the National Park System crossed by the Trail. Similar policies are in effect for the USDA Forest Service, other federal agencies, and most state agencies that administer lands crossed by the Trail.

While the Appalachian Trail Conservancy has no formal policy statement with respect to air quality issues, it and several of its affiliated Trail clubs (including the New York-New Jersey Trail Conference and the Appalachian Mountain Club) are active members of Hikers for Clean Air, an organization dedicated to protecting air quality in outdoor recreation environments.

Legislation and Policy Guidance for Management of Water Resources **-** The primary legislation governing water is the 1972 Federal Water Pollution Control Act, commonly referred to as the Clean Water Act. This act furthers the objectives of restoring and maintaining the chemical, physical, and biological integrity of the nation's waters and of eliminating the discharge of pollutants into navigable waters. It establishes effluent limitation for new and existing industrial discharge into U.S. waters, and authorizes states to substitute their own water quality management plans developed under §208 of the act for federal controls. This act also provides an enforcement procedure for water pollution abatement and requires conformance to permits

required under §404 for actions that may result in discharge of dredged or fill material into a tributary to, wetland, or associated water source for a navigable river.

The Water Resources Planning Act of 1965 and Water Resource Council's Principles and Standards is a national policy "to encourage the conservation, development, and utilization of water and related land resources on a comprehensive and coordinated basis by the federal government, states, localities, and private enterprises with the cooperation of all affected federal agencies, states, local governments, individuals, corporations, business enterprises, and others concerned." It establishes the Water Resources Council with responsibility for assessing the adequacy of water supplies, studying the administration of water resources, and developing principles, standards, and procedures for federal participants in the preparation of comprehensive regional or river basin plans. It also establishes the framework for state and federal cooperation through a series of river basin commissions. Water Resource Council's Principles and Standards for planning water and related land resources have been revised to achieve national economic development and environmental quality objectives.

A primary means for protecting water quality under the Clean Water Act is the establishment of water quality standards. Generally, water quality standards are established by the states (though subject to federal approval) and consist of three components: (1) the designated beneficial uses of a water body, such as contact recreation, aquatic life, cold water fishery, or body contact recreation (i.e. swimming or wading); (2) the numerical or narrative criteria that define the limits of physical, chemical, and biological characteristics of water that are sufficient to protect the beneficial uses; and (3) an anti-degradation provision to protect the existing uses of water. The standards are applicable to all waters of the United States and, depending on the state water quality program, may also apply to groundwater.

Monitoring, regulation, and protection of water quality is a responsibility shared by many local, state, and federal agencies that have mandates for land use planning, natural resource management, and/or environmental protection. The NPS should work actively with these agencies to enhance program cooperation, efficiency, and effectiveness. Cooperative activities include (but are not limited to) the following.

- Consulting with federal (e.g., U.S. Geological Survey and Environmental Protection Agency), state, local, and Native American agencies in the design of complementary and effective monitoring networks.
- Providing water quality monitoring data to the Environmental Protection Agency's Water Quality Storage and Retrieval system (STORET), which serves as the primary national repository for stream and lake water quality data.
- Providing regulatory agencies with information regarding NPS compliance with point source and nonpoint source pollution control programs.
- Consulting with appropriate Native American, local, state, and federal agencies regarding planned upstream activities, permit applications, and water quality issues of concern to the NPS.

Maintaining water in its natural condition, free of pollutants generated by human activity, is an important goal of NPS managers. The goal of the NPS as expressed in *Management Policies* is to preserve and protect entire ecosystems, an integral part of which are water and aquatic resources. In addition, the Clean Water Act, passed in 1972 and substantially amended in 1977 and 1987, was designed to restore and maintain the integrity of the nation's waters, including those of the National Park System. In addition, Section 313 of the Clean Water Act requires the NPS, in implementing its management activities, to "…. comply with all federal, state, interstate, and local requirements, administrative authority, and process and sanctions respecting the control and abatement of water pollution in the same manner and to the same extent as any non-governmental entity including the payment reasonable service charges."

The NPS *Management Policies* states that:

> " The National Park Service will perpetuate surface and groundwaters as integral components of park aquatic and terrestrial ecosystems.... The Service will determine the quality of park surface and ground water resources and avoid, whenever possible, the pollution of park waters by human activities occurring within and outside of parks. The Service will:"
>
> *-- NPS Management Policies 2006, page 50-51.*

- Work with appropriate governmental bodies to obtain the highest possible standards available under the Clean Water Act for the protection of park waters;
- Take all necessary actions to maintain or restore the quality of surface waters and ground waters within the parks consistent with the Clean Water Act and all other applicable federal, state, and local laws and regulations; and
- Enter into agreements with other agencies and governing bodies, as appropriate, to secure their cooperation in maintaining or restoring the quality of park water resources. (4.6.3)

-- NPS Management Policies 2006, page 51.

- In managing floodplains on park lands, the National Park Service will (1) manage for the preservation of floodplain values; (2) minimize potentially hazardous conditions associated with flooding; and (3) comply with the NPS Organic Act and all other federal laws and executive orders related to the management of activities in flood-prone areas, including Executive Order 11988 (Floodplain Management), the National Environmental Policy Act, applicable provisions of the Clean Water Act, and the Rivers and Harbors Appropriation Act of 1899. (4.6.4)

-- NPS Management Policies 2006, page 51.

- The Service will manage wetlands in compliance with NPS mandates and the requirements of Executive Order 11990 (Protection of Wetlands), the Clean Water Act, the Rivers and Harbors Appropriation Act of 1899, and the procedures described in Director's Order 77-1 (Wetland Protection).

- The Service will (1) provide leadership and take action to prevent the destruction, loss, or degradation of wetlands; (2) Preserve and enhance the natural and beneficial values of wetlands; and (3) avoid direct and indirect support of new construction in wetlands unless there are no practicable alternatives and the proposed action includes all practicable measures to minimize harm to wetlands.
- The Service will implement a "no net loss of wetlands" policy. In addition, the Service will strive to achieve a longer-term goal of net gain of wetlands across the national park system through restoration of previously degraded or destroyed wetlands (4.6.5)

-- NPS Management Policies 2006, page 52.

Legislation and Policy Guidance for Management of Biological Resources – The National Park Service Organic Act of 1916 (16 USC 1 et seq.) provides the very broad mandate "to conserve the scenery and the natural and historic objects and the wildlife 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."

The Endangered Species Act of 1973 directs the National Park Service to take actions to prevent adverse impacts to species listed as federally endangered or threatened. The term "endangered species" refers to any species which is in danger of extinction through all or a significant portion of its range, and "threatened species" refers to any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Section 7 of the Endangered Species Act requires all federal agencies to consult with the U. S. Fish and Wildlife Service regarding federally threatened and endangered species and to ensure that any action authorized, funded, or carried out by such agencies is not likely to jeopardize the continued existence of any federally endangered or threatened species or result in the destruction or adverse modification of the habitat of such species which is critical. A "critical habitat" for a threatened or endangered species refers to the specific geographical area that is essential to the conservation of the threatened or endangered species and which may require special management considerations or protection. Recovery plans are to be developed and implemented for the conservation and survival of each threatened or endangered species that is federally listed.

(Source: P.L. 93-205, 87Stat. 884, 16 U.S.C. 1531 et seq.)

Most of the 14 states through which the Appalachian Trail passes have their own individual state threatened and endangered species acts.
The National Park Service will fully meet its obligations under the NPS Organic Act and the Endangered Species Act to both proactively conserve federally listed species and prevent detrimental effects on these species. The NPS will:

- cooperate with both the U.S. Fish and Wildlife Service and the NOAA Fisheries to ensure that NPS actions comply with both the written requirements and the spirit of the Endangered Species Act, which includes consultation, conferencing, and informal discussions;
- undertake active management programs to inventory, monitor, restore, and maintain listed species' habitats, control detrimental nonnative species, manage detrimental visitor access, and reestablish extirpated populations as necessary to maintain the species;
- manage designated critical habitat, essential habitat, and recovery areas to maintain and enhance their value for the recovery of threatened and endangered species;
- cooperate with other agencies, states, and private entities to promote candidate conservation agreements aimed at precluding the need to list species; and
- conduct actions and allocate funding to address endangered, threatened, proposed, and candidate species (4.4.2.3).

--NPS Management Policies 2006, page 45

Management of state-listed and state and globally rare species of plants and animals is particularly important to management of the Appalachian Trail, since relatively few species in the A.T. corridor are federally listed species. Regarding state listed and state rare species, the NPS Management Policies (2006) state that:

- the NPS will inventory, monitor and manage state and locally listed species in a manner similar to its treatment of federally listed species to the greatest extent possible;
- the NPS will inventory other native species that are of special management concern to parks, such as rare, declining, sensitive, or unique species and their habitats, and will manage them to maintain their natural distribution and abundance, and
- the NPS will determine all management actions for the protection and perpetuation of federally or state listed species through park management planning and will consult with other federal and state agencies as appropriate (4.4.2.3).

--NPS Management Policies 2006, page 45

The National Park Service Omnibus Management Act of 1998 requires that the Secretary of the Interior to continually improve the NPS's ability to provide management, protection and interpretation of National Park System resources. The statute directs the NPS to manage its units by employing high quality science and information; to inventory the system's resources to create baseline information so that NPS can monitor and analyze future data to determine trends in the resources' conditions; and to use the results of the scientific studies for park management.

In 1999, Executive Order 13112 on Invasive Species became the first legal or executive authority to specifically address the issue of invasive or exotic species. This Executive Order states that, subject to the availability of appropriations and to the extent practicable, Federal agency have the responsibility to:

- prevent the introduction of invasive species;
- detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner;
- monitor invasive species populations accurately and reliably;
- provide for restoration of native species and habitat conditions in ecosystems that have been invaded;
- conduct research on invasive species; and
- promote public education on invasive species and the means to address them.

(Source: Executive Order 13112 of February 3, 1999, Section 2 (2), in Federal Register, Vol. 64, No. 25)

The Executive Order on Invasive Species also states that Federal agencies shall not take actions that it believes are likely to cause or promote the introduction of spread of invasive species. In addition, the executive order provided for the establishment of a National Invasive Species Council, which prepared a National Invasive Species Management Plan in 2001. The Management Plan provided detailed Federal responses for implementing the goals and objectives noted above, and it noted that adequate funding and public awareness are critical to meeting the goals and objectives. The Plan notes that more than 40% of endangered species are believed to be impacted by invasive species. The Plan recognizes that complete eradication is generally not feasible for widespread invasive species. Control and management objectives may also include: eradication within a local area, population suppression, limiting dispersal, or reducing impacts. The Plan notes that volunteers should be utilized wherever appropriate to help extend the limited funds available for control efforts.

(Source: Management Plan: Meeting the Invasive Species Challenge, National Invasive Species Council, January 18, 2001, 88 pp.)

The NPS Management Policies (2006) state that the NPS will successfully maintain native plants and animals by:

- preserving and restoring the natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal populations and the communities and ecosystems in which they occur;
- restoring native plant and animal populations in parks when they have been extirpated by past human-caused actions; and
- minimizing human impacts on native plants, animals, populations, communities, and ecosystems, and the processes that sustain them (4.4.1).

--NPS Management Policies 2006, p. 42

Whenever possible, natural processes will be relied upon to maintain native plant and animal species and influence natural fluctuations in populations of these species within NPS units. Situations in which management of native plants and animals in NPS units may be necessary are:

- to protect rare, threatened, or endangered species;
- when a population occurs in an unnaturally high or low concentration as a result of human influences and it is not possible to mitigate the effects of the human influences;
- to protect specific cultural resources of parks;
- to accommodate intensive development in portions of parks appropriate for development;
- to protect human health and safety; and
- to protect property when it is not possible to change the pattern of human activities (4.4.2)

--NPS Management Policies 2006, p. 44

The NPS Management Policies (2006) states that, in general, new exotic (non-native) species will not be introduced into parks. The Policies state that all exotic plant and animal species will be managed –up to and including eradication—if control is prudent and feasible. High priority will be given to managing exotic species that have, or potentially could have, a substantial impact on park resources, and that can reasonably be expected to be successfully controlled. Lower priority will be given to exotic species that have almost no impact on park resources or that probably cannot be successfully controlled. Where an exotic species cannot be successfully eliminated, managers will seek to contain the exotic species to prevent further spread or resource damage. Programs to manage exotic species will be designed to avoid causing significant damage to native species, natural ecological communities, natural ecological processes, cultural resources, and human health and safety.

The impacts of exotic or invasive plants on rare, threatened, and endangered species and significant natural communities within the Appalachian Trail corridor became increasingly recognized in the late 1990's, and its significance was emphasized by the Federal Executive Order on Invasive Species in 1999. In 2001, the Appalachian Trail Conservancy and the NPS Appalachian Trail Park Office developed a three-pronged Policy on Invasive Exotic Species:

- Education: The ATC will incorporate information on invasive exotic species and the threats they present into its education efforts and shall seek to raise the collective awareness of its members, volunteers, and staff regarding the potential harm caused by invasive species and methods that can be employed to control them effectively;
- Monitoring: The occurrence and spread of invasive exotic species will be monitored as resources permit, with priority given to those areas where

threatened and endangered species are at risk, and in natural communities that are most vulnerable to invasion;

- Control: Invasive exotic species will be controlled to the extent feasible, with priority given to those areas (1) where exotic species have the potential to do the greatest harm and (2) where actions to control exotic species will do the greatest good and have the highest likelihood of success. The ATC will work with its agency partners and member clubs to identify areas where rare plant or animal species or natural communities are threatened by invasive exotic species and assist in developing and implementing plans to control or eradicate invasive exotic species from those areas.

(http://www.appalachiantrail.org/site/c.jkLXJ8MQKtH/b.855323/k.D939/Policies.htm)

The NPS Management Policies (2006) states that the NPS shall utilize an Integrated Pest Management (IPM) approach to reduce risks to the public, park resources, and the environment from native and exotic (non-native) pests and pest-related management strategies. In general, native pests are allowed to function unimpeded, except where their control is needed to conserve rare, threatened, or endangered species or communities, to preserve or maintain cultural resources, or to manage a human health hazard. The NPS and each park unit are to conduct IPM activities according to the IPM process prescribed in Director's Order #77-7: Integrated Pest Management. Pest issues will be addressed on a case-by-case basis. Controversial pest issues, or those that have the potential to negatively impact the environment, must be addressed through established planning procedures and be included in an approved park management or IPM plan. IPM procedures will be used to determine when to implement pest management actions and which combination of strategies will be most effective for each pest situation. All prospective users of pesticides in parks must submit pesticide use requests to a designated IPM specialist, and these requests will be reviewed on a case-by-case basis, taking into account environmental effects, cost and staffing, and other relevant considerations. Pesticide applications will be performed by or under the supervision of certified or registered applicators licensed under the procedures of a federal or state certification system. All pesticide use on lands managed or regulated by the Service must be reported annually.

Legislation and Policy Guidance for Management of Cultural Resources - Americans values regarding protection of cultural resources are eloquently expressed in the first four parts of Section 1 of the National Historic Preservation Act of 1966, as amended [Public Law 89-665, 16 U.S.C. 470-1(b): 1-4]:

The Congress finds and declares that—

- the spirit and direction of the Nation are founded upon and reflected in its historic heritage;
- the historical and cultural foundations of the Nation should be preserved as a living part of our community life and development in order to give a sense of orientation to the American people;

- historic properties significant to the Nation's heritage are being lost or substantially altered, often inadvertently, with increasing frequency;
- the preservation of this irreplaceable heritage is in the public interest so that its vital legacy of cultural, educational, aesthetic, inspirational, economic, and energy benefits will be maintained and enriched for future generations of Americans.

The National Trails System Act, which formally designated the Appalachian Trail as the Appalachian National Scenic Trail, stipulated that it "shall be administered primarily as a footpath by the Secretary of the Interior, in consultation with the Secretary of Agriculture" [82 Stat 919:5(a)]. It went on to authorize "written cooperative agreements with the States or the political subdivisions, landowners, private organizations, or individuals to operate, develop, and maintain any portion of a national scenic or national historic trail either within or outside a federally administered area" [82 Stat 919:7(h)].

Congress has passed a wide range of federal laws pertaining to management of cultural resources. Foremost among these are the National Historic Preservation Act, the Antiquities Act of 1906, the Historic Sites Act of 1935 (Public Law 74-292), Executive Order 11593, the Archeological Resources Protection Act of 1979, as amended (Public Law 96-95), and the Native American Graves Protection and Repatriation Act of 1990 (Public Law 101-601). These acts provide systematic frameworks for managing cultural resources for the benefit of the American people on federally owned and regulated lands or on lands affected by federally funded or regulated actions. The keystones in this body of preservation law are Sections 106 and 110 of the National Historic Preservation Act (NHPA).
Section 106 states:

The head of any Federal agency having direct or indirect jurisdiction over a proposed Federal or federally assisted undertaking in any State and the head of any Federal department or independent agency having authority to license any undertaking shall, prior to the approval of the expenditure of any federal funds on the undertaking or prior to the issuance of any license, as the case may be, take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. The head of any such Federal agency shall afford the Advisory Council on Historic Preservation established under Title II of this Act a reasonable opportunity to comment with regard to such undertaking [16 U.S.C. 470f].

Section 110 requires Federal agencies to establish historic preservation programs to preserve and use significant historic properties. Among its other provisions, Section 110 stipulates that such programs shall ensure:

- that historic properties under the jurisdiction or control of the agency, are identified, evaluated, and nominated to the National Register;
- that such properties under the jurisdiction or control of the agency as are listed in or may be eligible for the National Register are managed and maintained in a way that

considers the preservation of their historic, archaeological, architectural, and cultural values in compliance with Section 106 of this Act and gives special consideration to the preservation of such values in the case of properties designated as having National significance;

- that the preservation of properties not under the jurisdiction or control of the agency, but subject to be potentially affected by agency actions are given full consideration in planning;
- that the agency's preservation-related activities are carried out in consultation with other Federal, State, and local agencies, Indian tribes, Native Hawaiian organizations carrying out historic preservation planning activities, and with the private sector [16 U.S.C. 470h-2(a)].

Rather than mandate specific actions, the National Historic Preservation Act instead requires consultation and consideration in all undertakings having the potential to affect significant cultural resources. The Act also created a framework for consultation and consideration that includes the Advisory Council on Historic Preservation (an independent government agency that provides guidance to the President, Congress, and the nation on matters relating to historic preservation), Federal, Tribal, and State Historic Preservation Offices (SHPO's), the National Register of Historic Places, and the National Historic Landmark programs.

The center pieces of the national historic preservation effort, the National Register of Historic Places and National Historic Landmark program, provide formal sets of criteria and procedures for identifying, evaluating, and designating cultural resources significant in American history, architecture, archeology, engineering, and culture. Properties considered for National Register nomination must possess integrity of location, design, setting, materials, workmanship, feeling, and association at national, state, or local levels of significance relating to one or more of the following criteria:

A. Association with historic events, activities or patterns;
B. Associations with persons important in American history;
C. Distinctive physical characteristics of design, construction, or form; or
D. Potential to yield important information.

The National Register also defines integrity as "authenticity of a property's historic identity, evidenced by the survival of physical characteristics that existed during the property's historic or prehistoric period" and establishes criteria for evaluating "integrity" (National Register Bulletin 16A: Appendix IV:2).

The National Historic Landmark program uses the same integrity criteria within a similar but more rigorous evaluative framework appropriate for properties possessing the potential to contain information of the highest level of national significance. As set forth in 36 CFR 65.4, the regulations governing National Historic Landmarks define properties meeting these criteria as those that:

- Are associated with events that have made a significant contribution to, and are identified with, or that outstandingly represent, the broad national patterns of United States history and from which an understanding and appreciation of those patterns may be gained; or
- Are associated importantly with the lives of persons nationally significant in the history of the United States: or
- Represent some great idea or ideal of the American people; or
- Embody the distinguishing characteristics of an architectural type specimen exceptionally valuable for a study of a period, style or method of construction, or that represent a significant, distinctive and exceptional entity whose components may lack individual distinction; or
- Are composed of integral parts of the environment not sufficiently significant by reason of historical association or artistic merit to warrant individual recognition but collectively compose an entity of exceptionally historical or artistic significance, or outstandingly commemorate or illustrate a way of life or culture; or
- Have yielded or may be likely to yield information of major scientific importance by revealing new cultures, or by shedding light upon periods of occupation over large areas of the United States. Such sites are those that have yielded, or which may be reasonably expected to yield data affecting theories, concepts, and ideas to a major degree.

Cemeteries, birthplaces, graves, religious properties, properties moved from original locations, reconstructions, commemorative locales, and properties less than 50 years old are only eligible for National Register or National Historic Landmark nomination when they are contributing properties of districts meeting evaluation criteria, are unique or sole surviving examples, possess outstanding, exceptional, or transcendent significance, or are traditional cultural properties important to an Indian tribe or Native Hawaiian organization.

In their capacity as resource managers in partnership with the National Park Service and the USDA Forest Service, the Appalachian Trail Conservancy Board of Managers adopted the following cultural resource management policy statement at its April 1989 meeting:

The Appalachian Trail Conservancy (ATC) seeks to preserve and protect cultural resource sites, including those that are nominated, eligible, or potentially eligible for the National Register of Historic Places. To this end, ATC will seek to ensure that its actions, in concert with the actions of trail-maintaining clubs and agency partners, do not adversely affect any cultural resource site eligible or potentially eligible for such designation.

The Appalachian Trail Conservancy recognizes cultural resources as an integral part of the Trail environment and the obligations that are imposed by federal statute upon federal agencies (and by state law upon state agencies) for protection of cultural resources. It is the policy of

ATC to support and endorse efforts to protect and enhance cultural resources located on or adjacent to the Appalachian Trail. ATC also believes that its principal mission, which is to protect and promote the Appalachian Trail, can aid efforts to protect cultural resources. As a matter of policy, ATC is confident that the Trail can coexist with and provide protection for cultural resource sites. Should conflicts arise, ATC will resolve matters through consultation with its management partners. If a situation arises where protection or use of the Trail has the potential to affect a cultural resource site, the Appalachian Trail Conservancy will enter into formal consultation procedures with the involved agency partner(s), Trail-maintaining club(s), and the State Historic Preservation Office prior to undertaking any action that could adversely affect a significant or potentially significant cultural resource [ATC 1997: Chapter 5(H)].

Trail-maintaining Club Cultural Resource Management Policies: Review of cultural resource policy or principles statements presented in resource management sections of 24 Trail-maintaining club Local Management Plans completed between 1992 and 2001 reveal the following policy patterns:

- All Trail clubs explicitly support and endorse ATC cultural resource preservation and protection principles and policies.
- Eighteen Trail clubs specifically identify consultation with appropriate federal, state, tribal agencies and other stakeholders as a key cultural resource management policy.
- Six Trail clubs endorse increased information dissemination efforts. Three of these are among the five trail clubs emphasizing the importance of minimally intrusive signage and interpretive facilities.
- Four Trail clubs recognize the need for cultural resource inventories within their trail sections.
- Five Trail clubs, responsible for a total of 38.7 miles of Appalachian Trail, report no present awareness of cultural resources within their sections of trail. All others identify types of resources or particular properties. The Natural Bridge Appalachian Trail Club in central Virginia, states that its 89.7 mile section "is among the richest on the entire A.T. in prehistoric and historic cultural resources."
- Three Trail clubs formally support nomination of particular cultural resource properties within their trail sections to the National Register of Historic Places.

D. Overview of Natural and Cultural Resources on the Appalachian Trail

According to the *2006 National Park Service Management Policies*, **natural resources** include:

- Physical resources such as water, air, soils, topographic features, geologic features, paleontological resources, natural soundscapes and clear skies, both during the day and at night;

- Physical processes such as weather, erosion, cave formation, and wildland fire;
- Biological resources such as native plants, animals, and communities;
- Biological processes such as photosynthesis, succession, and evolution;
- Ecosystems; and
- Highly valued associated characteristics such as scenic views.

- -NPS Management Policies 2006, page 36

The 270,000-acre land base of the Appalachian Trail contains a vast array of scenic and natural wonders: magnificent alpine and mountain habitats; spectacular lakes, rivers, and streams;, stately hardwood and coniferous forests; and pastoral fields, farmlands, and meadows.

The Appalachian Mountains stretch from Alabama in the United States to Newfoundland in Canada, in a north-south alignment which is thought to have enabled species migration throughout history. This ancient chain of mountains has helped shape the natural history of North America by providing gradients in elevation, latitude and moisture that have helped species persist through periods of climate change. The Appalachian Mountains' peaks, coves, and valleys provide isolated climatic refuges for boreal and subtropical species found nowhere else in the world.

Today, the Appalachian Mountains hold one of the richest assemblages of temperate zone species in the world. The Appalachian Trail's protected corridor anchors the nation's Eastern forests, which are ecologically vital components of the nation's natural resources, protecting watersheds that serve more than 10% of the nation's population. The Southern Appalachians, never impacted by glaciers, are a center of endemism for terminally slow organisms, including snails, vernal herbaceous plants and salamanders. Rivers also drain to the south in the Southern Appalachians, which allowed many species to escape ice-age extermination. As a result, the Southern Appalachians have an exceptionally rich diversity of fish, mussel and crayfish species.

NPS Management Policies define **cultural resources** as:

- Archaeological resources,
- Cultural landscapes,
- Ethnographic resources,
- Historic and prehistoric structures; and
- Museum collections.

-- NPS Management Policies 2006, page 60

The cultural landscape of the Appalachian Mountains, and their extraordinarily rich cultural history, may be as significant as the natural heritage of these ancient mountains. Archaeological evidence indicates that humans have inhabited the Appalachian Mountains for more than 10,000 years. The turns of more recent history, from the initial surge of European

settlers into the western frontier of a new country to the wilderness protection efforts of the late 20th century, also are woven into the lore and landscape of these mountains. The Trail itself passes through 18 National Register Properties and Districts, including the Harpers Ferry and Skyline Drive Historic Districts. Appalachian Trail lands also protect the sites of the Ring Quarry Prehistoric Mining District, the Brown Mountain Creek Free Black Community, large portions of the Battle of South Mountain, Shay's Rebellion Surrender, and many other significant cultural sites.

The Appalachian Trail itself is a national cultural icon, beginning as one man's dream and growing through the work of tens of thousands of Americans to become a recreational resource used and revered by millions of people each year. Despite the fact that it has been moved many times, the Trail stands alone as our nation's first continuous long-distance hiking trail, and it remains the country's premier trail today. It is also unique in its construction, having been constructed and maintained to design standards established by ATC.

Natural and cultural resource inventories: Trail managers have only begun to assemble comprehensive, Trail-wide inventories on this immense expanse of natural and cultural resources. Numerous local and regional inventories and surveys have been conducted – some of which even predate the Trail's designation as a National Scenic Trail.

None, however, were done on a Trail-wide scale with a consistent methodology, until the Appalachian Trail Park Office and ATC initiated a program in 1989 to inventory occurrences of threatened, endangered, and sensitive plant and animal species and exemplary natural communities along the Trail. These inventories, which involved participation by numerous national forests, state agencies, state natural heritage program offices, and Appalachian Trail clubs, were conducted on a state-by-state basis over a twelve-year period. Ultimately, the inventories identified more than 2,100 "element occurrences," or discrete occurrences of rare plants, animals, and rare or exemplary communities, at more than 500 locations along the length of the Appalachian Trail.

A similar program to inventory archaeological resources began in 1999. The Appalachian Trail Conservancy and Appalachian Trail Park Office secured funding and entered into a cooperative agreement with Pennsylvania State University to conduct an "overview and assessment" of cultural resources along the 229 miles of Trail in Pennsylvania. Fifty-five archaeological resource sites were identified in the initial inventory, which was completed in 2000. Further field research in 2001 and 2002 identified 21 additional sites. A second overview and assessment project, which identified 382 archaeological sites along the Trail in Connecticut, was completed in 2004. Plans are underway to continue the program in other states. In addition, the Appalachian Trail Park Office and ATC are working with the NPS Olmsted Center to evaluate the potential for conducting cultural landscape inventories of the Appalachian Trail.

A tremendous amount of data exists on other resource values, including geologic resources, air, water, and scenic quality. However, much of these data exist in local or regional contexts, with

widely disparate protocols, methodologies, and data standards. The National Park Service's Inventory and Monitoring Program is assisting the Appalachian Trail in obtaining comprehensive natural resource information for the Trail as time and funding permit, but some information is not likely to be available for years. No program currently exists for cultural resources.

These resources are described in greater detail in Chapter II, "Present Resource Status."

E. Relationship to Existing Planning Documents

Managing the Appalachian Trail is a complex undertaking, with multiple agencies and organizations often sharing responsibilities for specific tasks. In fact, rarely is a Trail project planned or carried out by one partner alone. Most projects are conceived, planned, and executed by at least three – and often four – partners. The land-managing agency, the Appalachian Trail Conservancy, and the local Trail-maintaining club are always involved. The NPS Appalachian Trail Park Office (in instances when it is not the actual land-managing agency) sometimes participates as well. The following documents guide this coordinated effort:

The Appalachian Trail Comprehensive Plan – *The Comprehensive Plan for the Protection, Management, Development, and Use of the Appalachian National Scenic Trail*, signed by the Director of the National Park Service and Chief of the USDA Forest Service in 1981, sets the over-all tenor for management of the Appalachian Trail. The *Comprehensive Plan* (available at: (http://www.appalachiantrail.org/site/c.jkLXJ8MQKtH/b.855323/k.D939/Policies.htm) establishes a broad set of management principles for the Trail and encourages a decentralized management framework that relies on management partners to resolve issues at the local level within the parameters of some broad policy guidelines. The *Plan* endorses the use of local management plans and agency plans for coordinating efforts to manage the Trail. Planning at the local level typically consists of two tiers of planning, local management planning and agency planning, which are described in more detail below.

The Appalachian Trail Conservancy's Local Management Planning Guide and Trail Club Local Management Plans – Local management plans are documents written by Trail-maintaining clubs in cooperation with their agency partners, ATC, and the Appalachian Trail Park Office that: (1) outline Trail club roles, responsibilities, and policies; and (2) define and prioritize Trail club programs and work projects along their respective sections of the Appalachian Trail. The plans are written in accordance with direction provided by the *Appalachian Trail Comprehensive Plan* and guidance provided in ATC's *Local Management Planning Guide*, which was last updated in 1997. The *Planning Guide*, which includes twelve chapters on resource management issues, is available at http://www.appalachiantrail.org/site/c.jkLXJ8MQKtH/b.855323/k.D939/Policies.htm.

Trail clubs prepare their local management plans with input from a variety of sources, including their land-managing agency partners, ATC, and the Appalachian Trail Park Office. ATC's Stewardship Council endorses each plan upon recommendation from the ATC regional partnership committee chair. Each local management plan contains brief policy statements by the Trail club on what roles and responsibilities, if any, the club is willing to assume with regard to natural and cultural resource management.

Agency Planning Efforts – Most agency partners are required by law to develop plans to guide their management activities. At the federal level, national parks develop general management plans, resource management plans, facility management plans, and backcountry management plans; national forests develop forest plans; and fish and wildlife units develop refuge plans. Each entity has defined an area that is set aside for the Appalachian Trail, either as a management area, prescription area, or Trail corridor in which actions are coordinated with other local Trail-management partners.

State agencies have similar mandates. Most agencies have plans that define their management emphases and prioritize their management activities. And, in almost every case, state land-managing agencies have entered into cooperative agreements with their other management partners that set aside a defined corridor for protection and management of the Trail.

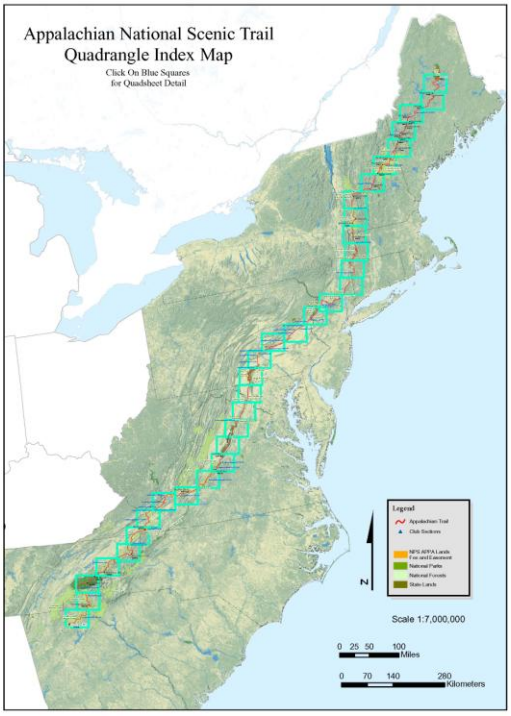
Agency resource management plans typically identify management actions that can be carried out in a manner that is consistent with the over-arching principles of the Trail and that allow for continued use of the Trail. Actions range from closures of damaged or sensitive areas, to control of invasive species, to protection of a threatened or endangered species, to interpretation and signage. Agencies also carry out monitoring programs to identify trends in air quality, water quality, forest and agriculture pests, and other resources.

The Appalachian Trail Strategic Plan – In 2005, the Appalachian Trail Park Office updated its strategic plan for the Appalachian National Scenic Trail. Among other things, the *Appalachian Trail Strategic Plan* provides overall goals and objectives for protection and management of natural and cultural resources based on Service-wide goals

F. Land Ownership and Responsibilities for Resource Management

One of the most confusing and challenging realities of managing the Appalachian National Scenic Trail is created by the complex patchwork of land ownership along much of the length of the Trail. The Trail crosses lands administered by eight national forests, six national parks, one national wildlife refuge, 67 state game lands, forest, or park areas, and more than a dozen local municipal watershed properties. In addition, the Appalachian Trail Park Office has acquired 2,700 tracts comprising more than 105,000 acres of land that are located in and among the larger blocks of existing forest, park, and game lands. (As of 2006, the Appalachian Trail Park Office still needs to acquire an additional 1,100 acres to complete the Trail corridor.) National forests, state agencies, and the Appalachian Trail Conservancy have acquired an additional 80,000 acres.

Maps I.G.1 through I.G.20, Land Ownership Maps of the Appalachian Trail provide a comprehensive, scalable series of maps in electronic format that depict this land ownership pattern.



For the purposes of this plan, it is important to understand a critical distinction in terminology pertaining to land ownership and management:

Appalachian Trail Park Office lands are lands specifically acquired and managed by the National Park Service Appalachian Trail Park Office for the Appalachian Trail. The Appalachian Trail Park Office serves as the primary management partner and exercises full jurisdictional responsibilities for these lands and interests in lands. However, the Park Office has delegated most responsibilities for Trail operations, development, maintenance, and management of these lands to the Appalachian Trail Conservancy and its Trail-maintaining clubs. This land base consists of some 2,300 tracts and 82,700 acres acquired by the National Park Service to protect the Trail that have not been administratively transferred to other land-managing agencies. These APPA lands are located almost entirely in nine states: Maine, Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Maryland, West Virginia, and Virginia. These lands do not include approximately 23,000 acres of land acquired by the National Park Service that have been transferred to and are now managed by the USDA Forest Service or other agencies.

The term **Appalachian Trail lands** is used in this plan to refer to *all* lands crossed by the Trail, including lands that (1) are identified in Appalachian Trail management areas or prescription areas, (2) are covered under a memorandum of understanding between the Appalachian Trail management partners responsible for managing that section of the Trail, (3) have been acquired for the protection of the Trail, or (4) are identified in some other manner as being set aside or managed as part of the Appalachian Trail. The agencies responsible for managing these lands typically identify specific responsibilities for Trail operations, development, maintenance, and management activities on these lands that are carried out by the Appalachian Trail Conservancy and its Trail-maintaining clubs. This land base consists of approximately 270,000 acres of land across all fourteen Trail states.

Maine

Approximately two-thirds of the 281-mile A.T. corridor lies on National Park Service APPA land, and one-third lies on state-owned land. More than 30,000 acres have been acquired by the National Park Service for the A.T. in Maine. The Trail also passes through two large state parks, Baxter State Park and the Bigelow Preserve, as well as numerous other state land ownership.

New Hampshire
Though approximately 8,500 acres along the Trail in New Hampshire were purchased by the National Park Service, these lands were administratively transferred to the USDA Forest Service in 1994. The White Mountain National Forest Plan (2005) identifies a management area for the Appalachian Trail on National Forest lands based on the application of the Agency's Scenery Management System. With the exception of three small state park units, Crawford, Franconia and Mt. Washington, the entire 161-mile length of the Appalachian Trail in New Hampshire is now located on lands administered by the White Mountain National Forest.

Vermont
Approximately 145 miles of the 150-mile length of the Appalachian Trail in Vermont is located on lands administered by the Green Mountain National Forest. Approximately 91 miles cross Green Mountain National Forest land. The Green Mountain National Forest Plan (2006) also identifies a management area for these sections of the Appalachian Trail based on the application of the Agency's Scenery Management System. In addition, 54 miles of Trail are located on 12,000 acres of land that were acquired by the National Park Service in the 1980s and 1990s and administratively transferred to the Forest Service in 1994. The remaining five miles of Trail cross lands administered by the State of Vermont's Agency of Natural Resources.

Massachusetts
Appalachian Trail lands are managed by the NPS Appalachian Trail Park Office, which administers approximately 5,300 acres and 33 miles of the Trail, and the Massachusetts Department of Environmental Management, which administers approximately 6,700 acres and 57 miles of Trail.

Connecticut
Appalachian Trail lands are administered by the NPS Appalachian Trail Park Office and the state. The National Park Service administers approximately 6,700 acres protecting 34 miles of Trail and the Connecticut Department of Environmental Protection administers roughly 2,100 acres and 17 miles of Trail.

New York
The Appalachian Trail in New York lies primarily on lands administered by the NPS Appalachian Trail Park Office and New York state agencies, including Sterling Forest State Park, Harriman State Park, Bear Mountain State Park, Hudson Highlands State Park, Clarence Fahnestock Memorial State Park, and the New York Department of Environmental Conservation Division of Lands and Forests. The Appalachian Trail Park Office administers approximately 8,300 acres of land and 57 miles of Trail. The remaining 32 miles of Trail cross 4,000 acres of state lands.

New Jersey
The Appalachian Trail lies within a protective corridor split almost evenly between state and federal land. Among the large state holdings are Wawayanda State Park, High Point State Park, Worthington State Forest, Stokes State Forest, and Abram Hewitt State Forest. In total, these and other state land holdings, which total nearly 4,000 acres of land, protect approximately 41

miles of Trail. The largest federal land entity is Delaware Water Gap National Recreation Area, located along the state border with Pennsylvania, which protects approximately 28 miles of Trail. The Wallkill River National Wildlife Refuge, the only federal wildlife refuge along the A.T., protects a one-mile section of the Trail near the state's border with New York, and two miles are protected by approximately 1,000 acres of NPS Appalachian Trail Park Office lands of the A.T.

Pennsylvania

The Appalachian Trail follows a 229-mile route through Pennsylvania state forests, state parks, and game commission lands, as well as through National Park Service Appalachian Trail lands and Delaware Water Gap National Recreation Area. More than half of the Trail (121 miles) is located on Pennsylvania state lands. Four miles of the Trail are administered by the NPS Delaware Water Gap National Recreation Area. The remaining 104 miles are protected by 13,500 acres of NPS Appalachian Park Office lands.

Maryland

Forty miles of the Appalachian Trail pass through a corridor of federal, state, and local park land. Federal lands include the Chesapeake and Ohio National Historical Park (protecting three miles of Trail) and land administered by the NPS Appalachian Trail Park Office (approximately 1,600 acres, protecting six miles of Trail). State park lands, which include portions of Greenbrier State Park, Gathland State Park, and Washington Monument State Park, all of which are within Maryland's South Mountain Recreation Area, which total more than 4,000 acres, protect the remaining 28 miles of Trail.. Washington County's Park Department administers a small section of the Trail at Pen Mar and the NPS recently secured an easement over a three-mile stretch of land passing through the Hagerstown Watershed.

West Virginia

South of the Potomac River, the A.T. generally follows the state boundary of West Virginia and Virginia for approximately 13 miles. Two of the miles in northeastern West Virginia are administered by NPS Harpers Ferry National Historical Park; and eleven are administered by the NPS Appalachian Trail Park Office. Several hundred miles to the south, the Appalachian Trail again follows the ridgeline between Virginia and West Virginia for a distance of approximately 10 miles, just north of Pearisburg, Virginia, on lands administered by the Jefferson National Forest.

Virginia

Approximately 549 miles, or one-fourth of the total length of the Appalachian Trail, are located in Virginia. North of Shenandoah National Park, approximately 55 miles of the Trail are situated on more than 11,000 acres of land administered by the NPS Appalachian Trail Park Office and the state of Virginia. The Trail passes through two state land holdings: Sky Meadows State Park and the G. Richard Thompson Wildlife Management Area. Also in northern Virginia, 95 miles of the Trail pass through Shenandoah National Park. In central and southwest Virginia, the Trail corridor passes primarily through Jefferson and George Washington National Forests, which have designated an Appalachian Trail management area or prescription area on approximately

75,000 acres. Smaller portions of the Trail pass through lands administered by the Blue Ridge Parkway (outside Waynesboro and Lynchburg) and the Appalachian Trail Park Office (outside Roanoke), and the state also administers a small portion of Grayson Highlands State Park to protect the Trail.

Tennessee
Approximately 80 miles of the A.T. corridor are located in Tennessee between the Virginia border and Carvers Gap, Tennessee, on lands administered by the Cherokee National Forest. The Cherokee National Forest Plan provides for a designated Appalachian Trail Management Area. The Tennessee Valley Authority administers a small tract of land near Watauga Dam.

North Carolina
The Trail also follows the Tennessee/North Carolina state line for an additional 134 miles on lands administered by the Cherokee National Forest (in Tennessee) and the Pisgah National Forest (in North Carolina). The Forest Plan provides a designated Appalachian Trail Management Area. Another 71 miles of the A.T. within Great Smoky Mountains National Park closely parallel the Tennessee/North Carolina state line. Following a short section across the Tennessee Valley Authority's Fontana Dam, the Trail continues south through North Carolina across lands administered by the Nantahala National Forest for another 88 miles to the Georgia border.

Georgia
Approximately 76 miles of the A.T. pass through lands administered by the Chattahoochee National Forest. The Forest Plan provides a designated Appalachian Trail Management Area. The southern terminus of the A.T. is located on Springer Mountain, Georgia. An eight-mile approach trail, which begins on state-owned property in Amicalola Falls State Park, leads to Springer Mountain.

G. Distinction between Resource Management Plan's Direction for Appalachian Trail Park Office Lands and Lands Administered by Other Agencies

This resource management plan, since it is intended to provide direction primarily for the Appalachian Trail Park Office and the Appalachian Trail Conservancy, will adopt the following approach for delineating responsibilities of these two organizational entities from other Trail-management partners:

1) To the greatest extent possible, inventories, assessments, and data-gathering will be conducted on a Trail-wide basis using a common methodology, irrespective of land ownership, so that Trail managers will have a common data set for management of Trail resources whenever possible. Inventory data will be shared with all management partners.

2) Site-specific recommendations contained in any inventory or assessment for management of resources on lands administered by the Appalachian Trail Park Office will be addressed and

prioritized in this resource management plan. Site-specific recommendations for management of resource on lands administered by other agencies will be forwarded to the responsible land-managing agency as recommendations only.

3) Trail-wide recommendations for Appalachian Trail Park Office and Appalachian Trail Conservancy management programs and activities (such as the natural heritage inventories and natural heritage site-monitoring program) contained in this resource management plan will be addressed and prioritized in this resource management plan. The Appalachian Trail Park Office and Appalachian Trail Conservancy will seek to coordinate and cooperate with other agencies and organizations to the greatest extent possible to facilitate consistent implementation of Trail-wide recommendations for management. However, participation in these efforts by other agencies and organizations is purely voluntary.

4) Responsibilities for implementing components of this resource management plan may be shared between the Appalachian Trail Park Office, the Appalachian Trail Conservancy, the Trail-maintaining clubs, and other agencies and organizations. However, this plan does not require or commit any agency or organization other than the Appalachian Trail Park Office to implement or adopt any project or program identified in this plan, nor does it infer any responsibility for any other agency or organization to do so.

CHAPTER II: PRESENT RESOURCE STATUS

A. Introduction to the Present Status of Resources on the Appalachian National Scenic Trail

This chapter describes available information about the current condition of natural and cultural resources along the Appalachian Trail.

Available natural resource baseline information for the Appalachian National Scenic Trail is extremely variable. A wealth of data exists for air, biological, and geologic resources. [see the Natural Resource Bibliography for the Appalachian Trail] However, most of these inventories, environmental analyses, management plans, and other documents have been compiled at a local or regional level, and more often than not, for a land base other than the Appalachian Trail (*e.g.*, for the George Washington National Forest, or for the state of Connecticut).

The Appalachian Trail Park Office (APPA), the Appalachian Trail Conservancy (ATC), and the NPS Inventory and Monitoring Network (I&M) have accumulated a significant amount of natural resource inventory and monitoring data. The most complete inventory is the inventory of rare, threatened, and endangered species and exemplary natural communities, which is the result of an intensive 12-year effort by APPA and ATC that was completed in 2001. This information is fairly consistent for rare plants and exemplary natural communities, but inventories for rare animal species are incomplete. Information for other biological resources (*e.g.* all vascular species inventories) also is incomplete.

The Appalachian Trail passes through three NPS regions, as well as five NPS Natural Resource Inventory and Monitoring (I&M) Networks. These networks were created in 2001 to assist the NPS in developing baseline data and implementing long-term ecological monitoring of natural resources in 270 national park units. The NPS I&M Northeast Temperate Network, based in Woodstock, Vermont, has assumed the lead responsibility for coordinating inventory and monitoring programs for the Appalachian Trail. In 2007, the NPS I&M Northeast Temperate Network hired an Appalachian Trail Network Coordinator to assume responsibility for coordinating the collection and analysis of park-defined resource monitoring indicators.

Table II.A.1, Natural Resources Inventory - 12 Data Sets outlines the status of Baseline Natural Resource Information using the format provided in Appendix A of *NPS-75*, the National Park Service's *Inventory and Monitoring Guideline*.

Table II.A.1, Status of Natural Resources Inventories for the Appalachian Trail (the 12 Data Sets)

Data Set	Responsibility for compilation	Status
Natural Resource Bibliography	NPS I&M Networks	on going
Base Cartographic Data	NPS APPA	on-going
Geology Map	NPS Geologic Resources Division	future
Soils Map	NPS Geologic Resources Division	future
Weather Data	NPS APPA, I&M, Air Resources Division	on going
Climate Divisions	NPS APPA, I&M, Air Resources Division	on going
Air Quality	NPS Air Resources Division	on going
Location of Air Quality Monitoring Stations	NPS Air Resources Division	complete
Water body location and classification	NPS APPA and Water Resources Division	on going
Water Quality Data	NPS APPA and Water Resources Division	future
Vegetation Map	NPS I&M, Vegetation Mapping Program	on going
Species List	NPSAPPA, I&M Networks	on going

Appendix A - Natural Resources Inventory - 12 Data Sets provides a more detailed analysis of the availability of these data.

Inventories of cultural resources are even less complete. Cultural resource overview and assessment surveys have been conducted along the Trail in two states (Pennsylvania and Connecticut). Cultural landscape inventories and List of Classified Structure inventories have been conducted in most of the National Park units crossed by the Trail; otherwise, these data sets are not available. The NPS Olmsted Center and NPS Appalachian Trail Park Office are currently developing a methodology for inventorying cultural landscapes along the Appalachian Trail. This plan, begun in 2005, is expected to be complete in 2008.

Cultural resource data sets that are available are described in more detail in Section II.F, according to category or designation, beginning with a cultural resource context, followed by an analysis of archaeological surveys, cultural landscape surveys, lists of classified structures, National Historic Landmarks, National Register properties, and contributing resources, and other historic resources.

However, significant needs remain in every aspect of cultural resource management to comprehensively identify and catalog cultural resources along the Appalachian National Scenic Trail. Table II.A.2 below describes the current status of cultural resource documentation:

Table II.A.2, Status of Cultural Resource Inventories on the Appalachian National Scenic Trail

Historic Context for the Appalachian Trail	complete 2002
Park Administrative History	not done*
Historic Resource Survey	not done
Archaeological Overview and Assessment	in progress
Cultural Landscape Inventory	in progress
Cultural Landscape Reports	not done
List of Classified Structures	not done
Museum Catalog Records for the National Catalog	not done
Ehtnographic Overview and Assessment	not done
National Historical Landmark and National Register Identification and documentation	in progress completed only for specific sites
Section 106 compliance	done for all projects
Curation agreement	done**

*Archival records maintained and catalogued by the Appalachian Trail Conservancy
**An arrangement currently exists with the NPS National Capital Region Museum Resource Center for curation of artifacts and objects located during archaeological surveys on NPS APPA lands; other agencies have similar arrangements in places within their own administrative structures

B. Geology and Soil Resources

1. Geologic History of the Appalachian Trail Environment

The Appalachian Trail, which crosses or is immediately proximate to five major geologic subprovinces along its 2,175-mile long traverse of the Appalachian Mountains, provides a unique perspective into the geologic history of the Appalachians. These five geologic subprovinces include the Piedmont, Blue Ridge, Valley and Ridge, Appalachian Plateau, and New England subprovinces.

The Appalachian Mountains – a fold and thrust belt extending from Alabama to Newfoundland – contain some of the oldest rocks and mountains in the world. The Appalachian Trail, situated on the crest of these mountains from its southern terminus at Springer Mountain, Georgia, to its northern terminus, at Katahdin, Maine, follows an unusually diverse geologic record. This extraordinary rock record ranges in age from more than one billion years during the Pre-Cambrian era to 140 million years during the Jurassic geologic time scale.

The formation of the present Appalachian Mountains was the result of a series of tectonic convergences that created pulses of "mountain building events," or orogenies, spanning the past four hundred and seventy million years. These orogenies – the Taconic, the Acadian, and the Alleghenian – are considered the primary orographic catalysts for the current topographic landscape of the Appalachian Mountains. During and after these events, the Appalachians (which some geologists speculate were once as tall as the modern-day Himalayas) were worn down by hundreds of millions of years of

physical and chemical erosion, leaving the distinctively unique landscape we find today.

The Taconic Orogeny, which occurred approximately 450 to 470 million years ago, was the first in this series of influential mountain-building events. It began as a result of the initial subduction of the Eastern Iapetus oceanic plate under the current North American plate, which formed a clastic wedge of sedimentary rock that served as the base for all other layers of rock to build upon. These ancient rocks, generally of the Ordovician Age (430 to 500 million years old), are classified as sedimentary and consist mostly of sandstones, shale and carbonates. The effects of this event can be seen distinctly in the rocks of the Taconic Mountains of New York and Bear Mountain and Mount Riga in Connecticut. Other prominent examples can be found in northern Pennsylvania, Connecticut and Massachusetts.

The Acadian Orogeny, which took place approximately 410 to 380 million years ago, occurred when the North American plate collided with Baltica, a drifting plate that is now considered Europe. At its peak intensity, this massive collision produced a mountain range that extended from southern Virginia to Newfoundland. Rocks of this chain are considered to be of the late Silurian/Devonian Age (350 to 410 million years old) and consist primarily of sedimentary rocks such as limestone, sandstone, and shale. However, metamorphosed rocks from the Acadian Orogeny, such as schist and granite, also are prevalent in the northern states crossed by the Appalachian Trail.

According to Collins Chew, author of *Underfoot: A Geologic Guide to the Appalachian Trail*, evidence of the Acadian Orogeny can be found in numerous places along the Trail. Chew states, “an assortment of Devonian sedimentary rocks, including limestone, shale, sandstone, and mixtures of sand, silt and lime, are found in Pennsylvania. In Virginia and other southern states, the deposits of Devonian sediments are much thinner... The A.T. is on Devonian granite rock at Katahdin in Maine, and a number of areas are underlaid with this granite in Maine and New Hampshire. Other mountains of this rock are Sugarloaf, Saddleback, and Moxie Bald in Maine and Kinsman and Velvet Rocks in New Hampshire.”

The third major mountain-building event, the Alleghenian Orogeny, took place approximately 290 to 250 million years ago. The effects of this event are most pronounced in the central and southern Appalachian Mountains. The Alleghenian Orogeny produced different effects in various subregions: compressional folding and faulting of the Valley and Ridge Province, westward thrusting of the Blue Ridge, and folding and minor metamorphism and igneous intrusion in the Piedmont Province.

Warping and faulting, accompanied by non-marine sedimentation and some volcanism, continued through the late Triassic and early Jusassic era some 220 to 180 million years ago.

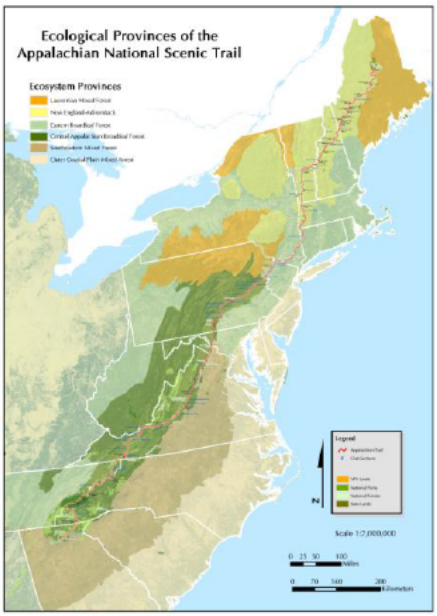
The most recent geologic occurrence affecting the Appalachians took place during the

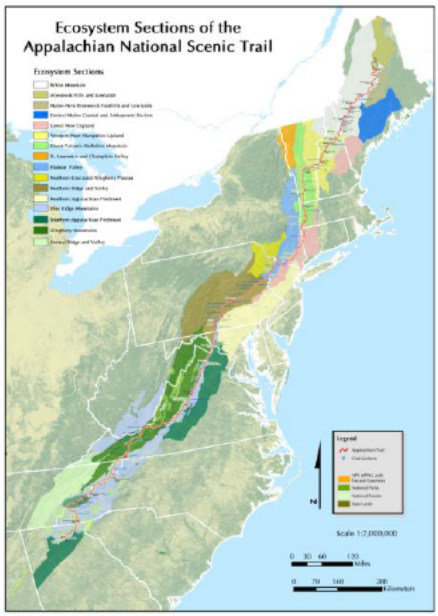
The most recent geologic occurrence affecting the Appalachians took place during the Pleistocene Era, which started roughly 1.8 million years ago and ended approximately 11,000 years ago. During this time, glaciation modified the landscape of much of New England and the mid-Atlantic region. Moraines, striations, glacial till, and other evidence of this activity are still readily apparent in many areas throughout the northern half of the Appalachian Trail environment.

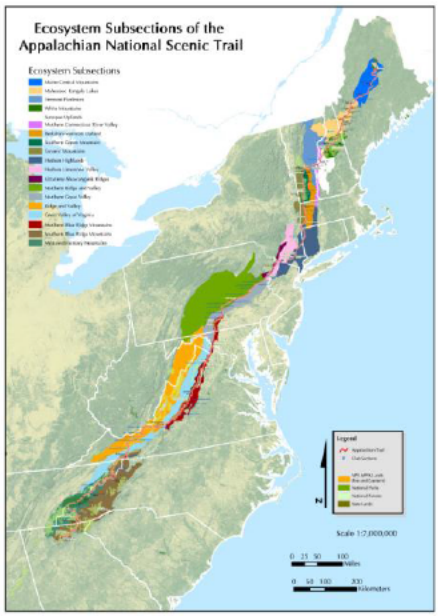
Of course, erosion during, between, and after these orogenic events represents the final factor in the complex geologic story of the Appalachians – in effect, creating the classic modern-day Appalachian landscape of rolling ridges and rounded summits of the Appalachians, from the Longfellow Mountains of Maine to the Blue Ridge Mountains of Virginia, Tennessee, North Carolina, and Georgia.

2. Geomorphology, Lithology, Stratigraphy, and Soil Taxa

The following summary of geographic features is excerpted and adapted from Ecological Subregions of the United States, *R.G. Bailey, USDA Forest Service (scale 1:7,500,000, revised 1994). The Appalachian National Scenic Trail crosses three provinces, eight ecological sections, and 20 ecological subsections in its traverse of the Appalachian Mountains. The following description is organized by ecological section, with a description of geomorphology, lithology, stratigraphy, and soil taxa provided for each section.* Table II.C.1, Ecosystem Provinces, Sections, and Subsections along the Appalachian Trail *provides a tabular summary of the respective categories, and* Maps II.C.1, Ecoregions of the Appalachian National Scenic Trail; II.C.2, Ecological Units of the Eastern United States (Provinces); II.C.3, Ecological Units of the Eastern United States (Sections); II.C.4, Ecological Units of the Eastern United States (Subsections) *illustrate the regional and subregional boundaries.*







Section M212A - White Mountains Section (within the following subsections: M212Ac Maine Central Mountains, M212Ad White Mountains, M212Ae Mahoosuc Rangeley Lakes, and M212Af Connecticut Lakes; and following geographic areas: western Maine,

north-central New Hampshire)

Geomorphology:
The White Mountains Section, which is part of the New England geomorphic province, overlaps the Appalachian Trail for a distance of 400.6 miles from Katahdin in central Maine to Mt. Moosilauke in west-central New Hampshire. It is a glacially scoured, maturely dissected, irregular highland characterized by clusters of low, rounded mountains and scattered monadnocks. Highest elevations occur in a wide belt trending southwest to northeast through the Section, ending in central Maine. Glacial features are most evident in the Section's southern half and include cirques carved into the high peaks and U-shaped valleys, as well as kames, eskers, and drumlins. Mass wasting, fluvial erosion, transport and deposition are the primary geomorphic processes. General elevation ranges from 1,000 to 4,000 ft (300 to 1,200 m); isolated peaks are greater than 5,000 ft (1,500 m); local relief ranges from 1,000 to 3,000 ft (300 to 900 m). Gentle slopes cover 20 to 50 percent of the area; 75 percent of gentle slopes occur in the lowland. Sub-envelop elevation ranges from 200 to 1,800 (60 to 550 m).

Lithology and Stratigraphy:
Thin, stony Pleistocene till and stratified drift mantle the bedrock except in the Connecticut River valley, where lacustrine sediments and terraces are thick. In the northern half of the Section, bedrock is mostly Devonian and Silurian sedimentary rocks which become metamorphosed to quartzite, slate, and schist toward the southwest. The mountainous belt is underlain by Paleozoic igneous rocks (granite, diorite, gabbro, rhyolite, and basalt) that either intrude or both intrude and cover lower Paleozoic schists, and by Proterozoic and Cambrian gneiss. Much younger Mesozoic granites occur at the southern end, intruding the most abundant rock types there, gneiss and amphibolite.

Soil Taxa:
Haplorthods, Haplaquepts, and Dystrochrepts with frigid temperature regime and udic and aquic moisture regimes comprise most of the soils. Cryorthods and Cryaquods with cryic temperature regime and udic and aquic moisture regimes are common at the highest elevations.

Section M212B - Vermont – New Hampshire Upland Section (within the following subsections: M212Ba Vermont Piedmont, M212Bb Northern Connecticut Valley, and M212Bc Sunapee Uplands; and the geographic area of western New Hampshire and eastern Vermont)

Geomorphology:
The Vermont – New Hampshire Upland Section, which is also part of the New England geomorphic province, overlaps the Appalachian Trail for a distance of 95.9 miles from Glencliff in west-central New Hampshire to the town of Bridgewater in

eastern Vermont. It is a glacially scoured, maturely dissected peneplain with open, low mountains and mondanocks. Glacial features include kames, eskers, drumlins, and lacustrine plains. Mass wasting, fluvial erosion, transport and deposition are the primary geomorphic processes operating. Elevation ranges from 600 to 3,000 ft (180 to 900 m); local relief ranges from 1,000 to 3,000 ft (300 to 900 m). Gently sloping land covers 20 to 50 percent of the area; more than 50 percent is found in lowlands. Sub-envelop elevation ranges from 200 to 1,800 (60 to 550 m).

Lithology and Stratigraphy:
Thin, stony Pleistocene till and stratified drift mantle the bedrock, except in the Connecticut River valley where lacustrine sediments and terraces are thick. In the northern half of the Section, bedrock is mostly Devonian and Silurian quartzite, slate, and schist, with small granitic intrusions. Toward the southern end, lower Paleozoic granite and higher-grade metamorphics (mostly gneiss) dominate, with a north to south belt of volcanics.

Soil Taxa:
Haplorthods, Haplaquods, and Haplaquepts with frigid temperature regime and udic and aquic moisture regimes are common. Fragiochrepts and Dystrochrepts with mesic temperature regime and udic moisture regime are common in the northern Connecticut River valley.

Section M212C - Green, Taconic, and Berkshire Mountains Section (within the following subsections: M212Cb, Taconic Mountains, M212Cc Berskhire-Vermont Upland, and M212Cd Southern Green Mountain; and the geographic area of southern Vermont and western Massachusetts)

Geomorphology:
The Green, Taconic, and Berkshire Mountains Section, which is also part of the New England geomorphic Province, overlaps the Appalachian Trail for a distance of 207 miles from the Green Mountains in Vermont to the far southwestern corner of Massachusetts. North of central Vermont, the Green Mountains are north to south trending, linear ranges. To the south, they and the Berkshires are highlands characterized by dissected, flat-topped plateaus (up-warped peneplains) with scattered monadnocks. The Taconic Mountains are west of and separated from the southern Green and Berkshire Mountains by a broad, nearly continuous valley (the Marble Valley) about 1,500 ft (460 m) lower than the highlands on either side. The Taconic Mountains contrast with the plateaus to the east by being more deeply cut into peaks, sharper ridges and canyons with a linear, north to south topographic trend. Scattered glacial features include kames and eskers; the mountains have been smoothed and rounded by glacial scour. Mass wasting, minor karst solution, fluvial erosion, transport and depositions are the primary geomorphic processes operating. Elevation ranges from 600 to 4,000 ft (180 to 1,200 m) with isolated peaks greater than 4,300 ft (1,300 m). Local relief ranges from 1,000 to 3,000 ft (400

to 900 m). Gentle slopes cover less than 20 to 50 percent of the Section; 75 percent occurs in lowlands. Sub-envelop elevation ranges from 200 to 1,800 (60 to 550 m).

Lithology and Stratigraphy:
Thin, stony Pleistocene till and stratified drift mantle the bedrock. Upper Proterozoic and lower Cambrian metaconglomerate, quartzite, schist, and metavolcanics underlie the northern ranges. Lower Ordovician and Cambrian marble, dolomite, and limestone occupy the long valley. Bedrock in the southern plateaus is mostly Proterozoic gneiss and amphibolite with scattered granitic plutons. Rocks of the Taconic allochthon once rested atop the rocks in the Green Mountains as the whole range was undergoing the tectonic events that created them. During uplift the present Taconic range slid on a plane of weakness, under the force of gravity, to its present position; concomitant folding produced a strong north to south stuctural grain. Because these rocks were on top, they are mostly of lower metamorphic grade slate, phyllite, and schist, with lesser quartzite and gneiss.

Soil Taxa:
Haplorthods, Haplaquepts, and Dystrochrepts with frigid temperature regime and udic and aquic moisture regimes are most common in the Green and Berkshire Mountains. Cryorthods and Cryaquods with cryic temperature regime and aquic and udic moisture regimes are common at the highest elevations. The Taconic mountains are characterized by Eutrochrepts, Dytrochrepts, and Udipsamments, with mesic temperature regime and udic moisture regime on lower mountain slopes and in the Marble Valley; Fragiochrepts and Dystrochrepts with frigid temperature regime and udic moisture regime occur at higher elevations.

Section 221A - Lower New England Section (within the following subsections: 221Ae Hudson Highlands; and the geographic area of northwestern Connecticut and southeastern New York)

Geomorphology:
The Lower New England Section, which comprises parts of the New England, Piedmont, and Coastal Plain geomorphic provinces, overlaps the Appalachian Trail for a distance of 153.6 miles from the far southwestern corner of Massachusetts to the northwestern corner of New Jersey. Glacial features such as small to large delta plains, lacustrine basins, eskers, and extensive drumlin fields are widespread. The Section gradually descends in a series of broad, hilly plateaus to the coastal zone. Central Connecticut and western Massachusetts are characterized by a north to south trending basin, a lowland plain, punctuated with a central linear ridge. Primary geomorphic processes along the Appalachian Trail in this section are fluvial erosion, transport and deposition, and mass wasting. Elevation ranges from sea level to 1,500 ft (450 m). Some high hills (monadnocks) are 2,000 ft (600 m). Local relief ranges from 100 to 1,000 ft (30 to 300 m). Gentle slopes cover less than 20 to 80 percent of the area; 50 to 75 percent are in lowlands. Sub-envelop elevation

ranges from 0 to 650 ft (0 to 200 m).

Lithology and Stratigraphy:
Surficial geology is Pleistocene age. In the northeastern part, coastal lowlands are covered by glacial marine sediment (mostly clay). Thin, stony till and glacial fluvial and glacial lacustrine sediment overlie bedrock inland. The bedrock geology is varied and complex. Intense, northeast to southwest trending, faulting, and folding, and plutonic and volcanic episodes have resulted in variegated sedimentary, igneous, and metamorphic rocks. These include Triassic-Jurassic red conglomerate, sandstone and shale (the north to south trending lowland), with a prominent diabase sill (the linear ridge); Carboniferous sandstone, conglomerate, shale and dolostone; Paleozoic granites and volcanics; lower Paleozoic and Proterozoic quartzite, marble, schist, gneiss, and greenstone; and massive Proterozoic granite, granodiorite, diabase, and gabbro. Minimum elevations range from about 200 ft (61 m) in the north to near sea level. Maximum local elevations are generally under 500 ft (152 m) but range to 1,000 ft (305 m). Gentle slopes cover 50 to 80 percent of the area; 50 to 75 percent occurs in uplands.

Soil Taxa:
Interior Section taxa near the Trail include Dystrochrepts and Haplaquepts with udic and aquic moisture and mesic temperature regimes.

Section 221B - Hudson Valley Section (within the following subsections: 221Ba Hudson Limestone Valley, 221Bd Kittatinny-Shawangunk Ridges; and the following geographic areas: southeastern New York, northern New Jersey, and eastern Pennsylvania)

Geomorphology:
The Hudson Valley Section, which is the northernmost extension of the Ridge and Valley geomorphic province, overlaps approximately 72.9 miles of the Appalachian Trail along the northwestern New Jersey/northeastern Pennsylvania border. It is characterized by a linear lowland, a glacial lake plain in part, bounded on either side by high escarpments. The lowland was created by graben-faulting, easily eroded bedrock, and glacial scour. Fluvial erosion, transport and deposition, and mass wasting are the primary geomorphic processes operating. Minimum elevations along the Trail range from about 125 to 200 ft (61 m). Maximum local elevations are generally under 500 ft (152 m) but range to 1,000 ft (305 m). Gentle slopes cover 50 to 80 percent of the area, 50 to 75 percent slopes occur in uplands.

Lithology and Stratigraphy:
The northern half of the central lowland is covered by Pleistocene lacustrine sediments; the remainder is covered by Quaternary alluvium. The uplands have thin, stony till over bedrock. Ordovician carbonate, shale, siltstone, and sandstone form bedrock in the lowlands. Uplands to the east are Ordovician-Cambrian metasediments and metavolcanics; to the west are Silurian conglomerates and

Devonian limestones.

Soil Taxa:
Dystrochrepts and Fragiochrepts with udic moisture regime and mesic temperature regime are most common in the lower Hudson River valley and along the margin of the Catskill and Taconic Mountains. Hapludalfs with mesic temperature regime and udic moisture regime are more commmon in the upper valley.

Section M221A - Northern Ridge and Valley Section (within the following subsections: M221Aa Ridge and Valley Subsection, M221Ad Northern Great Valley Subsection; and the following geographic areas: east-central Pennsylvania)

Geomorphology:
The Northern Range and Valley Section overlaps approximately 169.1 miles of the Appalachian Trail in Pennsylvania. It forms part of the Ridge and Valley geomorphic province and is characterized by a series of parallel, southwest to northeast trending, narrow valleys and mountain ranges (high ridges) created by differential erosion of tightly folded, intensely faulted bedrock. Drainage is structurally controlled, dominantly trellis with some dendritic patterns. Mass wasting, karst solution, and fluvial erosion, transport and deposition are the dominant geomorphic processes currently active. Elevation ranges from 300 to 4,000 ft (100 to 1,200 m). Local relief is 500 to 1,500 ft (150 to 450 m).

Lithology and Stratigraphy:
A veneer of unconsolidated materials overlies most bedrock: residuum on flat and gently sloping uplands, colluvium on slopes, and alluvium in valley bottoms. Shale, siltstone, sandstone, chert, and carbonates form bedrock in this section. Ordovician and Silurian units dominate the northern part of the Section, with some Devonian, Mississippian, and Pennsylvanian units (including coal) exposed in the larger synclines, and Cambrian limestone exposed in a few anticlines. The southern part is dominated by Devonian units with lesser amounts of Silurian and Ordovician rocks in some anticlines, and Mississippian and Pennsylvanian rocks in some synclines. Cambrian rocks show up along a few major thrust faults. Sandstone, chert, and some of the tougher carbonates hold up most of the upland portions of the Section. Weaker carbonates and shale underlie most valleys.

Soil Taxa:
Soils are mostly Ultisols, Alfisols, and Inceptisols, with mesic temperature regimes and mostly udic moisture regime. They are derived from heavily-weathered shale, siltstone, sandstone residuum and colluvium, cherty limestone, and limestone residuum.

Common at higher elevations, while Hapludults are dominant in broad valleys. Rhodudults have formed over rocks with a high content of mafic minerals. Soils are

generally moderately deep and medium textured. Boulders and bedrock outcrops are common on upper slopes, but are not extensive. These soils have a mesic temperature regime, a udic moisture regime, and mixed mineralogy. Similar soils with a frigid temperature regime are typically present at elevations above 4,800 feet. Soils receive adequate moisture for growth of vegetation throughout the year.

Section M221B - Allegheny Mountains Section (M221Ba Ridge and Valley, and M221Bb Great Valley of Virginia; and the following geographic areas: southwestern Virginia and south-eastern West Virginia)

Geomorphology:

The Allegheny Mountains Section, which overlaps the Trail for approximately 203.5 miles as it swings west in southwestern Virginia and southeastern West Virginia, comprises part of the Appalachian Plateaus geomorphic province. It is a maturely dissected plateau characterized by high, sharp ridges, low mountains, and narrow valleys. It has a prominent structural and topographic grain created by broad, northeast to southwest trending folds in the bedrock. Drainage is dendritic to trellis, but primarily the former. Mass wasting, karst solution, and fluvial erosion, transport and deposition are the primary geomorphic processes operating. Elevation ranges from 1,000 to 3,000 ft (300 to 900 m). Local relief generally ranges from 1,000 to 2,500 ft (300 to 600 m).

Lithology and Stratigraphy:

Bedrock is overlain by residuum on the ridges and mountain tops, colluvium on the slopes, and alluvial materials in the valleys. Devonian shale and siltstone, Mississippian carbonates and sandstones, and Pennsylvanian shale, sandstone, and coal form bedrock in the Section. Sandstone and some of the tougher carbonates hold up most of the upland portions; weaker carbonates and shale underlie most valleys.

Soil Taxa:

Soils are dominantly Ultisols, Inceptisols, and Alfisols, with mesic temperature regime and udic moisture regime. They are derived from heavily weathered shales, siltstones, sandstone residuum and colluvium, and limestone residuum. Spodosols with frigid temperature regime and aquic moisture regime occur in isolated pockets at the highest elevations.

Section M221D - Blue Ridge Mountains Section (M221Da Northern Blue Ridge Mountain, M221Dc Southern Blue Ridge Mountain, and M221Dd Metasedimentary Blue Ridge Mountain; within the following geographic areas: southeastern Pennsylvania, central Maryland, the eastern panhandle of West Virginia, northern, central, and southern Virginia, eastern Tennessee, western North Carolina, and northern Georgia)

Geomorphology:

The Blue Ridge Mountains Section, which is located entirely in the Blue Ridge geomorphic province, overlaps the Appalachian Trail in two places: for 381.7 miles in southern Pennsylvania, Maryland, and central Virginia, and then for 506.3 miles in Tennessee, North Carolina, and Georgia. It was formed by tectonic faulting and uplift of resistant, crystalline bedrock into a relatively narrow band of highly metamorphosed, somewhat parallel mountain ranges. The northern part of this section (north of Roanoke Gap in Virginia) is characterized by a single, broad (5 to 10 mi, 8 to 16 km) ridge that extends into southern Pennsylvania. The southern half of the Section is broader, higher, more mountainous, and displays little or no structural grain. Though high (46 peaks are over 6,000 ft (1,820 m) in elevation), the mountains are rounded and generally lack prominent angularity. Drainage is structurally controlled, dominantly trellis in the north; dendritic patterns dominate the southern half. Landforms on about 80 percent of the section are low mountains. The remainder of the section consists of open lowlands. Elevation ranges from 1,000 to over 6,000 ft (300 to 1,800 m). Local relief ranges from 500 to 1,000 ft (150 to 300 m).

Lithology and Stratigraphy:

Bedrock is overlain by a veneer of residuum on the ridges and mountain tops, colluvium on the slopes, and alluvial materials in the valleys. Although structural grain is not evident in the south half, the whole section is bounded on the eastern and western margins by southwest to northeast trending thrust faults, between more faults and tight folds. Bedrock is composed primarily of Proterozoic metasediments (quartzite, schist, and gneiss) and meta-igneous rocks (granite, rhyolite, basalt, and gabbro). Smaller areas underlain by Paleozoic granite occur along the eastern edge of the Section, with lower Cambrian sandstone, shale and dolomite, and broad zones of intensely sheared and altered rock. Lower Cambrian rocks occur intermittently along the western edge as well.

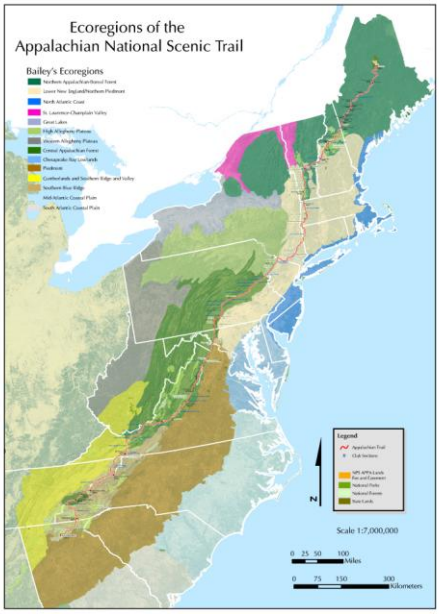
Soil Taxa:

Soils are dominated by Ochrepts and Udults. Dystrochrepts are on steep slopes of lower elevation mountains. Hapludults are on the low foothills, and Haplumbrepts have formed on foot slopes and in valleys.

C. Biological Resources

1. Forest Vegetation, Fauna, and Community Types

The following summary of potential natural vegetation and fauna is excerpted and adapted from Ecological Subregions of the United States, R.G. Bailey, USDA Forest Service (scale 1:7,500,000, revised 1994). The sections on vegetation community types come primarily from the A.T. natural heritage inventories and are specific to the Appalachian Trail.



Several important tables and maps accompany this section. Table II.C.1, Ecosystem Provinces, Sections, and Subsections along the Appalachian Trail *provides a tabular summary of the respective categories, and* Maps II.C.1, Ecoregions of the Appalachian National Scenic Trail; II.C.2, Ecological Units of the Eastern United States (Provinces); II.C.3, Ecological Units of the Eastern United States (Sections); II.C.4, Ecological Units of the Eastern United States (Subsections) *illustrate the regional and subregional boundaries.*

Section M212A - White Mountains Section The northernmost 401 miles of the Appalachian Trail in central and western Maine and northern New Hampshire lies within the White Mountains Ecosystem Section. (within the following subsections: M212Ac Maine Central Mountains, M212Ad White Mountains, M212Ae Mahoosuc Rangeley Lakes, and M212Af Connecticut Lakes; and the following geographic areas: western Maine, north-central New Hampshire)

Potential Natural Vegetation:

Kuchler vegetation types include northern hardwood, northern hardwood-spruce, and northeastern spruce-fir forest. Regionally-defined important vegetation types include northern hardwood-conifer, montane spruce-fir, lowland spruce-fir, alpine krummholz, and alpine meadow. Robbin's cinquefoil is a globally rare plant, unique to alpine communities of the Presidential Range in New Hampshire.

Fauna:

Spruce grouse, black-backed woodpecker, gray-cheeked thrush, long-tailed shrew, red squirrel, snowshoe hare, and moose characterize the colder conifer sites. Ruffed grouse, pileated woodpecker, broad-winged hawk, mourning warbler, chestnut-sided warbler, red-eyed vireo, barred owl, rose-breasted grosbeak, masked shrew, northern bog lemming, northern flying squirrel, and white-tailed deer characterize the hardwood-conifer sites. Eastern woodland caribou, wolverine, mountain lion, and timber wolf were extirpated. A few lynxes, bobcats, coyotes, black bears (seasonally), and humans are the larger predators today. Pine martens are increasing and fishers

are common. Spotted salamander, redback salamander, wood frog, northern leopard frog, mink frog, and eastern garter snake characterize a smaller herpetofaunal component compared to warmer and more southerly Sections in Maine and New Hampshire. The common loon, osprey, and otter commonly use the larger lakes, rivers, and flowages in the Section. Beech provides the primary source of hard mast in the Section.

***Vegetation Community Types*:**
This ecosystem section has some of the rarest and most significant plant communities in the Northeast. Alpine vegetation (above treeline) is one of the rarest community types in the eastern United States, found on only a fraction of one percent of the land. The alpine floristic community that is found on some of the highest summits over which the A.T. passes is considered to be unique in the United States. More than 60 species of plants here are considered to be true arctic-alpine species. This alpine plant community is composed primarily of low-growing shrubs, cushion plants, and graminoids. Dominant alpine species include Bigelow sedge (*Carex bigelowii*), three-forked rush (*Juncus trifidus),* deer-hair sedge (*Scirpus cespitosus*), blueberries and bilberries (*Vaccinium* spp.) diapensia (*Diapensia lapponicum*), mountain sandwort (*Minuartia groenlandica)*, three-toothed cinquefoil (*Potentilla tridentata*), and black crowberry (*Empetrum nigrum*).

In Maine, alpine ridge communities may be found at Mt. Katahdin, Bigelow Mountain, Baldpate Mountain, Goose Eye Mountain, and Saddleback Mountain. The only alpine area in NPS ownership along the full length of the A.T. is at Saddleback Mountain. The other four alpine areas are within State of Maine ownership. On Saddleback Mountain and Whitecap Mountain, krummholz plant communities may be found in the ecotone between alpine areas and spruce-fir forest. Treeline along the A.T. in Maine generally occurs above 3,500 feet. Alpine tarn plant communities along the A.T. in Maine are found at Bigelow/The Horns and Mahoosuc Arm/ Speck Pond. Speck Pond, located at an elevation of about 3,400 feet, is the highest tarn in Maine. Approximately 1,800 acres of alpine plant communities are found within the A.T. corridor in Maine. This acreage, combined with alpine plant communities along the Trail in New Hampshire, represents the only alpine area within a NPS unit in the eastern United States.

In the Presidential Range of New Hampshire's White Mountains, the A.T. crosses the largest continuous alpine area in the eastern United States. From Mt. Madison to Mt. Pearce (Mt. Clinton), the A.T. follows alpine ridges and mountains for 12.7 miles. Approximately 4,400 acres of alpine area lie within the A.T. corridor along this segment of the Trail, almost all of it within White Mountain National Forest. Along the middle portion of this segment, the A.T. crosses Mt. Washington, the highest peak in the Northeast at 6,288 feet. On average, alpine ridge communities are found above 4,700 feet here, but on Mt. Webster, the alpine area extends down to 3,800 feet. In addition to the alpine ridge community, numerous small alpine/subalpine bogs and a

few alpine/subalpine ponds (tarns) are found within the A.T. corridor in New Hampshire. To the east of the Presidential Range, a small alpine area that extends down to 3,700 feet is located on the summit of Shelburne Moriah Mountain. Southwest of the Presidential Range, the A.T. crosses alpine plant communities on Mt. Guyot, South Twin Mountain, Mt. Garfield, Mt. Layfayette, Mt. Lincoln, and Mt. Moosilauke.

Below treeline, high elevation or montane spruce-fir forest lies between about 2,200 feet and 4,000 feet in elevation. Red spruce (*Picea rubens*) and balsam fir (*Abies balsamea*) are the dominant species, with paper birch (*Betula papyrifera*) and mountain ash (*Sorbus americana*) also being present. Below this may be found lowland spruce-fir forest and a transitional northern hardwood-spruce forest. The northern hardwood forest dominates up to approximately 2,500 feet, with beech (*Fagus grandifolia*), sweet birch (*Betula lenta*), and sugar maple (*Acer saccarum*) being the predominant species. Hemlock (*Tsuga canadensis*) is often a significant component of this association. Other smaller community types include moist subalpine heathlands, acidic rocky summits, spruce woodlands, cold-air talus woodland, and streamshore and pondshore wetlands.

Section M212B - Vermont – New Hampshire Upland Section Approximately 96 miles of the A.T. corridor lies within this ecosystem section. (within the following subsections: M212Ba Vermont Piedmont, M212Bb Northern Connecticut Valley, and M212Bc Sunapee Uplands; and the geographic area of western New Hampshire and eastern Vermont)

Potential Natural Vegetation:
Kuchler vegetation types include northern hardwood and northern hardwood-spruce forest. Regionally-defined important vegetation types include montane spruce-fir, lowland spruce-fir, northern hardwood-conifer, and transition hardwood-conifer.

Fauna:
Gray jay, Cape May warbler, dark-eyed junco, red bat, snowshoe hare, red squirrel, fisher, and moose characterize the colder conifer sites in this Section. Ruffed grouse, pileated woodpecker, turkey, red-tailed hawk, chestnut-sided warbler, Nashville warbler, black-throated blue warbler, red-eyed vireo, rufous-sided towhee, scarlet tanager, smoky shrew, northern and southern flying squirrel, and white-tailed deer characterize the hardwood-conifer sites. Timber rattlesnake (in the southern part), American elk, timber wolf, and mountain lion were extirpated through land clearing and settlement activities. Coyotes, bobcats, a few lynxes, black bears (seasonally), and humans are the larger predators today. Pine martens and fishers are locally common. Beaver-created wetlands in this Section are common. Bullfrog, green frog, black duck, wood duck, hood merganser, northern harrier, great horned owl, meadow vole, mink and otter characterize the variety of wetlands. Spotted salamander, redback salamander, American toad, grey treefrog, spotted turtle, wood turtle, northern water

snake, and ribbon snakes characterize a richer herpetofaunal component than more northerly Sections. Oak and beech are primary sources of hard mast.

***Vegetation Community Types*:**
The Vermont-New Hampshire Upland Section contains many of the same forest communities as the preceding section, with the primary exception being that there are no alpine plant communities. The predominant vegetation community through which the A.T. passes in this section is the beech-birch-maple forest. This forest type extends up to about 2,500 feet above sea level. The primary trees in this vegetation community are beech (*Fagus grandifolia)*, sweet birch (*Betula lenta*), sugar maple (*Acer sa*ccarum), red maple (*Acer rubrum*), white pine (*Pinus strobus*), red oak (*Quercus rubra*), hemlock (*Tsuga canadensis*), and basswood (*Tilia americana*). On steep lower slopes or north slopes where soil is deep, a rich northern hardwood forest, high in species diversity, is present. In ravines on north-facing slopes and on dry thin-soiled west slopes, dense stands of Eastern hemlock and white pine are sometimes present. South and west-facing hills, because they are drier and generally warmer, have a greater proportion of red oak (*Quercus rubra*) and white oak (*Quercus alba*) in the overstory. Oaks are also more common in the Connecticut River Valley. At elevations above 2,000 feet, the beech-birch-maple forest intermixes with the spruce-fir forest type. Some community types of limited extent within this section of the A.T. are fens, seeps, bogs, a black spruce (*Picea mariana*) swamp, a red maple-tamarack (*Larix laricina*) peat swamp, and a calcareous rocky summit.

Section M212C - Green, Taconic, and Berkshire Mountains Section Approximately 207 miles of the A.T. corridor lies within this ecosystem section. (within the following subsections: M212Cb, Taconic Mountains, M212Cc Berskhire-Vermont Upland, and M212Cd Southern Green Mountain; and the geographic area of southern Vermont and western Massachusetts)

***Potential Natural Vegetation*:**
Kuchler vegetation types include northern hardwood, northern hardwood-spruce, and northeastern spruce-fir forest. Regionally-defined important vegetation types include montane spruce-fir, lowland spruce-fir, northern hardwood-conifer, and transition hardwood-conifer.

***Fauna*:**
The mountainous regions of southern and central Vermont and western Massachusetts have undergone tremendous changes in habitat conditions as a result of European settlement, the agrarian nature of that settlement, and continued human occupation of these mountains. The timber wolf and mountain lion were extirpated through land clearing activities and European settlement in the early 1900's. Other large vertebrates such as elk and moose were also eliminated from this region with encroaching settlement. Other species were also greatly reduced by human

inhabitants (e.g., beaver), as have been "noxious" species like the timber rattlesnake. With the re-establishment of forests on abandoned agricultural lands beginning in the late 1800's and early 1900's, many species have expanded to their original distributions. Wolves, mountain lions and elk have not returned. However, moose, beaver, bobcat, and black bear have steadily increased both in range and population with the changing habitat conditions. Efforts to re-establish species like the fisher and wild turkey have also proven successful. Common wildlife species include red-back salamander, red-spotted newt, gray treefrog, ruffed grouse, wood duck, barred owl, yellow-bellied sapsucker, black-capped chickadee, veery, red-eyed vireo, blackpoll warbler, ovenbird, little brown bat, snowshoe hare, northern flying squirrel, red-backed vole, white-tailed deer, and porcupine.

***Vegetation Community Types*:**
The Green-Taconic-Berkshire Section contains many of the same forest communities as the Vermont-New Hampshire Upland Section. A beech-birch-maple forest is found at lower elevations. In Vermont's Green Mountains, this forest type intermixes with spruce-fir forest at elevations above 2,000 feet. On the highest ridges of the Green Mountains can be found montane-spruce-fir forest. Above 3,800 feet, on Pico and Killington peaks, balsam fir (*Abies balsamea*) occurs in stunted form as krummholz.

In Massachusetts, the most extensive forest community in the A.T. corridor is the northern hardwood-hemlock forest at elevations of 1,000 to 2,000 feet. The dominant trees in this forest type are beech, black cherry (*Prunus serotina*), yellow birch (*Betula alleghaniensis*), paper birch (*Betula papyrifera*), red maple, sugar maple, red oak, white ash (*Fraxinus americana*), and Eastern hemlock. Mesic forest communities are dominated by sugar maple and white ash, and they have a high diversity of herbaceous plants. A dry, low-diversity, oak dominated forest with red oak, white oak, and red maple in the canopy is present on much of the long ridgeline between Jug End Summit and Sage's Ravine. Pitch pine (*Pinus rigida*) woodlands are scattered on rocky, exposed summits. A rarer dry forest type in the A.T. corridor is a calcareous mixed hardwood-hemlock forest that is present in the Vossburg Hills. A red spruce-balsam fir forest is found at elevations above 2,900 feet in Mt. Greylock State Reservation. Red spruce (*Picea rubens*) intermixes with the northern hardwood forest down to about 2,000 feet. Among the more limited plant community types found within the A.T. corridor in the Green-Taconic-Berkshire Mountains Ecosystem Section are shrub swamps, shrub fens, wet meadows, calcareous seepages, a calcareous marsh, and a forested swamp.

Section 221A - Lower New England Section Approximately 154 miles of the A.T. corridor lies within this ecosystem section. (within the following subsections: 221Ae Hudson Highlands; and the geographic area of northwestern Connecticut and southeastern New York)

***Potential Natural Vegetation*:**
Kuchler vegetation types include northern hardwood, Appalachian oak, and northeastern oak-pine forest. Regionally-defined important vegetation types include northern hardwood-hemlock-white pine, and central hardwoods.

***Fauna*:**
Disturbance of the original ecosystems and their faunal component resulted from European settlement. Large vertebrates were exterminated (*e.g.*, moose), reduced, or restricted (*e.g.*, white-tailed deer, wild turkey) by hunting and habitat loss. Original distributions were re-established or exceeded for some species with the re-establishment of forests on abandoned agricultural lands, in some cases, with higher population densities. The large predators have not returned; their niche has been partially filled by mid-size predators (*e.g.*, bobcat, coyote). This ecological shift, combined with hunting access restrictions, has resulted in imbalances between herbivores and plant resources. Extensive areas of regenerating forest and associated early successional habitat are lacking. Hard tree mast (*e.g.*, acorns, beechnuts) drives many faunal processes. Common wildlife species include the white-tailed deer, gray squirrel, white-footed mouse, red-eyed vireo, and red-spotted newt.

***Vegetation Community Types*:**
The Trail corridor in Connecticut consists primarily of mixed deciduous forests on lower slopes and oak/heath forests on middle and upper slopes. The mixed deciduous forest is a moist, mid-successional forest located on lower to middle slopes on all the ridges from Ten Mile Hill to Lion's Head. Sugar maple, white ash, black cherry (*Prunus serotina)*, and red oak are the major canopy species in this community. The second primary community type along the A.T. corridor in Connecticut is an oak-dominated forest that occupies drier, less fertile soils on middle and upper slopes for the entire length of the A.T. corridor in Connecticut. Red oak and chestnut oak (*Quercus montana*) are the most common trees, and ericaceous (heath) shrubs are primary components of the shrub layer. Eastern hemlock stands are common in ravines and on north-facing slopes. Rarer natural communities along the Trail corridor in Connecticut are floodplain forest, red maple-skunk cabbage (*Symplocarpus foetidus*) swamp, black spruce woodland swamp, circumneutral seepage forest, sugar maple-yellow oak (*Quercus muehlenbergii*)-hemlock forest on marble bluffs, rocky summit shrublands, and a shagbark hickory (*Carya ovata*)-Pennsylvania sedge (*Carex pensylvanica*) forest.

In New York's Appalachian Trail corridor, the most extensive plant communities are mixed coniferous-deciduous forests, dominated by hemlocks and several hardwood species, and upland deciduous forests, dominated by oaks. On lower slopes with moist soil, a relatively high diversity hardwood forest dominated by maples, oaks, hickories, black cherry, white ash, black birch, and hop hornbeam (*Ostrya virginiana*) is present. On mid-slopes, a drier, less diverse Appalachian oak-hickory forest consisting of red oak, chestnut oak, black oak (*Quercus velutina*), pignut hickory (*Carya glabra*),

black birch and red maple is present. On steep north or west-facing slopes and in ravines, a hemlock-northern hardwood forest frequently occurs. On upper slopes, a chestnut oak forest with ericaceous shrubs is present on thin, dry soils. On rocky ridgetops, a pitch pine-oak forest or pitch pine-oak-heath rocky summit community occurs.

Smaller scale upland habitats found within New York's A.T. corridor include oak-tulip poplar (*Liriodendron tulipifera*) forest, beech-maple forest, acidic talus slope woodland, and rocky summit grassland. Wetland vegetation types include red maple-hardwood swamp, floodplain forest, shrub swamp, highbush blueberry bog thicket, shallow emergent marsh, rich sloping fen, and inland Atlantic white cedar (*Chamaecyparis thyoides*) swamp.

Section 221B - Hudson Valley Section Approximately 73 miles of the A.T. corridor pass through the Hudson Valley Ecological Section. (within the following subsections: 221Ba Hudson Limestone Valley, 221Bd Kittatinny-Shawangunk Ridges; and the following geographic areas: southeastern New York, northern New Jersey, and eastern Pennsylvania)

***Potential Natural Vegetation*:**
Kuchler vegetation types include northern hardwood and Appalachian oak forest. Regionally-defined important vegetation types include central hardwoods, transition hardwoods, and pockets of northern hardwoods grading from south to north.

Fauna:
With European settlement, the original forest ecosystems and their forest-dependent fauna were reduced to marginal areas. With the re-establishment of forest on abandoned agricultural lands, many forest wildlife species have returned to their pre-settlement distributions and numbers. Large predators have not re-established themselves, either naturally or by re-introductions; and the reduced predation on major herbivores, especially white-tailed deer, has resulted in increasingly widespread overpopulation of these herbivores. Acorns are an important resource of forest habitats, providing an energy source that drives many wildlife processes. Fragmentation of forest cover by residential development is an important concern. Common wildlife species include white-tailed deer, gray squirrel, white-footed mouse, red-eyed vireo, and red-spotted newt.

***Vegetation Community Types*:**
In spite of its name, this part of the A.T. corridor is actually located in northwestern New Jersey and adjacent Pennsylvania. Most of the A.T. corridor in New Jersey passes through a dry, rocky chestnut oak forest dominated by chestnut oak and red oak, with associate species of red maple, black birch, black oak, and pignut hickory (*Carya glabra*). The shrub layer of this chestnut oak forest is dominated by ericaceous species such as mountain laurel (*Kalmia latifolia*) and blueberries (*Vaccinium* sp.). The

chestnut oak forest dominates the Trail corridor in Stokes State Forest, Worthington State Forest, High Point State Park, and Delaware Water Gap National Recreation Area. East of High Point State Park, chestnut oak forest covers the upper slopes of Pochuck, Wawayanda, and Bearfort mountains.

A more diverse mesic inland mixed oak forest dominates lower and midslope forests east of High Point State Park, with red oak, white oak, sugar maple, white ash, hop hornbeam, beech, and black cherry being common components. A mesic hemlock-hardwood forest community occurs in ravines and on sheltered north and west-facing slopes. A ridgetop pitch pine-scrub oak forest is often found on high, exposed ridges throughout New Jersey's A.T. corridor. Two rarer upland community types are dry-mesic calcareous forest and talus slope communities. Small-scale wetland community types found within the corridor include inland red maple swamp, floodplain forest, black spruce swamp, calcareous seepage swamp, and emergent and graminoid marsh.

Section M221A - Northern Ridge and Valley Section Approximately 169 miles of the Appalachian Trail lies within the Northern Ridge and Valley Ecological Section in east-central Pennsylvania. (within the following subsections: M221Aa Ridge and Valley Subsection, M221Ad Northern Great Valley Subsection; and the following geographic areas: east-central Pennsylvania)

Potential Natural Vegetation:
Because much of this area lies in the rain shadow of the Allegheny Mountains Section, vegetation reflects drier conditions. Kuchler types are mapped as Appalachian oak forest, oak-hickory-pine forest, and some northern hardwoods forest. Braun classified much of the area as oak-chestnut. Before arrival of the blight that decimated the chestnut, this Section was a stronghold of the species. Oaks now dominate. As a broad generalization, red and white oaks occur on more productive, mesic sites. Eastern white pine can occur, with white oak on the lower portions of slopes. Scarlet and black oaks are more common on drier sites. On the driest sites, oaks are mixed with pitch, table mountain, or Virginia pines. The latter can also occur as pure stands.

***Fauna*:**
The black bear is the sole representative of large carnivores. White-tailed deer are abundant and can have a major impact on understory flora. Smaller mammals include the gray and fox squirrels, deer mouse, meadow jumping mouse, weasels, and bats. The endangered Virginia big-eared and Indiana bats are associated with karst areas. Bird species are diverse and include a wide variety of both residents and neotropical migrants. Game birds include ruffed grouse and wild turkey. Bald eagles and peregrine falcons were never abundant historically. In recent years eagles have entered the area, and falcons have been reintroduced. Fish species include brook trout and sculpins at higher elevations, with the addition of smallmouth bass, rock bass, minnows, and darters at lower elevations. Amphibians and reptiles are abundant.

Insect life is highly diverse. Some butterfly and moth species are still being identified.

***Vegetation Community Types*:**
The dominant vegetation type here is mixed oak forest, which is present along the ridgetops that the A.T. frequently follows through this section. Primary components of the mixed oak forest are red oak, white oak, chestnut oak, scarlet oak (*Quercus coccinea*), red maple, tulip poplar, black birch, and several species of hickory. Scrub oak barrens of pitch pine, scrub oak (*Quercus ilicifolia*), sassafras (*Sassafras albidum*), and mountain laurel are found in the most xeric habitats. The Trail occasionally passes through Eastern hemlock-yellow birch ravines and forest stands. As the Trail crosses the Cumberland Valley, it passes through many disturbed and successional areas, but it occasionally passes through floodplain forest, mature oak-hickory forest, and xeric shale slopes of eastern red cedar (*Juniperus virginiana*). Small wetland areas within this ecological section include acidic seeps, grassy meadows, acidic shrub swamps, and rich seepage swamps.

Section M221B - Allegheny Mountains Section Between Roanoke and Marion, VA, to the west of Interstate 81, approximately 200 miles of the Appalachian Trail passes through the Allegheny Mountains Ecological Section. (M221Ba Ridge and Valley, and M221Bb Great Valley of Virginia; and the following geographic areas: southwestern Virginia and south-eastern West Virginia)

***Potential Natural Vegetation*:**
Kuchler mapped this Section as northeastern spruce-fir, northern hardwoods, mixed mesophytic, and oak-hickory-pine. Strongly influenced by elevation and aspect, the vegetation of the Allegheny Mountains can be placed in four broad groups: red spruce, northern hardwoods, mixed mesophytic, and oaks. Red spruce is characteristic above 3,500 ft (1,060 m) and includes stands of American beech and yellow birch. Beech is more common on northerly aspects, and yellow birch on southerly. The northern hardwood group features sugar maple occurring with beech and black cherry. The mixed mesophytic represents a transition to drier types and presents a wide variety of successional pathways. Characteristic species are red oak, basswood, white ash, and tulip poplar. The productive, diverse cove hardwoods are included in this group. Oak sites occur mostly on foothills, but are much less common in this Section than in the Northern Ridge and Valley Section.

***Fauna*:**
The black bear is the sole representative of large carnivores. Prior to European settlement, forests featured wolves, fishers, and mountain lions, but all of these species were hunted or trapped to local extinction. Fishers have since been reintroduced with modest success. White-tailed deer are abundant and can impact understory flora. Varying hare, red squirrel, and the endangered Virginia northern flying squirrel are associated with the red spruce vegetation zone (above 3,500 ft and primarily west and north of the Appalachian Trail). Elsewhere, gray and fox squirrels

are more abundant. Throughout the Section, smaller mammals include the deer mouse, meadow jumping mouse, various weasels, and bats. Bird species include a wide variety of both residents and neotropical migrants. Ruffed grouse and wild turkey are prominent game species. Fish species include brook trout and sculpins at higher elevations, with the addition of smallmouth bass, rock bass, minnows, and darters at lower elevations. Amphibians and reptiles are abundant. Insect life is highly diverse. New butterfly and moth species are still being identified.

Vegetation Community Types:
Among the forest types found in this section of the A. T. are mixed hardwood forest, mixed oak forest, chestnut oak-red oak forest, white pine-mixed oak forest, oak-hickory forest, Eastern hemlock-mixed hardwood forest, Eastern hemlock-oak forest, Eastern hemlock forest, Eastern hemlock-yellow birch forest, Eastern hemlock-red spruce forest, and sandstone slope woodland and glade. Small areas of high-elevation seepage wetland and acidic seepage wetland are also present.

Section M221D - Blue Ridge Mountains Section Approximately 890 miles of the Appalachian Trail passes through the Blue Ridge Mountains Ecological Section, extending from approximately Pine Grove Furnace State Park in Pennsylvania most of the distance to the end of the Appalachian Trail in northern Georgia. (M221Da Northern Blue Ridge Mountain, M221Dc Southern Blue Ridge Mountain, and M221Dd Metasedimentary Blue Ridge Mountain; within the following geographic areas: southeastern Pennsylvania, central Maryland, the eastern panhandle of West Virginia, northern, central, and southern Virginia, eastern Tennessee, western North Carolina, and northern Georgia)

***Potential Natural Vegetation*:**
Kuchler classified vegetation in this Section 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 shortleaf and Virginia pines. 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.) 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.

***Fauna*:**
Many species of small mammals and birds with northern or boreal affinities reach their southernmost range in eastern North America in the Blue Ridge Section. These include the New England cottontail rabbit, northern water shrew, rock vole, northern flying squirrel, blackburnian warbler, and saw-whet owl. This Section supports the largest diversity of salamanders in North America. At least 12 species of the genus *Plethodon* and six species of the genus *Desmognathus* are endemic to the Blue Ridge Section. Most endemic species are found in the central and southern subsections, where topographic relief is greater, peaks are more isolated, and higher rainfall occurs. Isolated populations of the green salamander and bog turtle are found in the southernmost subsection.

***Vegetation Community Types*:**
The Trail is not particularly diverse from southern Pennsylvania to Shenandoah National Park in Virginia, partly because of the minimal difference in elevation along this portion of the Trail. This region is characterized by a narrow chain of mountain peaks dominated by a canopy of oaks and hickories, interrupted by pockets of mesic forest with tulip poplar, maples, and beech. The dominant understory includes mountain laurel, flowering dogwood, spicebush (*Lindera benzoin*), and blueberries. Since most of the Trail follows ridgelines, conditions are lower in moisture with fewer ground layer species than in bottomland woods. Along the Potomac and Shenandoah rivers, the Trail passes through a floodplain forest. Along the West Virginia-Virginia border, the A.T. generally passes through a highly disturbed oak-hickory forest, with ericaceous shrub and ground layers and low species diversity. The Trail passes through a few small areas of basic seepage swamp.

In Shenandoah National Park, the A.T. has greater altitudinal variation, from less than 1,000 to more than 4,000 feet. Much of the Trail passes through mixed hardwood forest. In areas of greater moisture and on north slopes, the Trail passes through mixed hardwood-hemlock forest, with relatively small areas of Eastern hemlock forest, which have been heavily impacted by the hemlock woolly adelgid. Among the rarer plant communities along the Trail in Shenandoah National Park are both low and high-elevation greenstone glades. At the highest elevations of the Trail in the Park—around 4,000—the A.T. passes through scattered occurrences of red spruce (*Picea rubens*) and balsam fir (*Abies balsamea*).

In central and southern Virginia south of Shenandoah National Park, the Appalachian Trail passes through a variety of forest types, which is partly a result of the wide elevation change along this portion of the A. T. Among the more common forest types along this portion of the Trail are mixed oak forest, mixed hardwood forest, northern hardwood forest, oak-birch-heath forest, mixed oak-red maple forest, Eastern hemlock-mixed hardwood forest, Eastern hemlock forest, chesnut oak forest, pitch pine woodland, sugar maple forest, and Southern Appalachian cove hardwood forest. Less common vegetation types along the A. T. are several occurrences of shale slope

woodland, granitic glades, and low and high-elevation greenstone glades. At the Trail's highest elevations in Virginia (rising above 5,000 feet) at Mt. Rogers, Whitetop Mountain, and Pine Mountain are found several vegetation types unique to the state, such as red spruce-Fraser fir (*Abies fraseri*) forest, red spruce forest, Fraser fir forest, red spruce-yellow birch (*Betula alleghaniensis*) forest, and Southern Appalachian grassy bald.

In Tennessee and North Carolina, the elevation of the Appalachian Trail varies widely (from about 1,000-6,643 feet at Clingman's Dome), and the number of plant community types is possibly the greatest of any portion of the Trail. This is also the area of greatest tree diversity along the Trail. Among the more common vegetation types along this portion of the Appalachian Trail are montane oak-hickory forest, montane white oak forest, northern hardwood forest, high-elevation red oak (*Quercus rubra*) forest, Southern Appalachian northern hardwood cove forest, Southern Appalachian mesophytic cove forest, high-elevation mountain meadow, Carolina hemlock (*Tsuga caroliniana*) bluff forest, Eastern hemlock forest, pine-oak-heath forest, calcareous mesophytic forest, high-elevation rocky summits, montane acidic cliffs, boulderfield forest, high-elevation springs and seeps, Southern Appalachian bogs, heath balds, and riparian forests. A Southern Appalachian grassy bald plant community is found along much of the A. T. between Hump Mountain and Roan Mountain, as well as at Big Bald, generally at elevations above 5,000 feet. Red spruce-Fraser fir forest may also be found along sections of the Trail at Roan Mountain, Unaka Mountain, and at the highest elevations of Great Smoky Mountains National Park, generally above 5,000 feet. Both the red spruce – Fraser fir forest and the grassy balds are among the rarest plant community types along the entire Appalachian Trail.

In Georgia, the Appalachian Trail passes through a smaller number of forest types and plant communities than in Tennessee and North Carolina, partly due to the lower elevation range, which reaches a maximum at 4,458-foot Blood Mountain. There are no spruce-fir forests or Southern Appalachian grassy balds along the A. T. in Georgia. Among the more common forest types found along the Trail in Georgia are oak-hickory forest, cove hardwood forest, mixed mesophytic forest, tulip poplar forest, Eastern hemlock-white pine (*Pinus strobus*) forest, northern hardwood forest, boulderfield forest, rocky summits, and heath balds.

2. Rare, Threatened, and Endangered Species and Rare or Exemplary Natural Communities

More than 2,100 occurrences of rare, threatened and endangered (RTE) species and rare or exemplary natural communities have been identified at more than 515 natural heritage sites on Appalachian Trail lands. While some of these records are historic, the vast majority were identified or confirmed during recent surveys. The following

narrative summarizes these occurrences of rare, threatened, and endangered species by state, beginning in Maine and continuing south to the Trail's southern terminus in Georgia.

Occurrences of rare, threatened, and endangered (RTE) species were documented in a series of natural heritage inventories conducted on Appalachian Trail lands in each state between 1989 and 2001. *Table II.C.2, Inventories of Natural Heritage Resources Along the Appalachian Trail, by State, 1989 -2001* provides a summary of the occurrences found during these inventories. For the purposes of these natural heritage inventories, Appalachian Trail lands were defined as (a) all lands acquired by the National Park Service for the Appalachian Trail, (b) all lands affected by the Appalachian Trail prescription on National Forest lands, and (c) all lands in other jurisdictions, (such as state gamelands and state parks) within 500 feet either side of the footpath. State natural heritage program rankings were used to identify rare, threatened, and endangered species populations along the Trail. [See *Appendix C-1 State Natural Heritage Program Rankings*.]

Table II.C.2 Inventories of Natural Heritage Resources along the Appalachian Trail, by State, 1989 - 2001

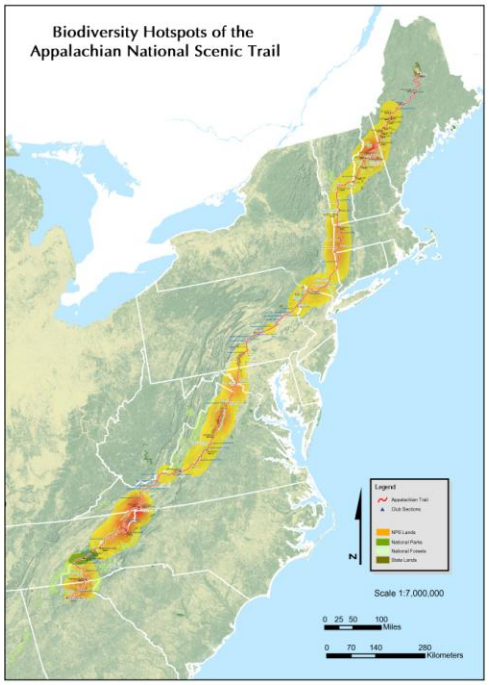
State	*Acreage Inventoried*	*Miles of A.T. Inventoried*	*Number of Natural Heritage Sites*	*Number of Natural Heritage Occurrences*	*Date Inventory Completed*
Maine	40,300	274.6	46	157	2000
New Hampshire	23,000	157.7	59	401	1991
Vermont	22,500	145.5	32	60	1991
Massachusetts	12,500	89.0	43	173	2000
Connecticut	6,000	46.7	27	57	1992
New York	12,292	90.9	21	56	2001
New Jersey	9,380	73.6	18	74	2001
Pennsylvania	30,000	229.8	15	25	1990
Maryland	5,372	37.0	8	32	2001
West Virginia	2,100	29.4	8	31	1997
Virginia	60,000	543.2	73	321	1994
Tennessee	10,800	73.2	58	167	1996
N. Carolina/Tenn.	27,500	234.0*	66	284	1993
Georgia	7,166	83.8**	41	214	2000

* Inventory includes approximately 88 miles of the A.T. that straddles the North Carolina/Tennessee border

**Inventory includes approximately 8 miles of the approach Trail to the Appalachian Trail at Amicalola Falls

The greatest number of rare, threatened, and endangered species, as well as many of the species of greatest rarity, are found on lands of the USDA Forest Service in New Hampshire, Virginia, Tennessee, North Carolina and Georgia. More than 200 occurrences of rare, threatened and endangered species and 70 rare or exemplary natural community occurrences are found on lands acquired by the National Park Service for the Appalachian Trail.

Additional occurrences of rare, threatened and endangered species are found near the Appalachian Trail in six other NPS units: Great Smoky Mountains National Park, Blue Ridge Parkway, Shenandoah National Park, Harpers Ferry National Historical Park, C & O Canal National Historical Park and Delaware Water Gap National Recreation Area. Data for RTE species in Great Smoky Mountains National Park exists, but it was not developed as part of the A.T. natural heritage inventories. Many additional RTE species within the A.T. corridor are found on state park and forest land, particularly in the states of Maine, Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, and Maryland. [See *Map II.B.1, Biodiversity Hotspots along the Appalachian National Scenic Trail.*]



Trailwide, the three greatest concentrations of rare, threatened and endangered species along the A.T. are in the Presidential Range of New Hampshire, the Mt. Rogers-Whitetop area of southwest Virginia, and the Roan Mountain area along the North Carolina-Tennessee border. All of these areas are on USDA Forest Service land. In the Presidential Range, 215 rare species occurrences have been documented on Appalachian Trail lands; in the Mt. Rogers-Whitetop area, 79 rare species occurrences have been documented; and in the Roan Mountain area, 67 rare species occurrences have been documented. Of the 14 occurrences of species on Appalachian Trail lands that are listed as federally endangered and the single occurrence listed as federally threatened, 11 lie within the two Southern biological hotspots. Table II.C.3 Federally Endangered and Threatened Species Along the A.T.

Federally Endangered and Threatened Species Along the A.T.

Geum radiatum	Spreading avens	E	G2	Roan Mountain Massif, Cherokee and Pisgah National Forests, TN/NC
Gymnoderma lineare	Rock gnome lichen	E	G2	Roan Mountain Massif, Cherokee and Pisgah National Forests, TN/NC
Glaucomys sabrinus coloratus	Carolina northern flying squirrel	E	G5T1	Roan Mountain Massif, Cherokee and Pisgah National Forests, TN/NC
Glaucomys sabrinus fuscus	Virginia northern flying squirrel	E	G5T2	Mt. Rogers National Recreation Area, Jefferson National Forest, VA
Plethodon shenandoah	Shenandoah salamander	E	G1	Shenandoah National Park
Isotria medeoloides	Small whorled pogonia	T	G2	State of Connecticut Land
Hedyotis purpurea	Roan Mtn. bluet	E	G5T2	Roan Mountain Massif, Pisgah National Forest, NC
Solidago spithamaea	Blue Ridge goldenrod	T	G1	Roan Mountain Massif, Cherokee and Pisgah National Forests, TN/NC
Microhexura montivaga	Spruce-fir moss spider	E	G1	Roan Mountain Massif, Cherokee and Pisgah National Forests, TN/NC

Approximately 330 occurrences of globally rare species [defined as G1, G2, or G3, using the natural heritage program ranking criteria – see *Table C*] are found within about 170 natural heritage sites on all Appalachian Trail lands. The greatest numbers of globally rare species are found within the states of New Hampshire, Virginia, Tennessee, North Carolina, and Georgia.

The number of species that are officially listed as state endangered or state threatened varies greatly from state to state, primarily because states differ in what groups of taxa are well-studied, what taxa have been inventoried, what habitats are traversed by the Trail, and what the listing process requires in each state. As a result, differences in counts between states should be treated with caution. For example, on Appalachian Trail lands, only seven species have been listed as state endangered or threatened in Virginia, while in New Hampshire 55 species have been listed as state endangered or threatened; yet both states have similar numbers of rare species occurrences.

Maine

Several globally rare species were found along the A.T. in Maine; however, none are listed as federally threatened or endangered. Among the significant finds of the Maine Natural Heritage Inventory were the discovery of a plant never before recorded in Maine, *Pinguicula vulgaris* (common butterwort), and the rediscovery of a rare rush,

Juncus vaseyi. Several sites along the A.T. in Maine provide breeding habitat for *Catharus bicknelli* (Bicknell's thrush), a species of special concern in the state and a breeding bird conservation priority in the United States and Canada.

The most significant natural heritage sites surveyed along the A.T. in the state are Bigelow Mountain, Goose Eye Mountain, West Sugarloaf Mountain, and Saddleback Mountain. Three of these four summits rise into the alpine (above treeline) zone, while the fourth, West Sugarloaf, lies primarily in the subalpine zone. The first two of these sites are on state-owned land, and the latter two sites are primarily located on land administered by the NPS Appalachian Trail Park Office. The summit of Katahdin, which is also in the alpine zone, was not thoroughly surveyed as part of this study. However, the Maine Natural Areas Program considers Katahdin to be among the most important sites for RTE plants in the state.

Bigelow Mountain has ten RTE plant occurrences and five rare animal occurrences, the greatest number of any site along the A.T. in Maine. Three globally rare species have been identified from this site: *Prenanthes boottii* (Boott's rattlesnake root), *Potamogeton confervoides* (alga-like pondweed), and *Catharus bicknelli* (Bicknell's thrush). These three species represent the only globally rare species identified along the A.T. in Maine. Goose Eye Mountain has ten occurrences of RTE plants.

Seven RTE plants have been identified on Saddleback Mountain, though more may be present, since land recently acquired from Saddleback Ski Area has not been fully surveyed. On West Sugarloaf Mountain, five RTE plants and one rare animal were identified on Appalachian Trail lands.

New Hampshire

A total of 401 RTE species occurrences were found in 59 natural heritage sites along the A.T. in New Hampshire during the survey completed in 1991, the most occurrences of any of the 14 states through which the A.T. passes. A primary reason for the large number of RTE species in NH is that the A.T. passes over many peaks in the relatively rare New England alpine zone, with individual peaks lying in close proximity to one another providing habitat for numerous discrete populations of rare alpine plants.

One of the rarest plants along the entire A.T. is *Potentilla robbinsiana* (Robbins' cinquefoil), a G1 plant whose entire global distribution consists of only two occurrences at high elevations in the White Mountains. This species is not only globally rare, but was officially listed as an endangered species at the federal level. Recently, the species was taken off of the federal threatened and endangered species list, due to an increase in its population size at these two locations over a number of years, as a result of transplanting activities coordinated by the Appalachian Mountain Club.

In addition to *Potentilla robbinsiana*, the following globally rare species were identified on Appalachian Trail lands in New Hampshire: *Betula minor* (small birch), *Geum peckii* (mountain avens), *Prenanthes bootii* (Boott's rattlesnake root), and *Arnica lanceolata*

(arnica). All but the last two species are found at several locations on Appalachian Trail lands in New Hampshire.

The most significant natural heritage sites in New Hampshire are Lakes of the Clouds/Monroe Flats, Great Gulf, Mt. Lincoln, Mt. Eisenhower, and Mt. Monroe/Oakes Gulf. Each of these sites has more than 15 populations of RTE species. All of the sites lie at least partially within New Hampshire's alpine zone, which is a rare community type in the eastern United States. The section of the A.T. in New Hampshire's Presidential Range represents the longest stretch of the A.T. that passes through alpine vegetation.

Vermont

In Vermont, a relatively small number of RTE species were found along the Appalachian Trail, at least by comparison to New Hampshire. The natural heritage inventory of the A.T. in Vermont identified 60 occurrences of RTE species and rare or exemplary natural communities within 32 natural heritage sites, most of which are located on lands managed by the Green Mountain National Forest. Natural heritage sites in Vermont generally contain no more than a handful of rare plant species or communities. In contrast to New Hampshire, no portion of the A.T. in Vermont passes through an alpine zone. Two plant species, *Potamogeton confervoides* (Tuckerman's pondweed) and *Panax quinquefolius* (ginseng), are considered globally rare. A rare bird species, *Catharus bicknelli* (Bicknell's thrush), has been found at higher elevations on Stratton and Glastenbury mountains.

The most significant natural heritage sites in Vermont are West Hartford Seep, Killington and Little Killington Peaks, Stratton Mountain, and Griffith Lake. West Hartford Seep is located on private land, and the other three natural heritage sites are located at least partially within Green Mountain National Forest.

Several globally rare communities were identified in the natural heritage inventory of the A.T. in Vermont. West Hartford Seep is an example of a riverside seep community, and Thendara Camp Fen and Totman Hill Fen are examples of medium fens. The globally rare subalpine krummholz community is represented on Pico Peak and Killington and Little Killington Peaks. Lottery Road Swamp is an example of a red maple-tamarack peat swamp.

Massachusetts

In the inventory in Massachusetts (completed in 2000), approximately 175 occurrences of RTE species were identified at 43 natural heritage sites on Appalachian Trail lands. The number of rare species and sites is unusually high for a state with less than 100 miles of the A.T. The inventory of Appalachian Trail lands in Massachusetts included a complete inventory of rare, threatened, or endangered vascular plants and a more limited inventory of rare vertebrates and some invertebrates. One globally rare plant, *Panax quinquefolius* (ginseng), and two globally rare animals, *Stylurus scudderi* (zebra clubtail dragonfly) and *Pieris virginiensis* (West Virginia white butterfly), were found

within the A.T. corridor in Massachusetts. Of the rare plants, 10 species are considered state endangered and 10 are state threatened. No federally endangered or threatened species were recorded along the A.T. in Massachusetts.

The most biologically significant site found along the A.T. in Massachusetts is the state's highest peak, Greylock Summit, in Greylock State Reservation. At the Greylock Summit natural heritage site, eight occurrences of RTE plants were identified. Of these, *Sorbus decora* (northern mountain ash), *Luzula parviflora* v. *melanocarpa* (black fruited woodrush), and *Vaccinium vitis-idaea* (mountain cranberry) are listed as endangered in Massachusetts. The occurrences of the latter two species on Mt. Greylock represent the only known locations for these species in Massachusetts. Occurrences of the state-rare *Dendroica striata* (blackpoll warbler) and *Desmocerus palliatus* (eastern elderberry longhorned beetle) were also observed on Greylock Summit.

Next in biological significance are natural heritage sites at Day Mountain and Hop Brook at Main Road. On Day Mountain, ten moderately rare species of vascular plants were identified within the rich mesic forest at this site, which is jointly owned by the NPS and the state. Three RTE animals were identified at the Day Mountain natural heritage site: *Accipiter cooperi* (Cooper's hawk), *Oporonis philadelphia* (mourning warbler), and *Pieris napi oleraceae* (mustard white butterfly). At Hop Brook at Main Road, on NPS land, are two RTE sedges, *Carex retrorsa* (hooked sedge) and *Carex tuckermanii* (Tuckerman's sedge), as well as four RTE animals – *Alasmidonta undulata* (triangle floater mussel), *Clemmys insculpta* (wood turtle), *Strophitus undulatus* (squawfoot mussel), and *Stylurus scudderi* (zebra clubtail dragonfly).

Other biologically significant natural heritage sites along the A.T. in Massachusetts are Hubbard Brook, Saddleball Ridge, Kitchen Brook Drainage, and the Dalton Gulf Area. At the Hubbard Brook site, the A.T. was rerouted a short distance to protect a population of the state-endangered *Agrimonia parviflora* (agrimony).

Two globally rare plant communities were documented in Massachusetts: a calcareous seepage swamp at the Shaker Campsite-Fernside Road site, and a silver maple-cottonwood floodplain forest at the Housatonic Floodplain natural heritage site.

Connecticut

The natural heritage inventory of Appalachian Trail lands in Connecticut was completed in 1992. The report documented 57 RTE species occurrences at 27 natural heritage sites along the Trail.

One globally rare (G2) and federally threatened plant, *Isotria medeoloides* (small whorled pogonia), is found on state land. This represents the only occurrence of this species in Connecticut. In 1998, the state prepared and implemented a management plan for the protection of this species by removing some trees to provide a more open habitat for the species.

Two globally rare animals are found on the A.T. in Connecticut: *Calephalis borealis* (northern metalmark butterfly), and *Papaipema* sp. *2* (ostrich fern borer moth).

The most significant natural heritage sites within or close to Appalachian Trail lands in Connecticut are Bingham Pond (private land), Bulls Bridge (NPS and Private land), Moore Brook/Spruce Swamp Creek (NPS land and private land), Bear Mountain (NPS land), and Lions Head and Wachocastinook Ravine (NPS land and private land).

Of the natural heritage sites in Connecticut, Bulls Bridge is the most significant site on NPS lands administered by the Appalachian Trail Park Office, and it has even been stated to be the most significant natural heritage site in the state of Connecticut. At Bulls Bridge, seven RTE plant occurrences, as well as two rare plant communities, circumneutral cliffs and dry circumneutral forest, were identified during the natural heritage inventory. In a subsequent inventory by a contract botanist in 2003, 13 RTE plant occurrences and five rare or exemplary natural communities were identified. Also found at the site is the globally rare *Calephalis borealis* (northern metalmark butterfly), a G3G4 species. The state endangered *Croatalus horridus* (timber rattlesnake) was observed at several locations along the Trail in Connecticut.

New York

A natural heritage inventory of RTE plants and animals along the A.T. in New York was completed in 2000. Field work for both plants and animals was undertaken by the New York Natural Heritage Office in 1999, with additional botanical field work performed by a contract botanist in 2000.

A total of 21 RTE plant occurrences, 13 RTE animal occurrences, and 22 rare community occurrences were identified at 21 natural heritage sites on Appalachian Trail lands in New York. No federally listed or globally rare plants were identified. One federally endangered and globally rare animal, *Accipenser brevirostrum* (shortnose sturgeon), was historically identified at the Hudson River natural heritage site. Another globally rare animal, *Enallagma lataerale* (New England bluet), was also identified within the A.T. corridor.

The most significant natural heritage site identified on Appalachian Trail lands in New York is Little Dam Lake, where several state-rare water plants were identified: *Potamogeton diversifolius* (water-thread pondweed), *Ceratophyllum echinatum* (prickly hornwort), *Megalodonta beckii* var. *beckii* (water marigold) and *Potamogeton pulcher* (spotted pondweed). Little Dam Lake also provides habitat for the state-endangered *Acris crepitans* (northern cricket frog). The most significant natural heritage site based on rare animal populations is the Hudson River near Bear Mountain Bridge, where *Accipenser brevirostrum* (shortnose sturgeon), *Falco peregrinus* (peregrine falcon), and *Haliaeetus leucocephalus* (bald eagle) have been identified. Nearby Iona Island, in the Hudson River, has been a well-documented bald eagle wintering area; the state has

designated this area as being off limits to all visitation.

Other significant rare species sites in New York are Hammersly Ridge, Bellvale Mountain, and South Mountain/Canada Hill. At Hammersly Ridge, The Nature Conservancy is a partial landowner and has been monitoring and managing the *Chamaelirium luteum* (blazing star) populations at the site.

Several globally rare plant communities were identified on Appalachian Trail lands in New York: an inland Atlantic white cedar swamp (G2G3) on Bellvale Mountain, a rich sloping fen (G3) on Hammersly Ridge, a floodplain forest (G3G4) community at Great Swamp, and a rocky summit grassland (G3G4) on Black Mountain and Bear Mountain. Several high-quality examples of three state-rare communities also exist on A.T. lands in New York: oak-tulip tree forest (six sites), pitch pine-oak-heath rocky summit (seven sites), and highbush blueberry bog thickets (four sites).

New Jersey

An inventory of RTE plants and rare or exemplary natural communities was completed on Appalachian Trail lands in New Jersey in 2001.

In this inventory, 54 occurrences of 41 rare plant taxa were identified at 18 natural heritage sites on Appalachian Trail lands. No federally-listed or state-listed taxa were identified on Appalachian Trail lands in New Jersey. However, two globally rare plants, *Poa languida* (drooping bluegrass) and *Panax quinquefolius* (ginseng) were found within the corridor. Thirteen occurrences of S1 plants (species that have been found in five or fewer locations in the state) were identified: *Amelanchier sanguinea* (round-leaved serviceberry), *Arceuthobium pusillum* (dwarf mistletoe), *Botrychium simplex* var. *simplex* (little grape fern), *Carex brunnescens* (brownish sedge), *Carex deweyana* (Dewey's sedge), *Kalmia polifolia* (pale laurel), *Lonicera canadensis* (fly honeysuckle), *Picea rubens* (red spruce), *Pinus resinosa* (red pine), *Rhododendron canadense* (rhodora), and *Streptopus roseus* (rosy twisted stalk). The occurrence of *Pinus resinosa* on Breakneck Mountain is the only known occurrence of this species anywhere in New Jersey.

The most significant natural heritage site along the A.T. in New Jersey is Breakneck Mountain, with its population of *Pinus resinosa* and three other S1 plants, *Amelanchier sanguinea*, *Carex deweyana*, and *Lonicera canadensis*. All four species have an endangered status in the state. Several less rare species are also found at this site. A state-rare talus slope community also is located here.

Next in significance among the natural heritage sites on A.T. lands in New Jersey are Tocks Swamp, Pochuck Creek Crossing, Dunnfield Creek, and Crater Lake. Tocks Swamp is a state-rare black spruce swamp that is home to the state-rare *Arceuthobium pusillum* (dwarf mistletoe), *Kalmia polifolia* (pale laurel), *Picea rubens* (red spruce), *Betula papyrifera* (paper birch), *Cornus canadensis* (bunchberry), and *Vaccinium oxycoccus* (small cranberry). The Pochuck Creek Crossing Natural Heritage Site contains nine

state-rare plants and three state-rare natural communities: calcareous seepage swamp, floodplain forest, and dry-mesic calcareous forest. The Dunnfield Creek Natural Heritage Site contains five state-rare plants and a mesic hemlock-hardwood forest, and the Crater Lake Natural Heritage Site has four state-rare plants and a state-rare example of a ridgetop pitch pine-scrub oak forest.

A total of 18 occurrences of seven rare natural community types have been identified on Appalachian Trail lands in New Jersey. State-rare plant communities found in upland areas include three examples of mesic hemlock-hardwood forest, six examples of ridgetop pitch pine-scrub oak forest, and two talus slope community sites. The only rare high-elevation wetland community identified in New Jersey is the black spruce swamp at Tocks Swamp. The calcareous Vernon Valley supports the possibly globally rare dry-mesic calcareous forest and the state-rare calcareous seepage swamp at Pochuck Creek Crossing. Pochuck and Wawayanda Creeks in the Vernon Valley and the Wallkill River have corridors of floodplain forest on river banks and terraces.

Pennsylvania

In spite of the length of the Trail's 229-mile route through Pennsylvania, a natural heritage inventory of Pennsylvania's A.T. lands completed in 1990 documented only 25 occurrences of RTE species and exemplary natural communities at 15 sites. The number of occurrences documented in the Pennsylvania inventory is smaller than any other Trail state, even states with fewer than 40 Trail miles, such as Maryland and West Virginia. One likely reason for the comparatively low number of occurrences documented in the Pennsylvania inventory is that only high potential sites and wetlands were targeted for field survey, compared to some smaller states, where all Trail miles were surveyed.

In 2002, a search of natural heritage records located on or near the Appalachian Trail in Pennsylvania uncovered an additional 49 occurrences of RTE species and exemplary natural communities. These records primarily resulted from a more thorough biological inventory of Cumberland County and from targeted animal surveys at other locations along the Trail. This tripling of natural heritage records along the A.T. in Pennsylvania illustrates the importance of surveying all A.T. lands (not just those of highest potential significance) and the dynamic nature of rare species occurrences over time.

No federally endangered plants or animals have been documented on Appalachian Trail lands in Pennsylvania. Two globally rare plants, *Carex polymorpha* (variable sedge) and *Euphorbia purpurea* (glade spurge) have been documented on Appalachian Trail Park Office lands. Two globally rare animals, *Papaipema* sp. *1* (Amainthium borer) and *Neotoma floridana* (Eastern woodrat), have been documented on state land along the A.T. in Pennsylvania.

The most significant natural heritage sites identified on Appalachian Trail lands in Pennsylvania are Big Flat Barren, Blue Mountain Ridge Top, Hunters Run, Big Offset Barren, and Stony Mountain. The Big Flat Barren and Blue Mountain Ridge Top sites

each contain several rare noctuid moth species. The *Papaipema* sp*. 1* at Blue Mountain Ridge Top is considered to be globally rare. The globally rare *Neotoma floridana* is documented at the Stony Mountain Natural Heritage Site.

The Hunters Run Natural Heritage Site has the greatest number of rare plant species documented along the A.T. in Pennsylvania, including the globally rare *Euphorbia purpurea*, as well as the state-threatened *Aster radula* (low rough aster) and *Solidago speciosa* (showy goldenrod). An occurrence of the globally rare *Carex polymorpha* (variable sedge) is located within the Big Offset Barren Natural Heritage Site. The two globally rare occurrences of *Euphorbia purpurea* and *Carex polymorpha* are the rarest species occurrences documented on Appalachian Trail Park Office lands in any A.T. state.

Maryland

A natural heritage inventory was conducted along 37 miles of the Appalachian Trail in Maryland in 2001. Although the inventory's primary concentration was to document RTE plants and exemplary natural communities, observations were also made of promising habitats for rare animal species. A total of 32 occurrences of RTE plants and five exemplary natural community occurrences were documented at eight natural heritage sites on Appalachian Trail lands.

The natural heritage inventory of Appalachian Trail lands in Maryland did not document any federally threatened or endangered species. One occurrence of *Neotoma magister* (Allegheny woodrat), a globally rare animal, was documented on NPS land in Harpers Ferry National Historical Park.

The most significant natural heritage sites in Maryland are on federal land within Harpers Ferry National Historical Park and the C & O Canal National Historical Park. The Maryland Heights site, which is located within Harpers Ferry National Historical Park, is the most significant natural heritage site identified along the Appalachian Trail in Maryland, followed by the Sandy Hook Floodplain and Weverton Floodplain sites along the C & O Canal.

The Maryland A.T. inventory documented five occurrences of exemplary natural communities. Two occurrences of silver maple wetland forest were documented where the A.T. passes through the C & O Canal National Historical Park. Two exemplary occurrences of sugar maple-yellow birch-American basswood forest were documented along the northern portion of the A.T. corridor in Maryland, and one occurrence of hemlock-sugar maple-yellow birch forest was documented in this same area.

West Virginia

Of the eight natural heritage sites that were identified along the Appalachian Trail in the Eastern Panhandle of West Virginia, five are within Harpers Ferry National Historical Park and three are on lands administered by the NPS Appalachian Trail Park Office.

There are no federally threatened and endangered species within this stretch of the A.T. The only globally rare species observed along the A.T. in West Virginia is *Scutellaria saxitalis* (rock skullcap).

No rare, threatened, or endangered species were found along a separate section of the Trail on the West Virginia-Virginia border several hundred miles to the south.

The most significant of the natural heritage sites along the A.T. in West Virginia lie within Harpers Ferry National Historical Park. Several rare plants in this section are known from only a few localities in West Virginia. Among these are *Scutellaria saxitalis*, *Maianthemum stellatum* (starry false Solomon's seal), *Melica nitens* (three-flower melic grass), *Arabis shortii* (Short's rockcress), and *Decodon verticillata* (hairy swamp loosestrife). One of the sites, Loudoun Heights, has four RTE plants, including the globally rare *Scutellaria saxitalis* (rock skullcap). This site also has two state rare animals, *Erynnis lucillus* (columbine duskywing) and *Eumeces laticeps* (broadleaf skink).

Several occurrences of significant natural communities, including rock outcrops, basic seepage swamps, and river floodplains, were identified along the Trail in northeastern West Virginia. The site with the greatest diversity of significant natural communities is the Wilson Gap/Devils Racecourse/Sand Spring site. This natural heritage site, located on Appalachian Trail Park Office lands as well as the adjacent Rolling Ridge tract (on which the Appalachian Trail Conservancy has an easement), contains several occurrences of state rare plant and animal species.

Virginia

Within Virginia, the Trail passes through 74 natural heritage sites containing 320 occurrences of RTE plant and animal species and rare or exemplary natural communities.

Seven occurrences of federally endangered rare animal species lie within the Trail corridor in Virginia. One of the rarest animals found along the entire length of the A.T. is the federally threatened *Plethodon shenandoah* (Shenandoah salamander). The entire global distribution of this species consists of a few occurrences within Shenandoah National Park, four of which are next to or overlap the Appalachian Trail. A federally endangered mammal, *Glaucomys sabrinus fuscus* (Virginia northern flying squirrel), occurs in three locations along the Appalachian Trail on U.S. Forest Service land in the Mt. Rogers National Recreation Area in southern Virginia. No federally endangered or threatened plants were documented on Appalachian Trail lands in Virginia, though many occurrences of globally rare plants were found.

The natural heritage inventory of Appalachian Trail lands in Virginia, which was completed in 1994, documented 56 occurrences of 23 globally rare plant and animal species within 29 natural heritage sites. The number of globally rare species found on Appalachian Trail lands in Virginia is the second highest number of any A.T. state. The

globally rare *Abies fraseri* (Fraser fir) is the rarest tree species documented along the entire A.T. Its global distribution is restricted to a few of the highest summits of the southern Appalachians. The Fraser fir's only location along the A.T. in Virginia is in the Mt. Rogers area. The rarest shrub documented along the entire A.T. is *Buckleya distichophylla* (piratebush), a G2 species found only in southwest Virginia and along the Tennessee-North Carolina border. In Virginia, piratebush is found on U.S. Forest Service land in the vicinity of Dragon's Tooth, McAfee Run, and Dismal Creek.

Other globally rare plant occurrences documented on Appalachian Trail lands in Virginia are: *Iliamna remota* (kankakee globe-mallow), *Carex polymorpha* (variable sedge), *Ilex collina* (long-stalked holly), *Paxistema canbyi* (Canby's mountain-lover), *Phlox buckleyi* (sword-leaved phlox), *Saxifraga caroliniana* (Carolina saxifrage), *Cardamine clematitis* (mountain bittercress), *Poa paludigena* (bog bluegrass), *Euphorbia purpurea* (glade spurge), *Hypericum mitchellianum* (Blue Ridge St. John's wort), *Prenanthes roanensis* (Roan rattlesnake root), *Cacalia muhlenbergii* (great Indian plantain), and *Phlox amplifolia* (large-leaved phlox). The single population of *Iliamna remota*, located on land owned by CSX Railroad adjacent to the former route of the Trail, apparently became extirpated several years ago. It also appears that the population of *Phlox amplifolia* on U.S. Forest Service land is no longer present. Several populations of *Poa paludigena* have been documented along the A.T. in Shenandoah National Park and the state-administered G. Richard Thompson Wildlife Management Area. *Carex polymorpha* has been documented in Shenandoah National Park and on U.S. Forest Service land at Punchbowl Mountain. *Ilex collina* and *Cardamine clematitis* occur at several localities along the A.T. in the Mt. Rogers area. The single A.T. populations of *Paxistima canbyi* and *Phlox buckleyi* occur in Shenandoah National Park, and several populations of *Euphorbia purpurea* occur within the A.T. corridor in the park. *Ilex collina*, *Hypericum mitchellianum*, *Prenanthes roanensis*, and *Cardamine clematitis* occur at several localities in the Mt. Rogers area.

Eight globally rare animal species and two federally endangered species have been documented along the A.T. in Virginia. The two federally endangered species, *Plethodon shenandoah* (Shenandoah salamander) and *Glaucomys sabrinus fuscus* (Virginia northern flying squirrel), have been previously noted. Other globally rare salamanders documented near or on the A.T. are *Plethodon hubrichti* (Peaks of Otter salamander) and *Plethodon welleri* (Weller's salamander). A globally rare bird, *Thryomanes bewickii altus* (Appalachian Bewick's wren) was documented from the Bluff City pasture area, but it is not known to currently exist at the site. Other globally rare animals identified on Appalachian Trail lands are *Stygobromus* sp. *nov*. (Sherando spinosoid groundwater amphipod) on Blue Ridge Parkway land, *Semionellus placidus* (a millipede) in Shenandoah National Park, and *Stygobromus spinosus* (Blue Ridge Mountain amphipod) in Shenandoah National Park and on lands administered by the NPS Appalachian Trail Park Office at Reservoir Hollow and Calf Mountain Springs natural heritage sites.

Several globally rare plant communities have been documented along the A.T. in Virginia: eutrophic saturated scrub, oligotrophic saturated scrub, oligotrophic herbaceous vegetation, oligotrophic scrub, mesotrophic scrub, submesotrophic scrub, and oligotrophic forest.

Based on the number and rarity of RTE species found at each site, the most significant natural heritage site along the A.T. in Virginia, and indeed the entire A.T., is Whitetop Mountain. This site, located on U.S. Forest Service land in Mt. Rogers National Recreation Area, contains 35 occurrences of 19 RTE plant and animal species and six occurrences of rare natural communities. Next in significance is the adjacent Mt. Rogers Natural Heritage Site, containing 29 occurrences of 23 RTE species, making this the third most significant site on the entire Appalachian Trail. Stony Man Mountain and Hawksbill Mountain in Shenandoah National Park are the next most significant natural heritage sites along the A.T. in Virginia. Pine Mountain near Mt. Rogers and The Pinnacle in Shenandoah National Park also contain a substantial number of RTE species occurrences.

Tennessee

In a 70-mile stretch of the A.T. in northeastern Tennessee (between the Virginia border and Roan Mountain on the Tennessee/North Carolina border), 167 occurrences of RTE species and rare or exemplary natural communities were documented within 58 natural heritage sites. Compared to the other state inventories, this is an unusually large number of rare species occurrences for such a short distance of the Trail. The Tennessee inventory, completed in 1997, documented 36 RTE plant species, four rare animal species, and 19 rare or exemplary natural communities. The four RTE animals that were documented on Appalachian Trail lands are *Corvus corax* (raven), *Limnothlypsis swainsonii* (Swainson's warbler), *Neotoma magister* (Allegheny woodrat), and *Pooecetes gramineus* (vesper sparrow). Almost all of the A.T. in northeastern Tennessee lies within the Cherokee National Forest, with a small portion occurring on Tennessee Valley Authority land near Watauga Lake.

None of the RTE species found along this portion of the A.T. are federally listed, though quite a few of them are globally rare. Two globally rare and state threatened trees, *Abies fraseri* (Fraser fir) and *Tsuga caroliniana* (Carolina hemlock), are found on Appalachian Trail lands in Tennessee. Sixteen occurrences of Carolina hemlock are found within the A.T. corridor. *Buckleya distochophylla* (piratebush), found within the Big Laurel Branch Wilderness, is the only globally rare shrub found within Tennessee on Appalachian Trail lands. There are seven species of globally rare herbaceous plants found along this portion of the A.T.: *Helianthus glaucophyllus* (white-leaved sunflower), *Prenanthes roanensis* (Roan rattlesnake root), *Gentiana austromontana* (Appalachian gentian), *Aconitum reclinatum* (Trailing wolfsbane), *Panax quinquefolius* (ginseng), Saxifraga *careyana* (Carey's saxifrage), and *Scutellaria saxitilis* (rock skullcap). One species of a globally rare mammal, *Neotoma magister* (Allegheny woodrat), was documented on Appalachian Trail lands near the Tennessee/Virginia border.

The most significant natural heritage site on Appalachian Trail lands in Tennessee (north of Roan Mountain, which is discussed in the next subsection) is Doll Flats Spring in Cherokee National Forest. This site contains the globally rare *Aconitum reclinatum*, *Prenanthes roanensis*, and *Saxifraga careyana*, as well as several less rare species. Other natural heritage sites on Appalachian Trail lands that contain at least two globally rare species are Big Laurel Branch Wilderness South, Doll Flats Meadow, Doll Flats Vista to Powerline, Doll Flats to Vista, Canute Place West Relocation, and Lost Pole Knob. Other natural heritage sites that have at least one globally rare species and five total RTE species occurrences are Dennis Cove Homesteads and Laurel Fork South.

Among the rare or exemplary natural communities found along the A.T. in Tennessee are acidic mesic and xeric cliffs, Carolina hemlock bluff forest, riverine forest, high elevation springs and seeps, boulderfield forest, grasslands, and high elevation meadows. At the present time, rarity rankings for these and other natural communities in Tennessee are lacking.

North Carolina (including portions of Tennessee where the Appalachian Trail follows the boundary between the two states)

The natural heritage inventory of the A.T. in North Carolina covers 234 miles of the Trail on U.S. Forest Service lands between Roan Mountain on the North Carolina/Tennessee border and the North Carolina/Georgia border. The North Carolina inventory was completed in 1993. It covers the lengthy portion of the A.T. that generally follows the North Carolina-Tennessee border from Roan Mountain to the Great Smokies, as well as the 70 miles south of the Smokies to the Georgia border. However, because biological inventories in the Smokies had already occurred or were underway, the section of the Trail passing through Great Smoky Mountains National Park was not surveyed as part of this A.T. inventory.

Within the 234 miles of the A.T. covered by the North Carolina inventory, 285 occurrences of RTE species and rare or exemplary natural communities were documented. The high elevation portion of the A.T. along Roan Mountain straddling the North Carolina/Tennessee border has one of the highest concentrations of RTE species occurrences along the entire A.T.

The North Carolina A.T. inventory was more extensive than inventories in many of the other A.T. states. Surveys were conducted for both vascular and non-vascular plants, as well as a number of animal groups. However, like some of the early A.T. natural heritage inventories in New England, the boundaries of occurrences of individual RTE species were not mapped.

The segment of the Appalachian Trail included in the North Carolina inventory contains by far the greatest number of globally rare species found in any A.T. state. Thirty-nine species of globally rare plants and seven species of globally rare animals were

documented from this portion of the A.T. One G1 plant – the federally threatened *Solidago spithemea* (Blue Ridge goldenrod) – has an extremely limited high-elevation distribution. Another G1 species, *Cephaloziella obtusilobula* (a liverwort) is not currently listed as federally endangered or threatened. *Microhexura montivaga* (spruce-fir moss spider) is a G1 federally endangered species. *Glaucomys sabrinus coloratus* (Carolina northern flying squirrel) is a G5T1 federally threatened species. *Trechus roanicus* (a ground beetle) may also be a G1 species, though its rarity is somewhat uncertain.

Fourteen species of plants and animals having a rarity rank of G2 (species that are known from six to 20 occurrences worldwide) were documented in the inventory. The following G2 plants occur on Appalachian Trail lands in this area: *Buckleya distichophylla* (piratebush), *Geum radiatum* (spreading avens), *Geum geniculatum* (bent avens), *Lysimachia fraseri* (Fraser's loosestrife), *Silene ovata* (mountain catchfly), *Hedyotis* (*Houstonia) purpurea var. montana*, *Brachydontium trichodes* (peak moss), *Plagiochila sullivantii* var. *sullivantii* (a liverwort), *Gymnoderma lineare* (rock gnome lichen), *Xanthoparmelia monticola* (a foliose lichen), and *Drepanolejeunea appalachiana* (a liverwort). Of these globally rare plants, *Hedyotis* (*Houstonia) purpurea var. montana, Geum radiatum,* and *Gymnoderma lineare* are federally endangered species.

The following G2 insects were also documented from the North Carolina portion of the A.T.: *Trechus luculentus luculentus* (a ground beetle), *Trechus luculentus wayahensis* (a ground beetle), and *Semiothisa fraserata* (Fraser fir angle).

Twenty-four G3 plants were documented on Appalachian Trail lands in the North Carolina inventory: *Trillium rugelii* (southern nodding trillium), *Trillium simile* (sweet white trillium), *Aconitum reclinatum* (Trailing wolfsbane), *Coreopsis latifolia* (broadleaf coreopsis), *Euphorbia purpurea* (glade spurge), *Helianthus glaucophyllus* (whiteleaf sunflower), *Lilium grayi* (Gray's lily), *Calystegia catesbiana* ssp. *sericata* (Blue Ridge bindweed), *Prenanthes roanensis* (Roan rattlesnake-root), *Carex misera* (wretched sedge), *Carex manhartii* (Manhart's sedge), *Panax quinquefolius* (ginseng), *Hypericum buckleyi* (Blue Ridge St. John's wort), *Hypericum mitchellianum* (St. John's wort), *Gentiana austromontana* (Appalachian gentian), *Stellaria corei* (Core's starwort), *Cardamine flagellifera* (Blue Ridge bittercress), *Thermopsis villosa* (Aaron's rod), *Saxifraga careyana* (Carey's saxifrage), *Disporum maculatum* (nodding mandarin), *Huperzia appalachiana* (Appalachian fir clubmoss), *Brachydontium trichodes* (peak moss) *Cephaloziella spinicaulis* (a liverwort), and *Hydrothyra venosa* (an aquatic lichen). *Erora laeta* (early hairstreak) is the only G3 animal documented along this portion of the A.T.

Roan Mountain, located along the North Carolina/Tennessee border, is the most significant natural heritage area documented along the A.T. in either state. Roan Mountain has so many RTE species that the mountain was divided into 6 natural heritage sites in the inventory. If taken as a whole, the six Roan Mountain natural heritage sites have the greatest number of RTE species and occurrences along the entire

A.T., with 45 occurrences of 24 different RTE plant species and 23 occurrences of 21 RTE animal species. More than one-half of the rare species occurrences on Roan Mountain are globally rare.

After Roan Mountain, the next most significant natural heritage sites documented in the North Carolina A.T. inventory are Standing Indian, with 10 rare plant and animal occurrences, and Big Bald, with 12 RTE plant and animal occurrences. Next in significance are the Rock Gap-Wallace Gap natural heritage site, with seven rare plant occurrences; Wayah Bald, with seven rare plant and animal occurrences; Hot Springs/Lover's Leap, with 11 rare plant and animal occurrences; and Wine Spring Bald, with six rare plant and animal occurrences.

Appalachian Trail lands in North Carolina also contain quite a few globally rare natural communities. The distribution of the red spruce-Fraser fir forest, which is a G2 natural community, is limited to the highest elevations of Roan Mountain, Unaka Mountain, and the Great Smoky Mountains. Grassy balds, also a G2 natural community, are found on Appalachian Trail lands on Roan Mountain, Grassy Ridge, and Big Bald. Other G2 natural communities found at natural heritage sites within the North Carolina portion of the A.T. are: high elevation rocky summit (found on Standing Indian, Muskrat Creek Shelter/Kitchens Knob/Raven Rock, Pinnacle Mountain/Big Spring Gap Shelter, and Rocky Bald); low elevation rocky summit (found at The Jump-up); boulderfield forest (found on Wine Spring Bald, Yellow Mountain, Rock Creek Headwaters, Indian Grave Gap, Stecoah Gap South, and Hogback); montane white oak forest (found at Siler Bald/Snowbird Gap and High Top); a swamp forest-bog complex (found at White Oak Swamp); and montane mafic cliff (found at Nantahala River North). High elevation seeps, a G3 natural community, also are found within this portion of the A.T. at several locations (Standing Indian, Standing Indian Shelter, Roan Mountain, Sassafras Ridge, Burningtown Bald/Cold Spring Shelter, Yellow Mountain, Walker Gap/Bee Cove, Muskrat Creek Shelter/Kitchens Knob/Raven Rock, and Rock Gap-Wallace Gap).

Georgia

The natural heritage inventory of the A.T. in Georgia was completed in 2000. In addition to covering 76 miles of the Appalachian Trail, the inventory also included the eight-mile approach Trail to Springer Mountain, which begins in Amicalola Falls State Park.

On Appalachian Trail lands in Georgia, 214 occurrences of RTE species were found in 41 natural heritage sites, which is a high number of occurrences for such a short stretch of the A.T. The Georgia A.T. inventory concentrated primarily on identifying RTE vascular plants, though some sections of the Trail were also inventoried for rare birds, reptiles, and amphibians. No federally endangered or threatened plants or animals were identified on Appalachian Trail lands in Georgia.

Seventy-six occurrences of 17 globally rare species were documented on Appalachian Trail lands in Georgia. Of all the globally rare species, *Frullania* cf. *appalachiana* (a

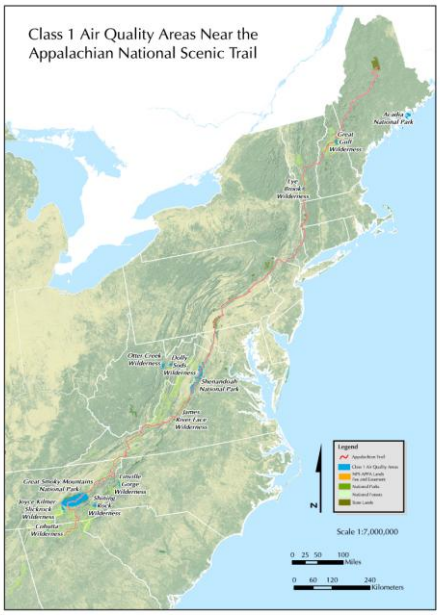
liverwort) is the only species that has a G1 status. The only G2 plant identified along the A.T. in Georgia is *Silene ovata* (mountain catchfly). A large number of G3 plants were identified within Georgia's A.T. lands: *Carex manhartii* (Manhart's sedge), *Coreopsis latifolia* (broadleaf tickseed), *Hypericum buckleii* (granite dome St. John's wort), *Hypnum cupressiforme* var. *filiforme* (a moss), *Trillium simile* (sweet white trillium), *Carex ruthii* (Ruth's sedge), *Vaccinium hirsutum* (hairy blueberry), *Calystegia catesbiana* ssp. *sericata* (silky bindweed), *Panax quinquefolius* (ginseng), *Pycnanthemum montanum* (Blue Ridge mountain mint), *Krigia montana* (false dandelion), *Cardamine flagellifera* (Blue Ridge bitter cress), *Carex amplisquama* (Fort Mountain sedge), and *Prosartes (Disporum) maculatum* (spotted mandarin). The only globally rare (G3) animal species that was identified on Appalachian Trail lands in Georgia was *Desmognathus aeneus* (seepage salamander).

By far the most significant natural heritage site identified in the A.T. inventory for Georgia is Blood Mountain, which is the highest elevation on the Georgia portion of the A.T. The inventory identified 17 occurrences of RTE species within this natural heritage site. The rarest of the species identified was the possible G1-ranked liverwort *Frullania* cf. *appalachiana*. Also identified on Blood Mountain are four other globally rare plants: *Hypericum buckleii*, *Vaccinium hirsutum*, *Krigia montana*, and *Pycnanthemum montanum*. A state rare bird, *Corvus corax* (northern raven), was also observed on Blood Mountain.

After Blood Mountain, the next most significant natural heritage site along the Trail in Georgia is Little Bald Knob, with ten RTE plant occurrences, including four globally rare species: *Carex ruthii* (Ruth's sedge), *Calystegia catesbiana* ssp. *sericata* (silky bindweed), *Cardamine flagellifera* (Blue Ridge bitter cress), and *Prosartes (Disporum) maculatum* (spotted mandarin). The next most significant natural heritage site in Georgia is Baker Mountain, with six rare plants, four of which are globally rare. Other significant natural heritage sites identified along the Georgia A.T. are Powell Mountain, Rich Knob, Tray Mountain, Spaniards Knob, and Blackwell Creek. Each of these natural heritage sites has at least six RTE species, and one of them, Tray Mountain, has twelve RTE species (although none of them are globally rare).

Though plant communities have not been ranked in Georgia for state rarity, several plant communities were identified as being rare in the state. A heath bald was identified on Springer Mountain, Blood Mountain, Tray Mountain, and along a ridgetop near Whitley Gap. A northern hardwood forest was identified on Tray Mountain and Dismal Knob. Boulderfield forest communities were identified in the Spaniards Knob and Unicoi Gap natural heritage sites.

D. Air Resources



As noted in Chapter I, the Appalachian National Scenic Trail passes through five mandatory Class I areas: Great Smoky Mountains National Park in Tennessee and North Carolina, Shenandoah National Park and the James River Face Wilderness Area in Virginia, the Lye Brook Wilderness Area in Vermont, and the Presidential Range-Dry River Wilderness Area, and skirts the perimeter of a sixth, the Great Gulf Wilderness Area in New Hampshire. These six Class I areas are administered by other National Park units or the USDA Forest Service. [See *Map II.E.1, Class I Areas along the Appalachian National Scenic Trail*.]

All other lands along the Trail, including all Appalachian Trail Park Office-administered lands, are designated Class II, and are allowed a moderate increase in certain air pollutants without being in violation of the Clean Air Act.

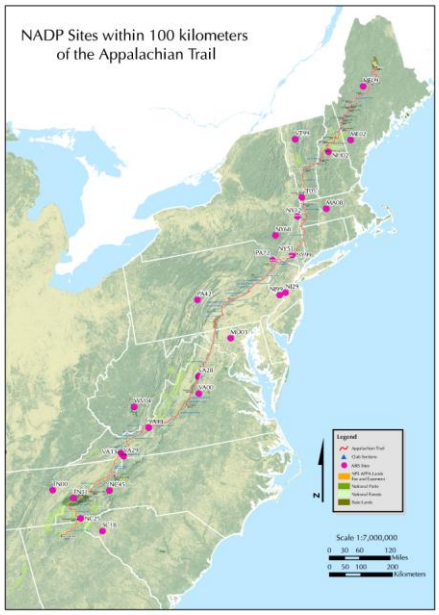
1. Condition of Air Resources

In order to monitor air pollution effectively, Trail managers need to (1) monitor the concentrations of pollutants in the air and (2) assess the effects of those pollutants on park resources. While neither the NPS Appalachian Trail Park Office nor the Appalachian Trail Conservancy currently operate any ambient air monitoring stations on the Appalachian National Scenic Trail, a number of national monitoring program stations located near the Trail monitor pollutants of primary concern to the National Park Service. The involved national monitoring programs include:

1) the *National Atmospheric Deposition Program/National Trends Network (NADP/NTN)*, a nationwide network of precipitation chemistry monitoring sites,
2) the *Clean Air Status and Trends Network (CASTNet)*, the nation's primary source for atmospheric data to estimate dry acidic deposition,
3) the *Interagency Monitoring of Protected Visual Environments (IMPROVE)* program, which monitors visibility (primarily in Class I areas), and
4) state- and federal-operated ozone monitors.

In general, these ambient monitoring stations appear to be fairly well distributed along the Trail, and are located in both urban and rural settings. However, it is likely that some monitors are not representative of conditions on the Trail, given differences in elevation and meteorology.

In 2002, the National Park Service Air Resources Division staff developed baseline air quality values for all NPS units. The project involved interpolating National Atmospheric Deposition Program/National Trends Network (NADP/NTN), Interagency Monitoring of Protected Visual Environments (IMPROVE), and ozone data nationwide to derive pollutant concentration isopleth maps for the U.S., with estimated values for specific NPS units. [See *Appendix C: Description of Parameters Used in Air Atlas Summary Table*]

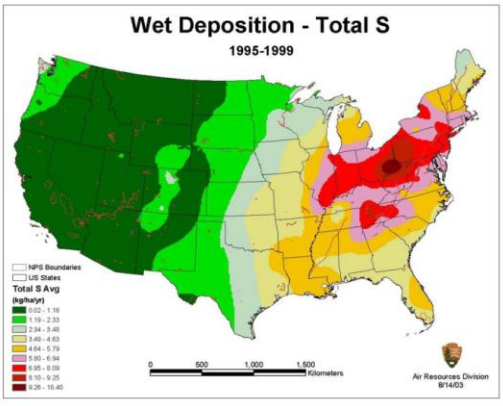


Given the length and complexity of the Appalachian National Scenic Trail, it was not possible to use interpolated values at a single location to represent air quality conditions for the entire Trail. As a result, Trail managers (with assistance from the NPS Northeast Regional Office Air Quality Program and the NPS Air Resources Division) relied on concentrated isopleth maps to indicate pollutant values along segments of the Appalachian Trail.

The following discussion focuses on the current condition of four basic measures of air quality: **Deposition**, **Visibility**, **Ozone Attainment Status**, and **Attainment Status for Other Air Pollutants**.

2. Wet Deposition as measured at NADP/NTN sites and Dry Deposition as reported for CASTNet sites

Air Atlas

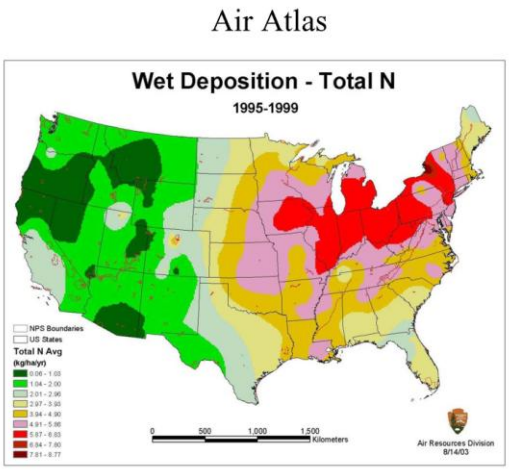


Wet Deposition: Atmospheric deposition of sulfur and nitrogen pollutants in precipitation can acidify soils and surface waters, which can have negative consequences for fish, plants, and other biota.

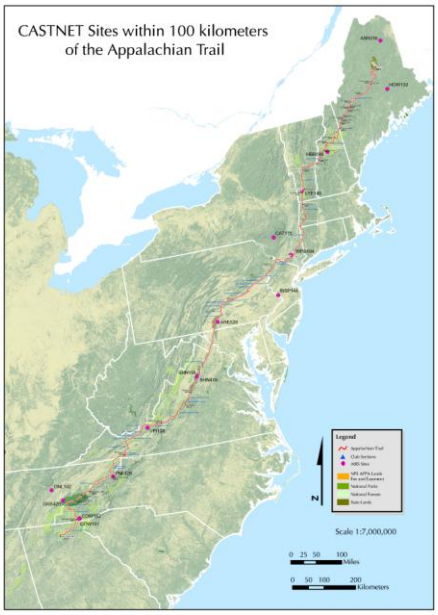
Map II.E.2, NADP Monitoring Program Sites within 100km of the Appalachian National Scenic Trail, depicts the location of NADP/NTN sites within 60 miles (100 kilometers) of the Appalachian National Scenic Trail. Descriptions of these sites also are provided in *Table II.E.1, Summary of Monitoring Sites Collecting Ambient Air Quality Data near the Appalachian Trail.*

Based on interpolated 1995-1999 NADP/NTN data, wet sulfur deposition was relatively high along the entire length of the Appalachian National Scenic Trail. Wet deposition was lowest in Maine, at 2.34 to 4.63 kilograms/hectare/year (kg/ha/yr) and highest in New York, New Jersey, Pennsylvania, Maryland, and some spots in the southern Appalachians, at 6.95 to 8.09 kg/ha/yr. [See *Map II.E.3, Average Annual Wet Deposition – Sulfur, 1995 – 2000*.]

Wet nitrogen deposition for the same timeframe was also relatively high, with the lowest concentrations again in Maine (2.97 to 3.93 kg/ha/yr), and the highest concentrations in New York, New Jersey, Pennsylvania, and Maryland (5.87 to 6.83 kg/ha/yr). [See *Map II.E.4, Average Annual Wet Deposition – Nitrogen, 1995 – 2000*.]



Dry deposition: Acidic pollutants are also deposited in dry form. Depending on the location, the relative contribution of dry deposition can be equal to, greater than, or less than that of wet deposition. Due to the limited number of CASTNet sites nationwide, data interpolation is not possible. Therefore, Appalachian Trail managers examined data from individual sites near the Trail. In 1995 through 1999, annual average dry sulfur deposition at CASTNet sites along the Appalachian Trail ranged from a low of about 0.4 kg/ha/yr in Vermont to a high of about 7.2 kg/ha/yr in Pennsylvania. Dry nitrogen deposition ranged from a low of about 0.4 kg/ha/yr in Vermont to a high of about 5.5 kg/ha/yr at Great Smoky Mountains NP in Tennessee. [See *Map E.5: CASTNet sites within 60 miles (100 kilometers) of the Appalachian Trail* and *Table II.E.1, Summary of Monitoring Sites Collecting Ambient Air Quality Data near the Appalachian Trail* and Map E.6: *NADP Isopleth Maps for the year 2006*



Acid Sensitivity: Although some limited sampling has taken place at several locations along the Trail, a comprehensive, coordinated Trailwide survey has not been conducted to determine if acid-sensitive soils and surface waters occur on the Appalachian National Scenic Trail. Perhaps the most thorough survey to date has been conducted by Dr. Ivan Fernandez of the

University of Maine at Orono, who has conducted surveys of acid deposition on soils and waters in Maine (including several sites along the Appalachian Trail) for more than 15 years. Acid sensitivity has been documented in other locations in the Southern Appalachian, Adirondack, and White Mountains, so it is likely that parts of the Trail that traverse these mountain ranges would have sensitive soils and surface waters, as well.

3. Visibility

Small or "fine" particles in the air, typically those less than 2.5 micrometers in diameter, are the main cause of human-caused visibility impairment. The particles not only decrease the distance one can see; they also reduce the colors and clarity of scenic vistas. Moisture in the air enhances the impact, so areas in the eastern United States with higher relative humidity have worse visibility than areas in the arid West.

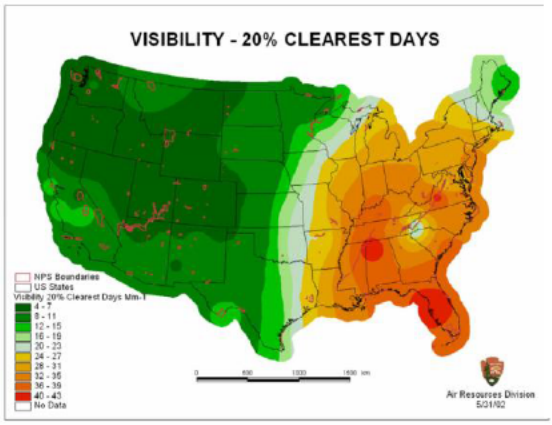
The primary contributor to visibility impairment in the eastern United States is sulfate, which is emitted by coal-fired power plants and oil refineries, among other sources. Other contributors include nitrates (from fossil fuel combustion), organics (from automobiles and manufacturing facilities), and light absorbing carbon (from woodburning). Soil, from windblown dust, is a relatively small contributor to visibility impairment in the East.

Visibility monitoring is conducted at a number of monitoring stations near the Trail, with visibility impairment documented at all locations. A review of the IMPROVE network's annual average visibility data for 1996-1998 showed that visibility was severely degraded in the southeast U.S., but that it gradually improved as one moved north. [See *Map II.E.7: IMPROVE sites within 60 miles (100 kilometers) of the Appalachian Trail*; and *Table II.E.2: Existing Visibility Monitoring near the Appalachian National Scenic Trail]*

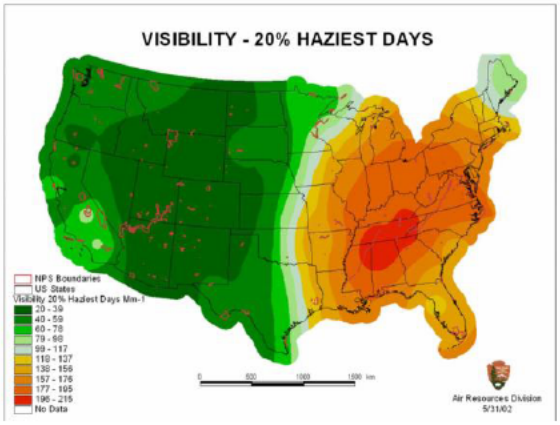
Visibility was worst at the IMPROVE site in the Cohutta Wilderness Area in Georgia, where standard visual range was 30 kilometers (20 miles). Based on interpolated data, standard visual range improved slightly to 38 to 45 kilometers (24 to 30 miles) in North Carolina, Tennessee, Virginia, Maryland and southern Pennsylvania. Standard visual range values in northern Pennsylvania, northern New Jersey, southern New York, Connecticut and southern Massachusetts averaged 45 to 60 kilometers (30 to 36 miles). Visibility was substantially better in northern Massachusetts, northern New York, New Hampshire, Vermont and southern Maine, with an annual average standard visual range

of 60 to 75 kilometers (36 to 45 miles). At the Moosehorn National Wildlife Refuge in eastern Maine (which is approximately 175 kilometers, or 110 miles from the Appalachian Trail), the 1996-1998 annual average standard visual range was 76 kilometers (45 miles). Nevertheless, the standard visual range at Moosehorn was still less than half the visual range at many sites in the Western U.S., and is significantly worse than conditions that would be experienced at the refuge in the absence of human-caused pollution. [See *Map II.E.8: Visibility along the Appalachian Trail; 20% Clearest Days*; and *Map II.E.9: Visibility along the Appalachian Trail: 20% Haziest ays*]

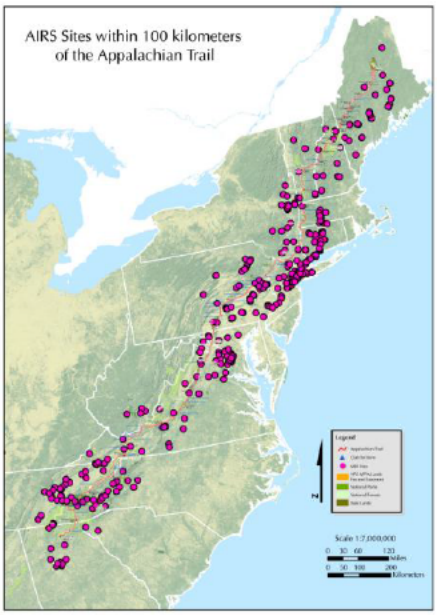
Air Atlas



Air Atlas



Only three IMPROVE sites in the Eastern U.S. – Acadia, Great Smoky Mountains, and Shenandoah National Parks – have been in operation long enough to assess trends in visibility impairment. Data from 1990-1999 indicate that visibility on the best and worst days has significantly improved at Acadia and Shenandoah National Parks, but there has been no significant trend at Great Smoky Mountains National Park. In spite of the improvement at the two eastern sites, the Environmental Protection Agency acknowledges that eliminating human-caused visibility impairment in the East will require substantial reductions in air pollution.



Ozone Attainment Status

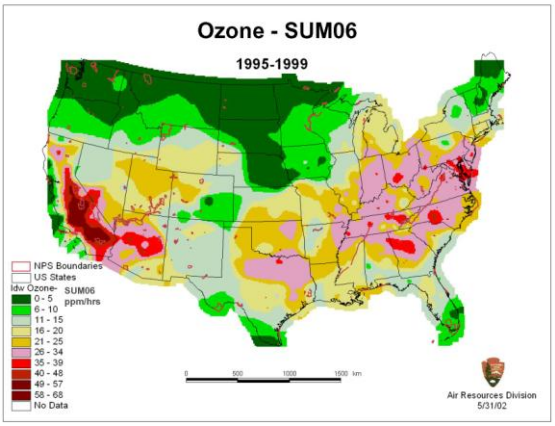
States monitor and assess compliance with Environmental Protection Agency's National Ambient Air Quality (NAAQS) standards for ozone. Appalachian Trail managers examined the Environmental Protection Agency's information about area attainment status to determine if any portions of the Appalachian National Scenic Trail pass through designated nonattainment areas for ozone. The Environmental Protection Agency's information is current as of September 17, 2004.

The new National Ambient Air Quality Standard for ozone is a 3-year average of the 4th highest daily maximum 8-hour ozone concentration. This value cannot exceed 85 parts per million (ppm), or the area will be designated nonattainment. Nonattainment areas are those areas where monitored pollution levels exceed concentrations established by the Environmental Protection Agency to protect human health and welfare. Numerous agencies and organizations have ozone-monitoring stations that are proximate to the Trail. [*See Map II.E.9: AIRS: Ozone Monitoring Sites within 60 miles (100 kilometers) of the Appalachian Trail; and Table II.E.1, Summary of Monitoring Sites Collecting Ambient Air Quality Data near the Appalachian Trail.*]

In August 2004, EPA published the list of counties they propose to designate nonattainment for the 8-hour ozone NAAQS. With the exception of New Hampshire, Vermont, and Maine, the Trail passes through proposed ozone nonattainment counties in all states. [See *Table II.E.3: 8-Hour Ozone State/Area/County Report*.]

While the National Ambient Air Quality Standard is designed to protect both human health and vegetation, other ozone metrics are more indicative of vegetation response. One such metric is the SUM06. SUM06 is the sum of all hourly average ozone concentrations greater than or equal to 60 parts per billion. In 1997, a group of ozone effects experts recommended 3-month, 8:00 a.m. to 8:00 p.m., SUM06 effects endpoints for natural vegetation, i.e., 8 to12 parts per million-hours (ppm-hrs) for foliar injury to natural ecosystems and 10 to 15 ppm-hrs for growth effects on tree seedlings in natural forest stands. [See *Map II.E.10: Ozone SUM06 Values along the Appalachian Trail 1995-199l*.] A recently completed ozone injury risk assessment indicates a moderate to high likelihood of ozone injury along significant portions of the Trail.

4. Attainment Status for Other Air Pollutants



States monitor five other air pollutants for which the Environmental Protection Agency has established National Ambient Air Quality Standards, and assess compliance with those standards. Appalachian Trail managers examined the Environmental Protection Agency's (EPA) information about area attainment status to determine if any portions of the Appalachian National Scenic Trail pass through designated nonattainment areas. The Environmental Protection Agency's information is current as of September 17, 2004.

The Trail does not pass through any designated lead, particulate matter, nitrogen dioxide, or carbon monoxide nonattainment areas. Part of Warren County, New Jersey, is designated nonattainment for sulfur dioxide, but the nonattainment area does not include the part of the county through which the Trail passes.

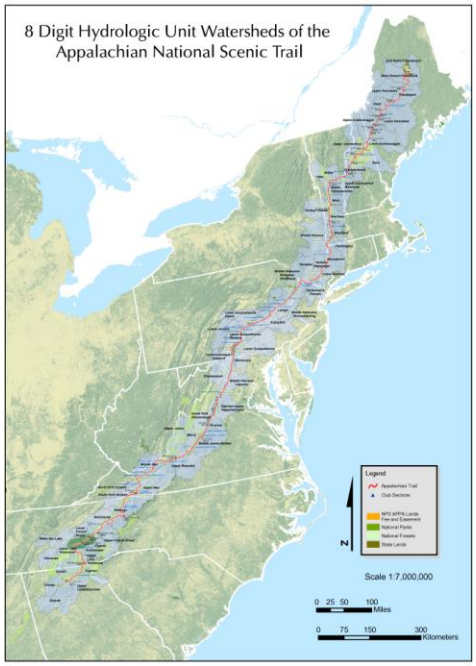
E. Water Resources

1. Introduction

The NPS Water Resources Division and Servicewide Inventory and Monitoring Program have conducted a preliminary water resource inventory for the Appalachian National Scenic Trail based on the U.S. Geological Survey's (USGS) 1:100,000 scale National Hydrography Dataset (http://nhd.usgs.gov/) and a corridor of land 500 feet on each side of the footpath.

This preliminary analysis identified approximately 196.1 miles of perennial rivers and streams; 33.64 miles of intermittent streams; 760 acres of lakes, ponds, and reservoirs, and 38.19 miles of shoreline. The Water Resources Division is in the process of acquiring the 1:24,000 scale National Hydrography Dataset for entire Trail, which will significantly increase these hydrographic statistics and provide a more accurate count of springs and seeps.

The Water Resources Division and the Servicewide Inventory and Monitoring Program have also prepared "baseline water quality data inventory and analysis reports" for all six other National Park units traversed by the Trail. These reports (http://www.nature.nps.gov/water/horizon.htm) summarize publicly available water quality data contained in the Environmental Protection Agency's Storage and Retrieval (STORET) national water quality database (http://www.epa.gov/storet/) and the USGS' National Water Information System (http://waterdata.usgs.gov/nwis/) for these parks. A Baseline Water Quality Data Inventory and Analysis Report specifically for the Trail corridor will be prepared during the next year.



2. Surface Water Characteristics

The following summary of water resources along the Appalachian Trail is excerpted and adapted from Ecological Subregions of the United States, R.G. Bailey, USDA Forest Service (scale 1:7,500,000, revised 1994). [See *Map II.F.1, 8-Digit Hydrologic Watersheds and Surface Waters of the Appalachian National Scenic Trail*]

Section M212A--White Mountains Section (within the following subsections: M212Ac Maine Central Mountains, M212Ad White Mountains, M212Ae Mahoosuc Rangeley Lakes, and M212Af Connecticut Lakes)

***Surface Water Characteristics*:**
Perennial streams provide an abundance of water. This Section includes the headwaters of numerous streams and rivers that intersect the Appalachian Trail, including the Penobscot, Kennebec, Piscataquis, and Androscoggin rivers. Drainage networks have deranged, rectangular, and dendritic patterns which developed as stream courses imposed from the Cenozoic were modified during the Pleistocene. Stream gradients are moderate to steep. Average annual runoff ranges from 16 to 24 in (410 to 610 mm) generally and from 16 to 50 in (410 to 1,270 mm) in the more rugged terrain of Maine and New Hampshire. Runoff increases locally with elevation. Maximum monthly stream flows occur in March and April. Extreme peak flows can occur any time of year and are usually associated with hurricanes or rain-on-snow events. Minimum monthly flows occur in August, September, and October. The section contains numerous lakes and "great ponds," including Rainbow Lake, Nahmakanta Lake, Pemadumcook Lake, Lower-Jo Mary Lake, Lake Hebron, Moxie Pone, Pleasant Pond, and Flagstaff Lake.

Section M212B - Vermont – New Hampshire Upland Section (within the following subsections: M212Ba Vermont Piedmont, M212Bb Northern Connecticut Valley, and M212Bc Sunapee Uplands)

Surface Water Characteristics:
Perennial streams are important water sources. Small lakes and wetlands occur in headwater and valley positions. The Connecticut River and its tributaries, including the White and Ottauquechee Rivers, dominate the unit. Trellis and dendritic drainage patterns occur. Metasedimentary bedrock is exposed in some streambeds, while Proterozoic rock and alkalic plutonic rock are more likely to be found in boulder beds. Stream gradients range from low to moderate and steep. Streams are generally incised. Average annual runoff ranges from 16 to 28 in (410 to 710 mm). High values reflect differences in local topography. Maximum monthly streamflows occur in March and April. Extreme peak flows can occur any time of year and are usually associated with hurricanes or rain-on-snow events. Minimum monthly flows occur in August, September, and October.

Section M212C - Green, Taconic, and Berkshire Mountains Section (within the following subsections: M212Cb, Taconic Mountains, M212Cc Berskhire-Vermont Upland, and M212Cd Southern Green Mountain)

***Surface Water Characteristics*:**

Perennial streams and small lakes provide abundant water. Rivers and streams range from low to steep gradients. Channels are generally incised. The headwaters of streams in northern Vermont are located in the piedmont to the east, and the major stream courses are imposed from a previously eroded surface. Primary features of the Appalachian Trail are the Housatonic and Hoosic Rivers, Upper Goose Pond, and the headwaters of numerous small rivers, brooks, streams, and mountain ponds. Average annual runoff ranges from 16 to 40 in (410 to 1,020 mm), increasing locally with elevation. Maximum monthly flows occur in March and April. Extreme peak flows can occur any time of year and are usually associated with hurricanes or rain-on-snow events. Minimum monthly flows occur in August, September, and October.

Section 221A - Lower New England Section (within the following subsections: 221Ae Hudson Highlands)

***Surface Water Characteristics*:**

Abundant water resources include perennial streams, natural and artificial lakes and ponds, fresh and saltwater wetlands, and estuaries. Streams exhibit deranged, dendritic, and trellis patterns due to a complex geomorphic history of stream imposition, differential weathering, glaciation, continental rebound, and stream capture. Stream gradients are generally low but steepen locally near the Connecticut River and in areas approaching the uplands and mountains. The Housatonic River and its tributaries, including Ten Mile River, are the predominant hydrologic features in Connecticut. The southern reach of the Hudson River dominates further west. Average annual runoff ranges from 18 to 24 in (460 to 610 mm). Maximum monthly streamflows occur in March and April. Extreme peak flow may occur any time of year and usually are associated with hurricanes or rain-on-snow events. Minimum monthly flows occur in August, September, and October. Most lakes and impoundments are small.

Section 221B--Hudson Valley Section (within the following subsections: 221Ba Hudson Limestone Valley, 221Bd Kittatinny-Shawangunk Ridges)

***Surface Water Characteristics*:**

Tributaries of the Hudson River, including the Wallkill River and Pochuck Creek crossings of the Appalachian Trail in northern New Jersey, dominate the unit. Perennial streams, small lakes, and fresh water and saltwater wetlands occur. The Hudson River, which intersects the Appalachian Trail just south of this section, is a low gradient incised stream. The Delaware River intersects the Trail at the southern

tip of this section. Major tributaries from the Taconics and Allegheny plateau have moderate and steep gradients. Under natural conditions, daily saltwater tides in the Hudson River would reach as far upstream as Albany, New York. Average annual runoff ranges from 10 to 22 in (250 to 560 mm). March and April are the months of highest streamflow. Lowest streamflow occurs in August.

Section M221A - Northern Ridge and Valley Section (within the following subsections: M221Aa Ridge and Valley Subsection, M221Ad Northern Great Valley Subsection)

***Surface Water Characteristics*:**
Major rivers crossed by the Appalachian Trail include the Lehigh, Schuykill, Susquehanna, and Juniata Rivers. Streams are most active in the spring, reflecting relatively frequent rainfall and snowmelt. Many smaller streams dry up in the summer and are not recharged until October to November. Stream patterns are trellis shaped, reflecting the regular folding of the geomorphology. Streams are generally more alkaline and productive than in the Allegheny Mountains. Wetlands are scarce.

Section M221D - Blue Ridge Mountains Section (M221Da Northern Blue Ridge Mountain, M221Dc Southern Blue Ridge Mountain, and M221Dd Metasedimentary Blue Ridge Mountain)

***Surface Water Characteristics*:**
This Section is generally characterized by a mature, dendritic drainage network. The Appalachian Trail crosses a number of major rivers in this section, including the Potomac and Shenandoah Rivers in northern Virginia, Maryland, and West Virginia, the James and Tye in central Virginia, and the French Broad in North Carolina. Natural lakes are rare to non-existent, except in the northeastern extremity of the Section, which was covered by Pleistocene glaciation. Watuga Lake in Tennessee and Fontana Lake in North Carolina are major, man-made impoundments. Small impoundments are common along upper reaches of streams. A few bogs, swamps, and salt marshes occur in areas adjacent to the Atlantic coast and Chesapeake Bay. The lower extremities of some of the major streams are affected by tides. There is ample water for farm, urban, and industrial uses. Urban development is affecting water yields. Good ground water recharge areas are being impacted by encroaching development.

Section M221B - Allegheny Mountains Section (M221Ba Ridge and Valley, and M221Bb Great Valley of Virginia)

***Surface Water Characteristics*:**
The drainage pattern is well established, dendritic to trellis, but primarily the former. Much of the Trail's route through this section is captured by the New

River and its tributaries, which eventually drain into the Ohio River to the west. However, the Trail also crosses the headwaters of the Holston River in this section. The Holston drains to the south. Streams are generally more acidic and less productive than in the Northern Ridge and Valley Section. Wetlands are scarce.

3. Water Quality

No comprehensive, previously published scientific investigations are known to exist that describe the current state of water quality along the entire A.T., although several past and ongoing studies have investigated water quality along segments of the Trail. Examples include stream studies in Shenandoah National Park, Great Smoky Mountains National Park and Delaware Water Gap National Recreation Area, and several locations in New England where streams and ponds are sampled as part of the Hubbard Brook Long Term Ecological Research (LTER) program.

Although no comprehensive A.T. specific studies are known to exist, the U.S. Environmental Protection Agency (USEPA) has compiled water quality data from myriad sources and makes these data as well as many other useful resources available to the public through their Water Program web site (http://www.epa.gov/water/). These data reside in the USEPA STORET database (http://www.epa.gov/storet/), and are largely the same data that are used by the National Park Service Water Resources Program to prepare "horizon" reports for individual parks (see above).

Among the resources available on the USEPA web site are a series of technical guidance manuals designed to help states and other entities "…*produce section 304(a) criteria*…". While the current focus is not to develop or legally establish section 304(a) criteria for water resources associated with the Appalachian Trail, the USEPA technical guidance manuals make it possible to produce a set of baseline water quality standards that resource managers can use to assess the ecological condition of water resources along the Appalachian Trail. The technical guidance manuals attempt to depict "reference conditions," or those conditions that might be anticipated where human induced impacts are minimal. This is accomplished by setting recommended standards using parameter values that correspond to the 25th percentile for each parameter set (except for secchi disk which is based on the 75th percentile). The resulting water quality parameter values are believed to represent less impacted waters within each of the target ecoregions or sub-ecoregions.

The USEPA technical guidance manuals are further organized around the types of waters found in each ecoregion. Manuals for Lakes and Reservoirs, and Rivers and Streams are available for the two ecoregions through which the Appalachian Trail passes. Each of these manuals aggregates data obtained from waters that represent the entire range of each type of water found within the two ecoregions or four sub-regions. Consequently, water quality standards established for the Appalachian Trail using the technical guidance manuals may be based, in part, on data obtained from

certain types of waters that are typical of the particular ecoregion or sub-ecoregion, but may not be well represented on the Appalachian Trail. As a result, the baseline values established using the technical guidance manuals may not accurately estimate the level for certain parameters. Despite this potential problem, the baseline values established using the technical guidance manuals will help establish a meaningful starting point, or reference for future resource management and monitoring efforts.

The ecoregion system used by USEPA (Omernik, 1987) divides the Continental United States into 14 areas that share similar geographic and nutrient characteristics (USEPA, 2000a; 2000b; 2000c, 2001). This ecoregion scheme differs from the U.S. Forest Service ecoregion system (Bailey, 1987) that was used earlier in this section to characterize the types of surface water resources typically found along the Appalachian Trail (see above). Both systems have merit, and neither system is clearly superior to the other. The Omernik (1987) ecoregion system is preferred for setting water quality standards because USEPA makes data summaries for the regions and sub-regions readily available.

Based on the Omernik (1987) system, the Appalachian Trail crosses two ecoregions and four sub-regions (Figure x1).

Extending from the northwest corner of New Jersey through Maine, the Trail is within the Nutrient Poor Largely Glaciated Upper Midwest and Northeast ecoregion, Region VIII (Figure x2). The Trail remains in the Northeastern Highlands sub-region throughout most of this ecoregion except for the northwest corner of New Jersey which is within the North Central Appalachian sub-region. The Nutrient Poor Largely Glaciated Upper Midwest and Northeast ecoregion is defined accordingly:

> *"The Nutrient Poor Largely Glaciated Upper Midwest and Northeast is cool and moist. It is characterized by extensive forests, nutrient-poor soils, a short growing season, limited cropland, and many marshes, swamps, lakes, and streams. Less cropland and fewer people occur here than in neighboring nutrient regions; related nutrient problems in surface waters are also less. Water quality issues center around the effects of acid precipitation, logging, lake recreation, and nearlake septic systems.*
>
> *Perennial streams are common and are often fed by water stored in the glacial deposits that overlie non-calcareous bedrock. Streams typically have low concentrations of alkalinity, sulfate, chloride, and dissolved solids due, partly, to the insolubility of the bedrock. Levels of fecal coliform, total nitrogen, total phosphorus, and suspended sediment are also usually low; stream concentrations of these constituents are typically much less than in nearby, more developed nutrient regions.*
>
> *Many oligotrophic and mesotrophic lakes occur in Region VIII. Total phosphorus*

concentrations are usually much lower, and Secchi transparencies are much higher than in the lakes of the Corn Belt and Northern Great Plains (VI). Acid precipitation caused by airborne emissions from upwind industrialized regions is a major water quality problem in the eastern portion of Region VIII and can threaten fish survival in weakly buffered glacial lakes."

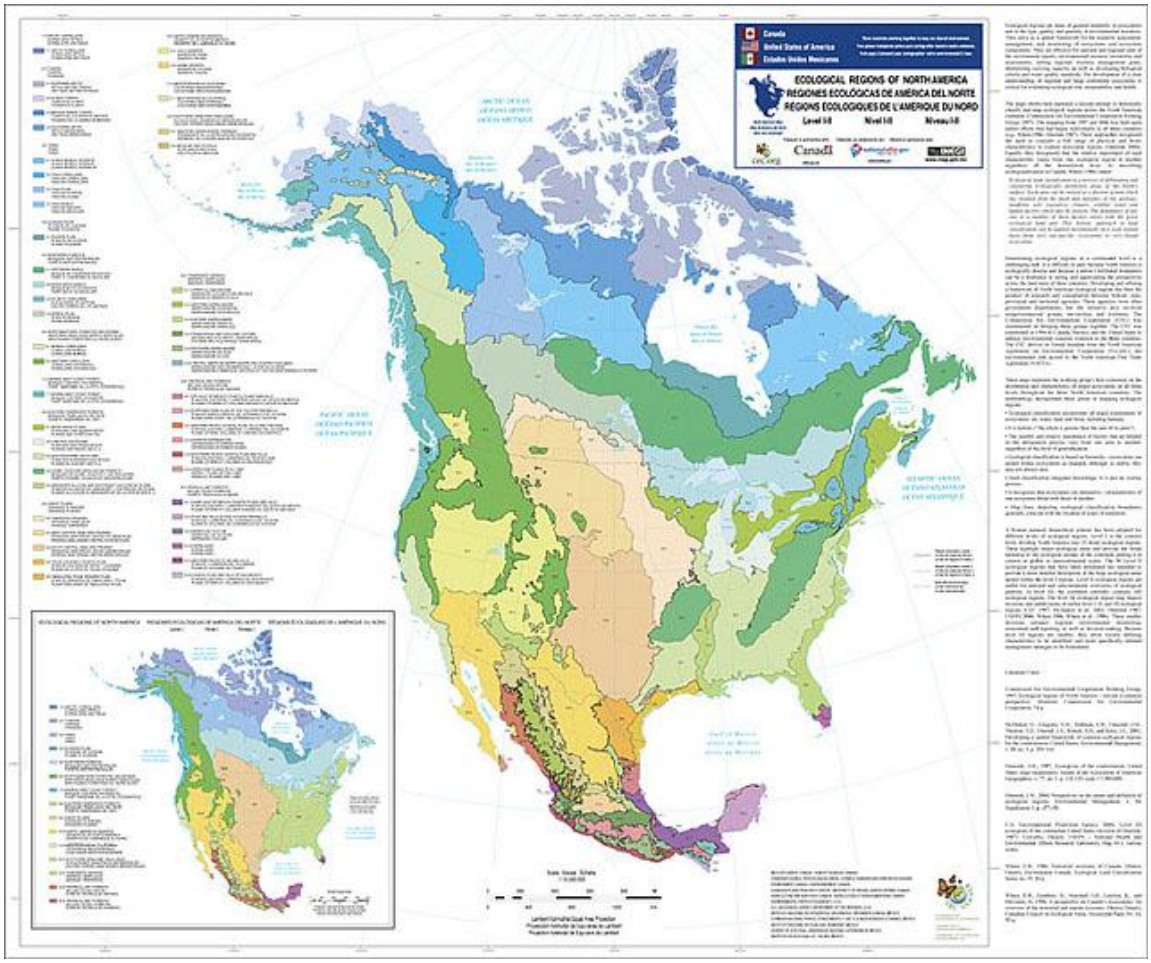


Figure G.1 - Ecoregions of North America

The Northeastern Highlands sub-region (# 58, Figure G.2) is described by USEPA in the following statement:

"The Northeastern Highlands comprise a relatively sparsely populated region characterized by nutrient poor soils blanketed by northern hardwood and spruce fir forests. Land-surface form in the region grades from low mountains in the southwest and central portions to open high hills in the northeast. Many of the numerous glacial lakes in this region have been acidified by sulfur depositions originating in industrialized areas upwind from the ecoregion to the west."

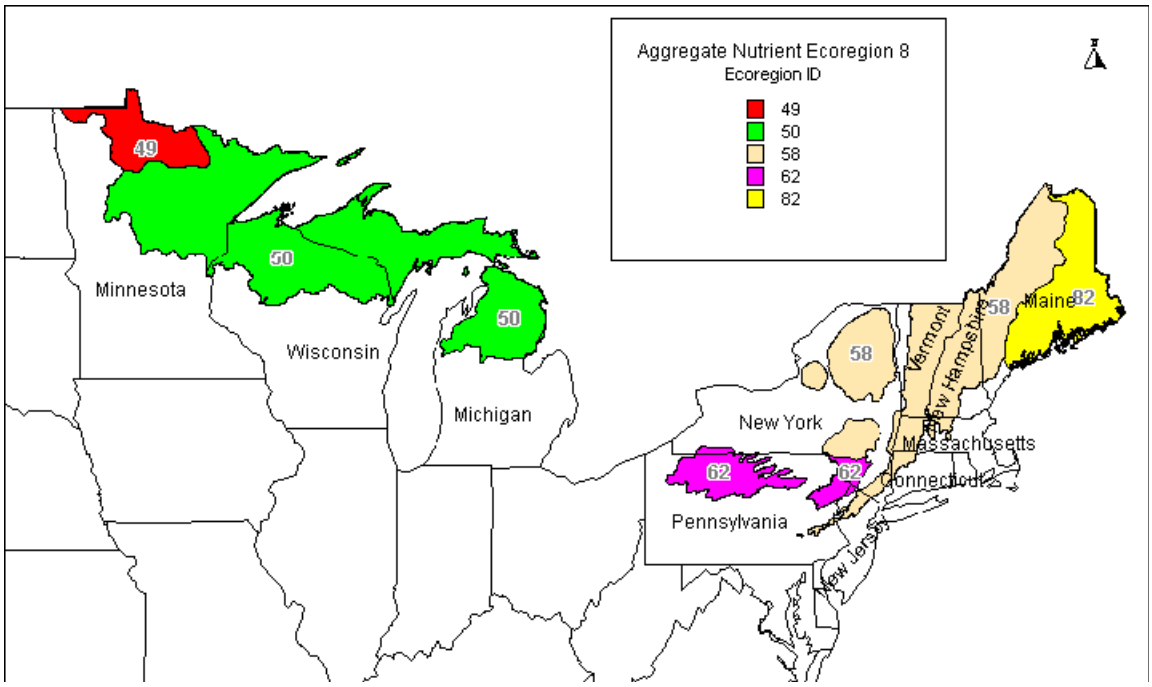


Figure G.2 - Aggregate Ecoregion VIII with level III ecoregions shown (from USEPA, 2000c)

The North Central Appalachian sub-region (# 62, Figure G.2) is described by USEPA in the following statement:

> *"More forest covered than most adjacent ecoregions, the North Central Appalachians ecoregion is part of a vast, elevated plateau composed of horizontally bedded sandstone, shale, siltstone, conglomerate, and coal. It is made up of plateau surfaces, high hills, and low mountains, which unlike the ecoregions to the north and west, was largely unaffected by continental glaciation. Only a portion of the Poconos section in the east has been glaciated. Land use activities are generally tied to forestry and recreation, but some coal and gas extraction occurs in the west."*

From the Northeast corner of Pennsylvania through Georgia, the Appalachian Trail is within the Central and Eastern Forested Uplands ecoregion, Region XI (Figure x3). Two sub-regions, the Blue Ridge and the Ridge and Valley sub-regions, extend laterally in a northeast to southwest orientation and typify the portion of the Central and Eastern Forested Uplands ecoregion through which the Appalachian Trail passes. The Central and Eastern Forested Uplands ecoregion is generally described accordingly:

> *"The Central and Eastern Forested Uplands Ecoregion is disjunct and comprises most of the unglaciated, forested low mountains and upland plateaus in the central and eastern United States. It is underlain primarily by sedimentary and metasedimentary rocks and is characterized by forests, high relief terrain, steep slopes, and high gradient streams. Region XI is higher and more rugged than the*

neighboring Regions VI, VII, IX, and X. Streams are generally faster moving and clearer than the lower gradient streams of surrounding regions. Lakes are far less common than in cooler, glaciated areas such as Region VIII. Dominant land uses in the Central and Eastern Forested Uplands (XI) are logging, recreation, and grazing. The erosion hazard can be severe on steep slopes if the soil or vegetation is disturbed by logging or road building. Land slides and sheet flow have contributed sediments to streams which, in turn, have affected benthic habitat, turbidity, hydrology, stream temperature, and stream biota. Coal mining is locally common. It has contributed dissolved solids, suspended sediment, and acidic drainage to streams which have, in turn, impacted fish and aquatic invertebrates. Cropland agriculture and urban activity are generally less common than in nearby, lower and less-rugged regions; related water quality issues such as nutrient runoff to streams is also less. Nevertheless, in Region XI, there are a few urban areas as well as scattered croplands such as the Great Valley. Major poultry and aquaculture operations are found in Region XI along with associated inputs of nutrients."

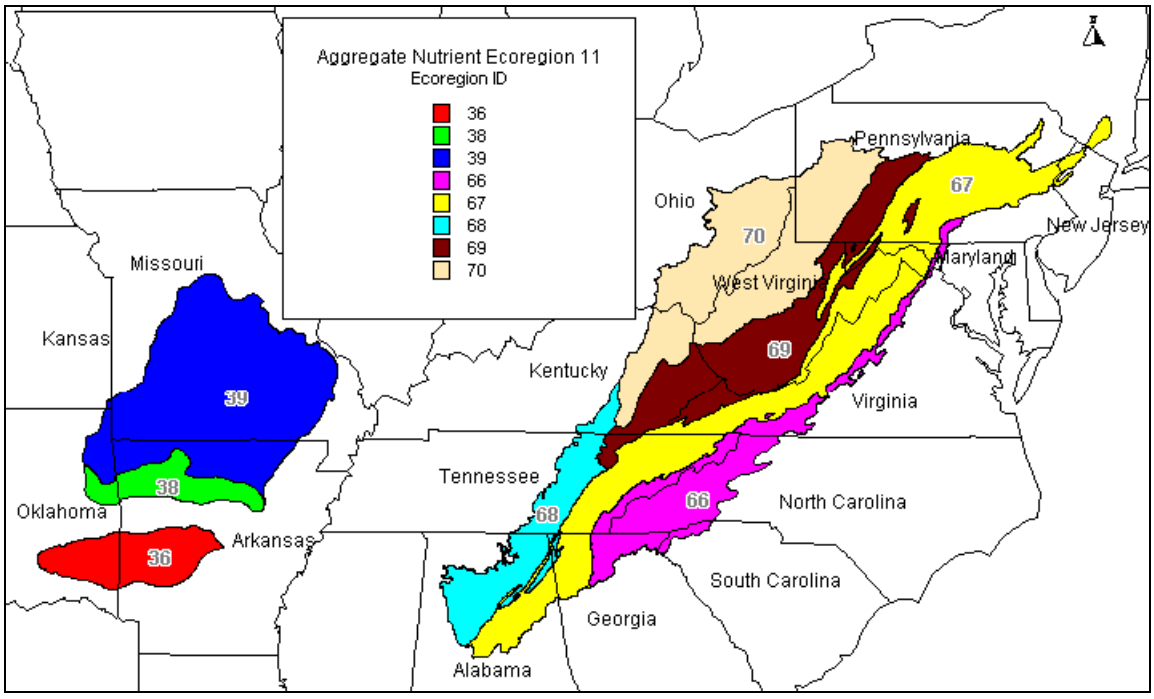


Figure G.3 - Aggregate Ecoregion XI with level III ecoregions shown (from USEPA, 2000b)

The Blue Ridge sub-region (# 66, Figure G.3) is described by USEPA in the following statement:

"The Blue Ridge extend (sic) from southern Pennsylvania to northern Georgia, varying from narrow ridges to hilly plateaus to more massive mountainous areas with high peaks. The mostly forested slopes, high-gradient, cool, clear streams, and rugged terrain occur on a mix of igneous, metamorphic, and sedimentary

geology. Annual precipitation of over 200 centimeters can occur on the well-exposed high peaks of the Great Smoky Mountains that reach over 1830 meters. The southern Blue Ridge is one of the richest centers of biodiversity in the eastern U.S. It is one of the most floristically diverse ecoregions, and includes Appalachian oak forests, northern hardwoods, and Southeastern spruce-fir forests. Shrub, grass, and heath balds, hemlock, cove hardwoods, and oak-pine communities are also significant."

The Ridge and Valley sub-region (# 67, Figure G.3) is described by USEPA in the following statement:

"This northeast-southwest trending, relatively low-lying, but diverse ecoregion is sandwiched between generally higher, more rugged mountainous regions with greater forest cover. As a result of extreme folding and faulting events, the region's roughly parallel ridges and valleys have a variety of widths, heights, and geologic materials, including limestone, dolomite, shale, siltstone, sandstone, chert, mudstone, and marble. Springs and caves are relatively numerous. Present-day forests cover about 50% of the region. The ecoregion has a diversity of aquatic habitats and species of fish."

Water Quality Standards

Water quality recommendations available from USEPA are intended to assist states and other entities set standards for nutrient criteria. Data for many other water quality parameters are also available from the USEPA STORET database, but USEPA only recommends standards for parameters such as Secchi disk, Chlorophyll a, Phosphorus, and Nitrogen – those measures that most directly associated with assessing the nutrient status of a waterbody. The number of waters surveyed, the number of stations, and the number of actual records for each parameter that were used by the USEPA to set the various standards is shown in Table x1 and Table x2 for Lakes and Streams respectively.

Definitions

Secchi Disk Transparency

A secchi disk is a simple device used to measure water transparency. A measurement is made by recording the depth at which point the disk is no longer visible in a column of water. Secchi disk measurements are not ordinarily taken in streams or rivers.

Turbidity

Turbidity is a measure of suspended particulate matter present in a column of water, and relates to water transparency. There are several common methods used for determining turbidity, none of which report values that are interchangeable.

	Northeastern Highlands sub-region	North Central Appalachian sub-region	Blue Ridge sub-region	Ridge and Valley sub-region
# of Lakes / Reservoirs	849	15	76	52
# of Lake Stations	1898	39	236	228
- # of records for Secchi depth	24,451	4,591	1,352	1,163
- # of records for Chlorophyll *a* (all methods)	11,478	3,101	974	1,361
- # of records for Total Kjeldahl Nitrogen (TKN)	6,014	4,927	1,240	479
- # of records for Nitrate + Nitrite (NO2 + NO3)	7,692	4,758	1,669	1,408
- # of records for Total Nitrogen (TN)	193	4	4	18
- # of records for Total Phosphorus (TP)	16,590	5,122	1,565	1,776
Total # of records for key nutrient parameters	66,418	22,503	6,804	6,205

Table G.1. Lake records for Aggregate Ecoregion VIII & XI (USEPA, 2001 & 2000b)

	Northeastern Highlands sub-region	North Central Appalachian sub-region	Blue Ridge sub-region	Ridge and Valley sub-region
# of Stream Names	370	205	123	911
# of Stream Stations	803	349	282	2,009
- # of records for Turbidity	22,682	4,405	7,120	18,446
- # of records for Chlorophyll *a* (all methods)	31	10	272	2,079
- # of records for Total Kjeldahl Nitrogen (TKN)	17,034	3,833	5,578	18,169
- # of records for Nitrate + Nitrite (NO2 + NO3)	19,854	4,821	6,078	10,611
- # of records for Total Nitrogen (TN)	82	115	46	1,672
- # of records for Total Phosphorus (TP)	21,228	10,504	7,245	32,983
Total # of records for key nutrient parameters	80,911	23,688	26,339	83,960

Table G.2. River and Stream records for Aggregate Ecoregion VIII & XI (USEPA, 2000a & 2000c)

Nitrogen

Total Kjeldahl Nitrogen, or TKN is the sum of all forms of organic nitrogen (ammonia + ammonium). $NO_2 + NO_3$ Nitrogen is the sum of Nitrite and Nitrate. Total Nitrogen is reported in two ways, calculated and reported. The calculated value is the sum of TKN and NO2 + NO3, whereas the reported TN values represent those values derived from newer analytical techniques. The calculated value is currently the more common way to report this value.

Total Phosphorus

Total Phosphorus (TP) is a measure of all forms of phosphorus present in a sample, and has been used to determine the trophic classification of lakes (Vollenweider, 1968; Sawyer, 1947) because Phosphorus was traditionally thought to be the limiting, or "lacking" nutrient in most freshwater systems. Based on the assumption that the amount of available Phosphorus "drives," or "limits" productivity, lakes with TP concentrations less than 10 ug/L are classified as oligotrophic (low productivity); 10 – 20 ug/L as mesotrophic (moderately productive); 20 ug/L or higher as eutrophic (highly productive). Insight into which of the major nutrients (Nitrogen or Phosphorus) limit productivity in a water resource is gained by calculating the Total Nitrogen to Total Phosphorus (TN:TP) ratio. Ratios of 7:1 or less suggest that Nitrogen may limit productivity, while ratios of approximately 10:1 or higher suggest that Phosphorus is the limiting nutrient (USEPA, 2000d).

Chlorophyll *a*

Chlorophyll *a* is an important photosynthetic pigment, and measures of this component of primary productivity are useful for determining the trophic status of a water resource. Higher measures of chlorophyll *a* indicate greater amounts of primary productivity. One additional measure of chlorophyll *a*, Periphyton Chlorophyll *a* is available for streams and rivers in the Ridge and Valley sub-ecoregion. Periphyton is biological material that is attached or grows upon submerged surfaces such as rocks, thus, periphyton chlorophyll *a* is a measure of primary productivity associated with material that is attached to the stream or river substrate.

Lakes and Reservoirs

The following tables identify the USEPA recommended standards for the four sub-ecoregions through which the Appalachian Trail passes: Northeast Highlands (Table x2); North Central Appalachians (Table x3); Blue Ridge (Table x4); and, Ridge and Valley (Table x5).

Parameter	No. of Lakes	Reported Values		25th Percentiles based on all seasons data for the Decade P25* all seasons
		Min	Max	
TKN (mg/L)	21	0.05	0.97	0.33
NO2 + NO3 (mg/L)	91	0.003	1.11	0.014
TN (mg/L) - calculated	NA	0.053	2.08	0.344
TN (mg/L) - reported	107	0.16	1.41	0.20
TP (ug/L)	535	1.0	228.17	7.0
Secchi (M)	611	0.5	13.1	5.1
Chlorophyll *a* (*u*g/L) - F	73	0.66	37.09	2.52
Chlorophyll *a* (*u*g/L) - S	1	7.27	7.27	7.27
Chlorophyll *a* (*u*g/L) - T				

Table G.2 – Reference conditions for Northeastern Highlands sub-region (# 58, Figure G.2)

Parameter	No. of Lakes	Reported Values		25th Percentiles based on all seasons data for the Decade P25* all seasons
		Min	Max	
TKN (mg/L)	8	0.06	0.44	0.14
NO2 + NO3 (mg/L)	12	0.01	0.3	0.06
TN (mg/L) - calculated	NA	0.07	0.74	0.20
TN (mg/L) - reported	2	0.44	0.60	0.44
TP (ug/L)	14	5.5	62.5	9.25
Secchi (M)	11	1.7	4.5	4.0
Chlorophyll *a* (*u*g/L) - F	9	2.13	11.3	2.70
Chlorophyll *a* (*u*g/L) - S	--	--	--	--
Chlorophyll *a* (*u*g/L) - T				

Table G.3 – Reference conditions for North Central Appalachian sub-region (# 62, Figure G.2)

Parameter	No. of Lakes	Reported Values		25th Percentiles based on all seasons data for the Decade P25* all seasons
		Min	Max	
TKN (mg/L)	18	0.175	0.542	0.288
NO2 + NO3 (mg/L)	21	0.017	0.668	0.142
TN (mg/L) - calculated	NA	0.192	1.21	0.43
TN (mg/L) - reported	9	0.205	2.405	0.38
TP (ug/L)	40	7.375	80.375	17.5
Secchi (M)	29	0.938	83.375	2.102
Chlorophyll *a* (*u*g/L) - F	5	2.375	38.513	3.275
Chlorophyll *a* (*u*g/L) - S	22	2.75	25.3	5
Chlorophyll *a* (*u*g/L) - T		--	--	--

Table G.5 – Reference conditions for Ridge and Valley sub-region (# 67, Figure G.3)

Parameter	No. of Lakes	Reported Values		25th Percentiles based on all seasons data for the Decade P25* all seasons
		Min	Max	
TKN (mg/L)	52	0.025	1.235	0.086
NO2 + NO3 (mg/L)	60	0.003	0.588	0.029
TN (mg/L) - calculated	NA	0.028	1.823	0.115
TN (mg/L) - reported	2	0.12	0.32	0.12
TP (ug/L)	27	2.5	61.125	5
Secchi (M)	54	1.025	6.45	4.369
Chlorophyll *a* (*u*g/L) - F	42	0.5	4.475	1.35
Chlorophyll *a* (*u*g/L) - S	22	1.157	8.7	2.5
Chlorophyll *a* (*u*g/L) - T	3	2.16	46.2	2.16

Table G.4 – Reference conditions for Blue Ridge sub-region (# 66, Figure G.3)

Rivers and Streams

The following tables identify the USEPA recommended standards for the four sub-ecoregions through which the Appalachian Trail passes: Northeast Highlands (Table G.6); North Central Appalachians (Table G.7); Blue Ridge (Table G.8); and, Ridge and Valley (Table G.9).

Parameter	No. of Streams	Reported Values		**25th Percentiles based on all seasons data for the Decade P25* all seasons**
		Min	Max	
TKN (mg/L)	122	0.05	1.20	0.10
NO2 + NO3 (mg/L)	77	0.01	2.85	0.16
TN (mg/L) - calculated				0.26
TN (mg/L) - reported	8	0.34	0.84	0.42
TP (ug/L)	149	2	450	5
Turbidity (NTU)	61	0.28	4.33	0.80
Turbidity (FTU)	34	0.25	7	0.25
Turbidity (JCU)	--	--	--	--
Chlorophyll *a* (*u*g/L) - F	--	--	--	--
Chlorophyll *a* (*u*g/L) - S	3	3.4	7	3.4
Chlorophyll *a* (*u*g/L) - T	--	--	--	--
Periphyton Chl *a* (mg/m^2)	--	--	--	--

Table G.6 – Reference conditions for Northeastern Highlands sub-region (# 58, Figure G.2)

Parameter	No. of Streams	Reported Values		**25th Percentiles based on all seasons data for the Decade P25* all seasons**
		Min	Max	
TKN (mg/L)	60	0.03	1.25	0.10
NO2 + NO3 (mg/L)	55	0.01	1.06	0.09
TN (mg/L) - calculated				0.19
TN (mg/L) - reported	37	0.13	6.88	0.32
TP (ug/L)	130	2	106	10
Turbidity (NTU)	61	0.30	7.23	0.80
Turbidity (FTU)	41	0.30	16.38	5.25
Turbidity (JCU)	--	--	--	--
Chlorophyll *a* (*u*g/L) - F	--	--	--	--
Chlorophyll *a* (*u*g/L) - S	3	0	0	0
Chlorophyll *a* (*u*g/L) - T	--	--	--	--
Periphyton Chl *a* (mg/m^2)	--	--	--	--

Table G.7 – Reference conditions for North Central Appalachian sub-region (# 62, Figure G.2)

Parameter	No. of Streams	Reported Values		**25th Percentiles based on all seasons data for the Decade P25* all seasons**
		Min	Max	
TKN (mg/L)	55	0.025	0.713	0.102
NO2 + NO3 (mg/L)	78	0.003	1.128	0.058
TN (mg/L) - calculated		0.028	1.841	1.06
TN (mg/L) - reported	5	0.233	1.208	0.28
TP (ug/L)	84	0	213.75	7.125
Turbidity (NTU)	12	0.325	8.725	1
Turbidity (FTU)	57	0.25	25	1.675
Turbidity (JCU)	10	0.55	6.675	0.8
Chlorophyll *a* (*u*g/L) - F	2	1.625	2	1.625
Chlorophyll *a* (*u*g/L) - S	8	1	6	2
Chlorophyll *a* (*u*g/L) - T				
Periphyton Chl *a* (mg/m^2)				

Table G.8 – Reference conditions for Blue Ridge sub-region (# 66, Figure G.3)

Parameter	No. of Streams	Reported Values		**25th Percentiles based on all seasons data for the Decade P25* all seasons**
		Min	Max	
TKN (mg/L)	188	0.025	2.55	0.169
NO2 + NO3 (mg/L)	289	0.003	5.96	0.23
TN (mg/L) - calculated		0.028	8.51	0.399
TN (mg/L) - reported	174	0.092	6.363	0.214
TP (ug/L)	533	0	1387.9	10
Turbidity (NTU)	146	0.625	52.25	2.4
Turbidity (FTU)	52	1.4	40	4.25
Turbidity (JCU)	16	1.325	20.575	3.425
Chlorophyll *a* (*u*g/L) - F	0	--	--	--
Chlorophyll *a* (*u*g/L) - S	33	0.595	17.3	1.063
Chlorophyll *a* (*u*g/L) - T	--	--	--	--
Periphyton Chl *a* (mg/m^2)	7	26.85	53.75	32.75

Table G.9 – Reference conditions for Ridge and Valley sub-region (# 67, Figure G.3)

Discussion

The Appalachian Trail crosses many of the highest peaks and traverses many of the highest ridgelines in the eastern United States. The Trail also descends to lower elevations, and crosses most of the major rivers at some point prior to reaching the Atlantic Ocean. The composite nature of habitat through which the Trail passes makes it difficult, or impossible to concisely evaluate the condition of water quality on the Trail and to make broad management recommendations. However, using the aforementioned USEPA ecoregion classification scheme, it is possible to build a set of nutrient parameter expectations for a portion of the water resources found along the Trail. Specifically, the reference values presented in Tables x2 through x9 may be a

useful tool for predicting the condition of water resources found where the Appalachian Trail is highest in a particular watershed. Streams that are high in a watershed, first and possibly second order streams, are less likely to be impacted by human activity and nutrient values would be expected to more closely track the predicted values presented in Tables x6 through x9. Similarly, higher elevation lakes and ponds should be less impacted by human impact and like first or second order streams are likely to have nutrient levels that are close to the predicted values in Tables x2 through x5. Thus, it is reasonable to evaluate data obtained from more remote, and/or high elevation waters found along the Appalachian Trail against the values contained in Tables x2 through x9. Lower elevation waters or waters that are in close proximity to more heavily developed areas may be expected to have nutrient parameter values that are greater than the 25th percentile levels, and may occasionally approach the maximum values presented in Tables x2 through x9. This dichotomy poses certain considerations for managers. First, high elevation or remotely located waters may require little active management beyond monitoring, though problems that are identified may be easier to rectify because the cause of the problem may be on lands owned or managed by the Appalachian Trail Park Office or the Appalachian Trail Conservancy. Conversely, lower elevation waters or waters that are close to developed areas are more likely to demand some form of management, but the necessary actions may not be possible given the complexities of multiple land ownership and distance between the cause and the Appalachian Trail.

There are other issues to consider with respect to water quality beyond trophic status. For example, each of the USEPA ecoregion and sub-ecoregion descriptions indicate that waters in these areas typically have low alkalinity levels, or ability to buffer acidic inputs. This is particularly true of streams that are high in a watershed and of ponds and lakes that have small watersheds like many found along the Appalachian Trail. Unfortunately, there is little baseline information available from USEPA upon which to build expectations. Summary data for alkalinity is only available from the northeast highlands sub-ecoregion (Table x10). The mean alkalinity level for lakes and ponds in the northeast highlands is quite low at just under 6 mg/L, whereas stream alkalinity is more moderate at approximately 54.7 mg/L. Like trophic status, alkalinity status presents a dilemma for managers because the source of acidification that these low alkalinity resources are believed to be so susceptible originates a great distance from the Appalachian Trail. Site specific remediation measures may be possible, but they are expensive and short term.

Parameter		**Statistics**				
Name	Units	No. of Obs.	Avg.	Std. Dev.	Min.	Max.
Lake & Pond Alkalinity	mg/L	2321	5.9938	6.245	0.1	98
Stream Alkalinity	mg/L	31	54.6581	18.8252	19.8	85.4

Table G.10 – Alkalinity for Northeast Highlands sub-region (# 58, Figure G.2)

Recommendations:

The configuration of the Appalachian National Scenic Trail presents logistical difficulties that make it difficult to systematically monitor the status of the water resources found along the Trail. Rather than attempt to develop a systematic water quality monitoring program for the Appalachian Trail, it is more realistic to identify and work with local and regional programs that already conduct water quality monitoring in watersheds that intersect the Appalachian Trail. In many instances, these local and regional programs may be collecting data that are directly relevant to Appalachian Trail water resource management concerns. Where existing programs do not already track information that is relevant to Appalachian Trail resource management needs, it may be possible to work with the local and/or regional programs to expand their efforts to incorporate the Appalachian Trail. Where existing programs do not exist, resource managers should try to identify organizations and/or agencies that may be interested in developing new monitoring programs. When information from one or more existing groups suggests that additional more focused investigation is warranted, resource management staff should seek resources for more detailed investigation.

F. Cultural Resources

This section summarizes baseline information about cultural resources along the Appalachian National Scenic Trail that is currently available to the Appalachian Trail Park Office and Appalachian Trail Conservancy. Because of the Trail's geographic scope, management complexity, and the fact that a substantial portion of Appalachian Trail lands has only recently been acquired, comparatively little systematic cultural resource inventory information exists for Appalachian Trail lands.

This section is organized according to types of cultural resource studies and baseline reports conducted by the National Park Service. These studies typically include documentation of historic contexts, a park administrative history, a historic resource survey, an archaeological overview and assessment, a cultural landscape inventory, cultural landscape reports, a list of classified structures, museum catalog records for the national catalog of museum objects, an ethnographic overview and assessment, and identification and documentation of National Historical Landmark and National Register of Historic Places properties, contributing resources, and other historic resources. In addition, a brief discussion of Section 106 compliance is provided at the end of this section.

1. Historic Contexts for the Appalachian Trail

A "historic context" identifies historical themes delineated by time periods and geographic areas to provide a framework within which individual cultural resources can

be evaluated and listed in the National Register of Historic Places. In 2002, Dr. Robert Grumet of the National Park Service's Northeast Regional Office completed a six-month study of the Appalachian Trail and submitted a report titled *Historic Contexts of the Appalachian National Scenic Trail*. According to Grumet:

> "The setting of Appalachian Trail history is unique, comprising a 2,175-mile-long undulating ribbon of ridge-line rarely more than 1,000-feet-wide at its broadest points. A complex history has unfolded on this mountain stage, one embracing a wide range of events, incidents, and characters. Overviews summarizing the full sweep of history along the Appalachian Trail reveal broad patterns of continuity and change useful in crafting vision statements and fixing management goals and priorities. Management and protection of particular Appalachian Trail cultural resources preserving vestiges of this history more often require smaller, more comprehensible increments of time, place, and theme."

Grumet described the following framework in *Historic Contexts of the Appalachian National Scenic Trail*:

The Appalachian Trail, 1920-Present.

- Building the Trail, 1920-1968.
- Managing the Trail (including protecting the Trail), 1968-Present.

The Quest for a Usable Wilderness, 1750-1968.

- Farms and Furnaces, 1750-1900.
- Development and Devastation, 1820-1968.
- Sublime Wilderness, 1850-1880.
- Rise of the Trail Movement, 1880-1920.

Native American Appalachians, 12,000 years ago to 1850.

- Contact, Coexistence, and Dispossession, 1500-1850.
- Emergence of Townlife, 1,500-500 years ago.
- Appalachian Hunters and Gatherers, 10,000-1,500 years ago.
- People Come to the Appalachians, >12,000-10,000 years ago

Grumet describes each of these contexts in greater detail, through an analysis of time periods, geographic areas, and historic themes. Of particular relevance is his summary of the historic context of the Appalachian Trail itself:

> Born in the mind of forester Benton MacKaye (1921), the Appalachian Trail became a reality in 1925 with the founding of the Appalachian Trail Conference (Waterman and Waterman 1989). Initially led by Arthur Perkins and later by

Myron Avery (1931-1952), the Appalachian Trail Conference coordinated efforts of club Trail construction crews. Assisted by New Deal-era Civilian Conservation Corps and Works Progress Administration agencies (Carr 1998; McClelland 1993), Trail crews completed construction of a continuous Trail route running from Maine to Georgia by 1937.

Rebuilt in the years following World War II, the Trail gradually became a vital Trailway used by thousands of hikers. The Trail came to symbolize many things to many people (Bryson 1998; Redick 2001; and Rubin 2000). Trail maintenance and management procedures employed a technology calculated to preserve values treasured by hikers (Birchard and Proudman 2000). Public concern for the Trailway finally resulted in its designation as one of the first National Scenic Trails created by the National Trail System Act of 1968 (Foster 1987). Since that time, a unique partnership of volunteer organizations and public agencies has worked together to manage and maintain the Appalachian National Scenic Trail as a cultural resource of unparalleled national significance.

Copies of Dr. Grumet's *Historic Contexts of the Appalachian National Scenic Trail* are on file in the offices of the Appalachian Trail Park Office and Appalachian Trail Conservancy.

2. Park Administrative History

A "park administrative history" describes how a park was established and how it has been managed to the present day. As of 2008, a formal administrative history for the Appalachian National Scenic Trail has not been conducted. The Appalachian Trail Conservancy's archives contain more than 80 years of archival records, as do many of the archives and libraries of the early Appalachian Trail clubs. Several efforts have been made to assemble a comprehensive picture of this material; the most recent being a concerted effort in the early 1990s by a research team headed by Dr. Jack G. Morrison of Shippensburg University that resulted in an unpublished manuscript titled The Archival Holdings of the Appalachian Trail Conference – A Preliminary Inventory (1991). The voluminous records that document the design and construction of the Appalachian Trail in Maine are located in the Avery Collection of the Maine State Library in Augusta, Maine. The Potomac Appalachian Trail Club also maintains extensive archival records of the early history of the Appalachian Trail.

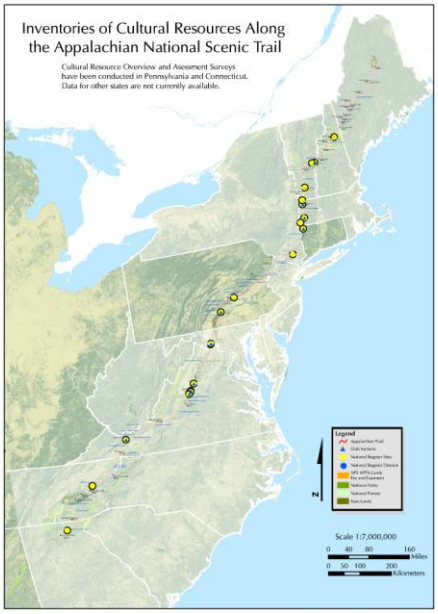
3. Historic Resource Study

A "historic resource study" (HRS) provides a historical overview of a park or region and identifies and evaluates a park's cultural resources within historic contexts. As of 2008, a Historic Resource Study for the Appalachian National Scenic Trail has not been conducted. Much of the developmental history of the Appalachian Trail is described in records retained in the archives of the Appalachian Trail Conservancy. Numerous historical and quasi-historical summations of the developmental history of the Appalachian Trail have been published. The most prominent of these efforts are: (1)

Trail Years: A History of the Appalachian Trail Conference, by Brian B. King (2003), and (2) The Appalachian National Scenic Trail: A Time to Be Bold, by Charles H. W. Foster (1987). The first document listed above is a publication of the Appalachian Trail Conservancy intended to provide ATC members and other interested parties with a summary account of the developmental history of the Trail. The second is an extensive published account of the combined efforts of the National Park Service, the Appalachian Trail Conservancy, states, other federal agencies, and many other private citizens and public agencies to secure federal and state protection for the Appalachian National Scenic Trail through passage of the National Trails System Act and public acquisition of a corridor of land surrounding the Trail. A Historic Resource Study could build upon these works and analyze the Trail's developmental history and other themes and contexts within the framework of Dr. Grumet's Historic Contexts of the Appalachian Trail.

4. Archaeological Overview and Assessments and Similar Studies

An "archaeological overview and assessment" describes known and potential archaeological resources for a park. Documentation of known and expected cultural resource properties along the Appalachian Trail – at least to the extent that it is available to the Appalachian Trail Park Office and Appalachian Trail Conservancy – is fragmentary and incomplete. In fact, overview and assessment studies have been completed for the Appalachian Trail in only two states: Pennsylvania (1999) and Connecticut (2004). [See *Map II.H.1: Inventories of Cultural Resources along the Appalachian National Scenic Trail*.]



In many locations along the Trail, National Park Service, U.S. Forest Service, and other Federal land managers have conducted surveys on lands under their jurisdiction to fulfill their responsibilities under Section 106 of the National Historic Preservation Act. Few, however, have had the funding resources to conduct a more comprehensive assessment of cultural resources on their lands in accordance with Section 110 of the Act. Several state agencies have conducted extensive research, particularly in state historic parks like Pine Grove Furnace State Park in Pennsylvania and Gathland State Park in Maryland. Professional and amateur historians and archaeologists also have conducted local or regional studies that contribute to the overall knowledge of cultural resource along the Trail. In other areas, however, little or no data exists. The following state-by-state narrative summarizes information that is currently available to the Appalachian Trail Park Office and Appalachian Trail Conservancy:

Maine: The Maine Appalachian Trail Club and the University of Maine conducted a secondary-reference inventory of cultural resources in 1986. Although never finalized, the draft inventory contains an extensive list of historically occupied sites and features along the Trail in Maine.

New Hampshire: The White Mountain National Forest has an extensive record of archaeological and historical research for lands under its administration. However, no studies specific to Appalachian Trail lands administered by the Forest have been conducted in New Hampshire.

Vermont: Surveys conducted by Green Mountain National Forest cultural resource personnel indicate that low elevations, gaps, and saddles along the Trail route in Vermont have the highest archeological potential. Some balds and mountain tops are reported to have sacred or traditional significance to Native Americans. Plans are currently being developed to interpret the archeological remains of the now abandoned Aldrichville townsite. Forest Archeologist David Lacey has identified seven additional cultural resource sites within the Appalachian Trail corridor on U.S. Forest Service lands in Vermont. These include one extensive prehistoric quartzite quarry stretching along a one kilometer stretch of the Trail, two quartzite flake scatters, a quartzite knife find spot, several stone cairns, and three places regarded as traditional cultural properties by Abenaki people. None of these locales have been subjected to intensive testing, and none are presently known to possess diagnostic artifacts or organic remains associated with human occupation.

Massachusetts: No comprehensive studies of cultural resources along the Appalachian Trail lands have been conducted in Massachusetts. In 2005, the NPS Omsted Center for Landscape Preservation began work on a methodology for conducting cultural landscape inventories along the length of the Appalachian Trail. This methodology, which is expected to be finished in 2009, will include a pilot study of the Appalachian Trail in Massachusetts.

Connecticut: In 2004, the Connecticut State Archaeologist and a subcontractor completed a comprehensive cultural resource overview and assessment project of the 52-mile section of the Appalachian Trail in Connecticut under a cooperative agreement with the Appalachian Trail Conservancy. This survey, which took three years to complete, identified 382 cultural resources along the Trail in that state and provided detailed ASMIS information, GPS coordinates, and management recommendations for all of the sites. This survey represents the most thorough assessment of cultural resources on the Appalachian Trail to date.

New York: No comprehensive studies of Appalachian Trail lands have been conducted in New York.

New Jersey: The Appalachian Trail Park Office and the Appalachian Trail Conservancy

are exploring the potential for conducting a cultural resource inventory and overview for Appalachian Trail lands in New Jersey. This study would use State Historic Preservation Office files and other cultural resource management documentation to build upon Ronald J. Dupont, Jrs.' *Hiking With History: Heritage on the Appalachian Trail in New Jersey* (Dupont 1994), which documents and describes more than 20 culturally important sites along the Trail in New Jersey.

Pennsylvania: A cultural landscape survey of Trail lands in the Cumberland Valley of Pennsylvania completed in 1998 documented a number of point features, such as stone wall steps, ponds, buildings, garden sites, a cemetery, and a large "resting tree" preserved to shade farmers while working; cluster features, such as farmsteads, farm fields, pastures, stone wall intersections, and hedgerow intersections; and linear features, such as stone walls, hedgerows, fence lines, abandoned farm roads, roads, and bridges. This survey included the following nine individually named cultural resources: Scott Farmstead, Bernhisel Bridge, Rutter House, White Oak Resting Tree, the US 11 Footbridge, Chambers Family Cemetery, Hertzler Farmstead, Boiling Springs Village, and the Sunday Farmstead.

In 1999, the Department of Anthropology of the Pennsylvania State University conducted a literature search of previously reported archeological resources along the Trail corridor in Pennsylvania under a cooperative agreement with the Appalachian Trail Park Office and Appalachian Trail Conservancy. The study identified 55 cultural resource sites or features, including one frontier fort (Fort Dietrich Snyder), four iron furnaces, numerous charcoal hearths, and one coal mining estate (the Stony Creek Coal Estate, also known as Saint Anthony's Wilderness, a broad area between the Susquehanna and Schuylkill rivers encompassing Rausch Gap and Yellow Springs). Researchers further identified fourteen previously recorded prehistoric resources (none presently known to contain diagnostic artifacts within intact features or deposits) and twenty-five areas (most coinciding with road, canal, or rail alignments) possessing potential to contain significant cultural resources. Additional field research by an extraordinary volunteer, an intern, and a National Park Service archaeologist in 2001 and 2002 provided additional documentation and field verification of the 55 sites identified in the report, as well as preliminary data for an additional 21 sites.

Maryland: In 1998, the Appalachian Trail Park Office, the Appalachian Trail Conservancy, the Potomac Appalachian Trail Club, and the Central Maryland Heritage League entered into a Memorandum of Understanding to develop a long-term management plan to survey and interpret the South Mountain Battlefield in Washington and Frederick Counties, Maryland.

In 2004, Indiana University of Pennsylvania completed a detailed archaeological survey and management plan for the Fox's Gap site of the Battle of South Mountain under a contract with the Appalachian Trail Conservancy, with additional guidance and direction provided by the Appalachian Trail Park Office, the Maryland Department of Natural

Resources, the Potomac Appalachian Trail Club, and the Central Maryland Heritage League.

Portions of the B & O Railroad Potomac River Crossing and the Harper's Ferry Historic District in Maryland and the Washington Monument, the first memorial to the nation's first president, are currently the only properties on the Appalachian Trail in Maryland listed in the National Register of Historic Places. Studies are currently underway to determine the potential eligibility of South Mountain battle sites at Crampton Gap, Fox's Gap, and Turner's Gap for listing in the National Register of Historic Places.

West Virginia: No comprehensive studies of Appalachian Trail lands have been conducted in West Virginia. Harpers Ferry National Historical Park has an extensive cultural resource management program. Forty years of archaeology in the Park have generated more than 50 reports and 500,000 objects. The Park's List of Classified Structures, updated in 1991, contains 157 structures. Two landscape plans were prepared between 1990 and 1992.

Virginia: In northern Virginia, Shenandoah National Park's List of Classified Structures lists twenty-eight properties, broken down into five property types, within Appalachian Trail corridor lands in park boundaries. Built or modified for park use by the Civilian Conservation Corps during the 1930s, these properties include the Appalachian Trail itself, fourteen cabins and shelters (including one National Register property), three stone walls, five fire pits and hearths, and five springs and springhouses.

George Washington and Jefferson National Forests archeologist Mike Barber reported in 2002 that 25 archeological sites had been identified within the Appalachian Trail corridor on U.S. Forest Service lands in Virginia. Two of these sites preserve remains of historic farmsteads. Diagnostic artifacts associated with particular time periods in prehistory have been recovered at six locales; scattered stone chips identified as debris left over from quarrying, tool manufacture, or resharpening activities, have been primarily found on the surface of the remaining 17 sites. In 2001, Forest Service staff assisted the Appalachian Trail Park Office in recording and stabilizing the Catawba Crest Archaeological Site.

Also in Virginia, the Blue Ridge Parkway maintains several historic structures within the immediate vicinity of the Appalachian Trail near Humpback Rocks, as well as extensive records of archaeological sites in the vicinity of the Trail.

Tennessee: No data are currently available for Tennessee.

North Carolina: The National Forests of North Carolina have surveyed only a small fraction of the 230 miles of Appalachian Trail under U.S. Forest Service jurisdiction. Archaeologist Rodney Snedecker reported identification of 46 prehistoric sites, 7 historic archeological sites, and 3 historic Trails (the Over Mountain Victory, Trail of Tears, and

Bartram Trails). He further reported that some sites have only surface components; others have subsurface and intact deposits and features. An unspecified number of cultural resources possessing intact subsurface deposits have been determined eligible for listing in the National Register of Historic Places. Several sacred sites and traditional gathering areas, and other traditional cultural properties are also reported on U.S. Forest Service Trail lands in North Carolina (Rodney Snedecker 2002: personal communication).

Georgia: No comprehensive studies of Appalachian Trail lands have been conducted in Georgia.

5. Cultural Landscape Surveys

The "cultural landscape inventory" (CLI) is a computerized inventory of all cultural landscapes in which the National Park Service has or plans to acquire a legal interest. Its purpose is to identify cultural landscapes within the National Park System and provide information on their location, historical development, features, and management. To date, no cultural landscape surveys have been conducted specifically for the Appalachian National Scenic Trail. Both Shenandoah National Park and the Delaware Water Gap National Recreation Area have completed cultural resource inventories that include portions of the Appalachian Trail.

However, the NPS Omsted Center for Cultural Landscapes is working closely with the Appalachian Trail Park Office and the Appalachian Trail Conservancy to develop a methodology for conducting cultural landscape inventories on the Appalachian Trail. A draft report was completed in 2006. In 2006, the Omsted Center contracted with the State University of New York at Syracuse to sponsor a field school and complete a CLI of the Appalachian Trail in Shenandoah National Park. This results of this inventory will be used to fine-tune the draft report. A final report is expected to be released in 2009.

6. List of Classified Structures

The "list of classified structures" (LCS) is a computerized inventory of all historic and prehistoric structures of historical, architectural, or engineering significance in which the National Park Service has or plans to acquire a legal interest. List of classified structures inventories are only just beginning along the Appalachian Trail. A review of an informal research project conducted by a volunteer and the data contained in the NPS Facility Management System (FMSS) indicates that at least 20 of the 95 Appalachian Trail shelters originally constructed by the Civilian Conservation Corps (the CCC) are still in existence. One of these shelters, the Rocky Run Shelter, is currently being renovated by the Potomac Appalachian Trail Club, with a grant provided by Preservation Maryland and technical assistance from the Maryland Department of Natural Resources, the Appalachian Trail Conservancy, the Appalachian Trail Park Office, and the NPS Preservation Center in Frederick, Maryland. More than a dozen other shelters

constructed by Trail clubs (including the huts constructed by the Appalachian Mountain Club in the White Mountains) and other organizations (such as the Works Progress Administration) are believed to be historically significant. Most of the remaining shelters along the Trail have been constructed since the 1960s.

Although a substantial number of structures were acquired as part of the Appalachian Trail protection program, the vast majority of these structures have been tract homes, sheds, outbuildings, and garages. Most of these "incidentally acquired" structures have been demolished or are slated to be demolished. In each case, Appalachian Trail Park Office personnel have consulted or are consulting with the state historic preservation officer to determine that the facilities slated for demolition do not have historical significance.

Only three structures among these incidentally acquired structures – the Prospect Mountain Ski Tow Cabin in Vermont, the Boiling Springs regional office in Pennsylvania, and the Kegley Farmhouse in southwest Virginia – have been identified as eligible for the National Register of Historic Places. All three have been retained. The Green Mountain Club, with assistance from the Appalachian Trail Conservancy, the Green Mountain National Forest, the Marsh-Billings National Historical Park, and the Appalachian Trail Park Office have stabilized and are restoring the Prosper Mountain Ski Tow Cabin. The Boiling Springs regional office has been restored and is utilized by the Appalachian Trail Conservancy as a regional office and visitor center. Necessary actions have been taken to stabilize and prevent vandalism at the Kegley farmhouse. A fourth National Register property, the April Hill Farm (also known as the Westover-Bacon-Potts Farm) in Massachusetts, is owned and maintained by the Appalachian Trail Conservancy

The Delaware Water Gap National Recreation Area currently lists Pennsylvania and New Jersey sections of the Appalachian Trail on its LCS inventory.

The following properties within Shenandoah National Park were built or modified for use as part of the Appalachian Trail by the Civilian Conservation Corps during the 1930s and are listed in the park's LCS (Stephen Clark 2001:personal communication):

Cabins and Shelters
- Pinefield Hut
- Black Rock Hut
- Pass Mountain Shelter
- Gravel Springs Hut
- Hightop Hut
- South River Maintenance Hut
- Rock Spring Hut
- Bearfence Hut

Trails
- Appalachian Trail

Stone Walls & Retaining Walls

Harpers Ferry National Historical Park, the C&O Canal National Historical Park, the Blue Ridge Parkway, and Great Smoky Mountains National Park may also have properties associated with the Appalachian Trail in their LCS inventories.

7. National Catalog of Museum Objects

The National Catalog lists all cultural objects that meet the criteria for museum objects in the National Park System. No catalog of museum objects has been developed for the Appalachian Trail.

8. Ethnographic Overview and Assessment

An ethnographic overview and assessment describes accessible archival and documentary data on park ethnographic resources and groups who traditionally define features within the park as significant to their ethnic heritage. No ethnographic overview and assessments have been prepared for the Appalachian Trail.

9. National Historic Landmarks and National Register Properties

The National Register of Historic Places is the nation's official list of districts, sites, buildings, structures, and objects that are significant in American history and culture.

Two sections of the Appalachian Trail itself have been determined to be eligible for the National Register of Historic Places: (1) a section of the Trail in northern New Jersey, where the Trail follows the New York-New Jersey state line; and (2) a section of the Trail in the Delaware Water Gap National Recreation Area in eastern Pennsylvania and northwestern New Jersey. Records of these determinations are available through the Appalachian Trail Park Office. Both determinations were made as part of a Section 106 review of the potential effects of a proposed utility project. Other sections of the Trail have not been evaluated. However, few sections of the Appalachian Trail are in their original location. In fact, most sections of the current Trail footpath on Appalachian Trail Park Office lands have been constructed in the last 20 years, subsequent to the completion of the land protection program that permitted the Trail to be relocated off public roads and back into a woodland environment.

Federal actions have resulted in the designation of the two National Historic Landmarks on lands within the Appalachian National Scenic Trail corridor listed below:

Crane and Company Old Stone Mill Rag Room, Massachusetts
Palisades Interstate Park, New Jersey and New York (pending boundary re-study)

Nineteen National Register of Historic Places properties and districts have been listed by Federal or State agencies on Appalachian Trail lands. Numerous others exist within one mile of the Trail. [See *Map II.F.2: National Register of Historic Places Properties along*

the Appalachian National Scenic Trail, *Table II.F.1: National Register of Historic Places Properties along the Appalachian National Scenic Trail*, and *Appendix D: National Register of Historic Places Properties Within One Mile of the Appalachian National Scenic Trail*.] The properties and districts that Grumet considered to be part of the Appalachian Trail are shown below in *Table II.F.1*:

Table II.H.1: National Register Properties and Districts on the Appalachian Trail
(districts are italicized*)*

New Hampshire
Tip-Top House (1853)

Massachusetts
Mount Greylock Summit Historic District
Tyringham Shaker Settlement Historic District
Westover-Bacon-Potts Farm

Connecticut
Bull's Bridge

Falls Village Historic District

New York
Bear Mountain Bridge & Toll House (1924)

New Jersey
High Breeze Farm

Pennsylvania

Boiling Springs Historic District
Carbon County Section of the Lehigh Canal
Waterville Bridge

Maryland
Washington Monument (1827; rebuilt 1934)
B & O Railroad Potomac River Crossing

West Virginia

Harpers Ferry Historic District

Virginia

Burke's Garden Rural Historic District

Skyline Drive Historic District

George T. Corbin Cabin and Stone Wall
Big Meadows Site

Georgia

Blood Mountain Shelter
Walasi-Yi Inn

The New Jersey Historic Preservation Office has determined that the following two properties within the Appalachian National Scenic Trail corridor in New Jersey are eligible for listing in the National Register of Historic Places:

Ring Quarry Prehistoric Archeological District
Delaware Water Gap National Recreation Area Section of the Appalachian Trail:

Potentially Contributing Resources: Grumet (2002) compiled a list of potential Contributing Resources (cultural resources that may be associated with National Register Properties) from literature sources, which include:

Herb Hiller Plaque
Kaiser Road
AMC Mohican Outdoor Center
Mohican Camp Road
Catfish Fire Tower (1922)
Millbrook-Blairstown Road
B-17 Crash Site (1944)
Housing Development Ruins
Blue Mountain Lakes Road (Flatbrookville Road)
Harding Lake Rockshelter
Rattlesnake Mountain Viewpoint
Bird Mountain Viewpoint
Brink Road Shelter (1970)
Brink Road
US 206/Worthington Bakery
Upper North Shore Road/Rt 636
Sunrise Mountain Road
Culver Fire Tower (1934)
Gren Anderson Shelter (1958)
Sunrise Mountain Pavilion (1937)

Sunrise Mountain Road
Crigger Road
Swenson Wood Road
Mashipicong Shelter (1936)
Deckertown Turnpike
Lake Rutherford
NJ 23
Rutherford Shelter (1967)
High Point Inn
  Kuser Family Mansion/
  High Point State Park Headquarters
High Point Monument (1930)
High Point Shelter (1936)

Other Potentially Historic Properties: In 2002, NPS cultural resource specialist Dr. Robert Grumet listed more than 1,290 individually named components of the Appalachian Trail's current built environment, using the most recent editions of Appalachian Trail guidebooks. These properties include shelters, viewpoints, improved roads, bridges, impoundments, buildings, monuments, towers, and railroad grades. At present, none of these features have been evaluated for their potential cultural significance. Resources already mentioned in this report, such as Trails, campsites, Trail heads, parking areas, and unnamed roads, rail grades, fences, walls, quarries, kilns, springs, and other features, are not included in these lists.

10. Section 106 Compliance

The Appalachian National Scenic Trail has worked with cultural resource specialists on staff at the NPS Northeast Regional Office, the Valley Forge Center for Cultural Resources, and Harpers Ferry National Historic Park to conduct Section 106 compliance actions. These undertakings include proposals by utility companies and transportation departments for pipelines, powerlines, road constructions, communication towers, and other utilities. Some of these undertakings, such as the Iroquois Pipeline, have been substantial. Section 106 compliance also is conducted for Trail management actions proposed by the Appalachian Trail Conservancy and Appalachian Trail-maintaining clubs, including parking areas, Trail relocations, shelters, footbridges, and Trailheads. Thus far, these have been small-scale developments, affecting fewer than 20 acres of Appalachian Trail lands during the past ten years.

CHAPTER III: CURRENT RESOURCE MANAGEMENT CAPABILITIES, ISSUES, THREATS, AND PROGRAM NEEDS

A. Introduction to the Appalachian Trail Resource Management Program

This section identifies current management capabilities and overall natural resource management program needs for (1) coordination of Trail-wide resource management programs (such as conducting systematic state-by-state inventories of natural resources along the entire Appalachian Trail); and (2) site-specific resource management needs and issues on lands administered by the Appalachian Trail Park Office only. As explained in greater detail below, this plan is intended to provide management direction for natural and cultural resources programs of the National Park Service Appalachian Trail Park Office and the Appalachian Trail Conservancy, within the larger context of cooperative management of the Appalachian National Scenic Trail.

Any discussion of management programs for the Appalachian National Scenic Trail needs to begin with a discussion of its extraordinarily complex land ownership pattern and management framework. As described under Land Ownership in Chapter I, the Appalachian Trail – in addition to crossing 82,700 acres of land administered by the Appalachian Trail Park Office – crosses an extensive land base administered by many other federal and state agencies. Each of these land-managing entities manages its section of the Appalachian National Scenic Trail:

- in partnership with the local Trail-maintaining club(s) and the Appalachian Trail Conservancy;
- in conformance with a memorandum of understanding or other instrument adhering to the management principles outlined in the *Appalachian Trail Comprehensive Plan*; and
- in accordance with its own administrative jurisdictional responsibilities.

Because of this complex, intermingled land ownership pattern, it is impractical and inefficient at best – and in some cases impossible – to conduct inventories solely on Trail lands administered by one agency. However, systematic inventories are critical for establishing priorities for resource management. Consequently, the Appalachian Trail Conservancy and the Appalachian Trail Park Office have encouraged and facilitated the development of resource inventories for all Appalachian Trail lands, regardless of ownership. Most frequently, these inventories have been conducted on a state-by-state basis. This approach provides all of the primary land managers along the Trail with a consistent set of data on which to base decisions that could affect Trail resources.

The next subsection of this plan is titled "**Sensitive Resource Areas**." The accompanying maps depict the general location of natural and cultural resource areas on all Trail lands, to the extent that this information is contained in these state-by-state inventories and assessments facilitated by the Appalachian Trail Conservancy and Appalachian Trail Park

Office or available from other sources. [Note: Site-specific locational data is not provided, to ensure that the location of sensitive natural or cultural resources remains confidential.]

The Appalachian Trail Conservancy and Appalachian Trail Park Office also have initiated and continue to support several Trail-wide volunteer-based monitoring programs, the oldest of which are :

- the A.T. corridor monitoring program, which consists of regular monitoring of Appalachian Trail corridor boundaries to discourage trespass and other illegal use of Appalachian Trail lands;
- the A.T. natural heritage site-monitoring program, which is focused on monitoring RTE species and threats to these species at specific natural heritage sites along the Trail.

These monitoring programs help land managers identify trends and potential problems that may require more intensive monitoring or further management actions to protect vulnerable resources. The RTE protection program also provides Trail maintainers with plant identification sheets to help them avoid harming RTE plants during routine Trail maintenance.

The Appalachian Trail Mega-Transect Program: The A.T. MEGA-Transect was officially launched in November 2006, although the concept began to emerge several years prior. For more information on the history and precursor projects to the A.T. MEGA-Transect, see the 2006 A.T. MEGA-Transect Symposium Proceedings posted on the ATC's website. The A.T. MEGA-Transect is the ATC and APPA umbrella program for environmental monitoring and natural resource management: the program includes aspects of environmental monitoring and natural resource management that are mandatory as per the National Park Service's delegation agreement to ATC, as well as projects that may not be mandatory but will serve the long-term goals of the NPS and the ATC, including education and outreach.

The programmatic mission is to establish the A.T. MEGA-Transect to monitor and understand changes in the environment to effectively manage natural resources, foster an appreciation for nature and conservation, and "tell the story" of the health of the Appalachian Trail and surrounding lands to visitors, neighbors, and the American public.

The goals of the A.T. MEGA-Transect are to:

- Monitor- collect new and existing data on key indicators of environmental health with citizen scientists, organizations, researchers, and agencies
- Understand- transform data into knowledge about the status a nd trends through analysis, synthesis, and modeling
- Inform and Engage- share this knowledge to engage, educate, and involve decision makers, stakeholders, and the American public in managing and

protecting the A.T. environment . Seek to attain the goals of existing natural resource and environmental legislation and make sound decisions for positive change.

Projects that meet mandatory resource stewardship requirements as per the delegation agreement include:

- The A.T. natural heritage site-monitoring program described above. This is one of the earliest monitoring efforts put in place by the ATC and the A.T. Park Office.
- Exotics monitoring and management, in particular to protect RTE species and sites: exotics management is mostly handled by the NPS Exotic Management Teams at the moment, and there is no comprehensive or strategic monitoring for exotic species separate from the natural heritage site-monitoring program. ATC has however recognized the importance of exotics monitoring and management and will strive to put a project in place based on sound protocols to track and manage exotics to a greater extent.

Additional projects that are being piloted by the ATC include:

- Wildlife monitoring using motion-triggered infrared cameras: this survey will enable the ATC, the NPS and the Smithsonian Institute, who is leading the project, to gain a greater understanding of the distribution of wildlife in different areas of the corridor, and thus of the quality of the wildlife habitat in different areas of the corridor and potentially the integrity of the corridor as a wildlife migration corridor. In addition to the scientific benefits of the study, the wildlife survey has enjoyed wide interest and support from club volunteers as well as new volunteers unaffiliated to clubs and the media.
- American Chestnut Data Gathering Project: This project is being run in cooperation with The American Chestnut Foundation, and is meant to contribute to TACF's current blight-resistant American chestnut breeding program as well as the future restoration of the American Chestnut on the Appalachian range.
- Water Quality Monitoring on the A.T. through World Water Monitoring Day

Other topics of interest for which projects may be developed in the future include:

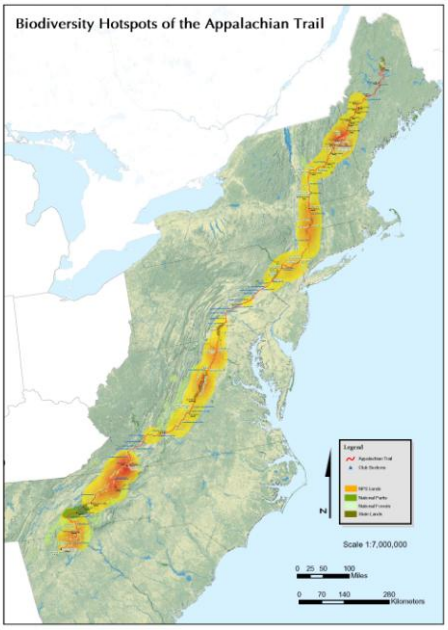
- Forest health monitoring
- Phenology
- Air quality
- Mountain birds
- Landscape dynamics
- Visitor Impacts

Beyond these initiatives, no further actions are considered in this plan that are common to all Trail lands and managers of those lands. **In other words, this plan does not dictate any specific management emphasis, identify any zones or management areas, or propose management actions for any lands other than lands administered by the Appalachian Trail Park Office**. As a result, Chapter III.C, which focuses on identification of park management areas, addresses resource management considerations and resource management zones on Appalachian Trail Park Office lands *only*.

Further, although Chapters III.E, III.F, III.G, III.H, and III.I include discussions of Trail-wide inventory needs and threats, the discussions on management needs that follow focus on resource management programs for the Appalachian Trail Park Office and Appalachian Trail Conservancy only.

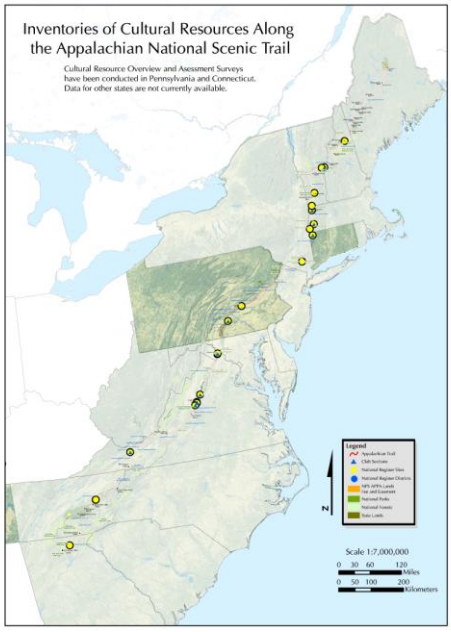
B. Sensitive Resource Areas

Sites containing sensitive natural and cultural resources on the Appalachian Trail have been delineated on *Maps II.B.1 and II.H.1*, based upon information that has been collected through a series of cooperative inventories of natural and cultural resources. The information available at this time is by no means comprehensive. In fact, a significant consideration in formulating the resource management program needs in this Resource Management Plan at this time is to identify information that has not yet been systematically collected.



Sensitive *natural* resource areas are based upon data obtained through a series of inventories conducted by state natural heritage programs and contractors in cooperation with the Appalachian Trail Conservancy, the Appalachian Trail Park Office, the USDA Forest Service, state agencies, and Trail-maintaining clubs between 1989 and 2002. [See *Map II.B.1, Biodiversity Hotspots along the Appalachian Trail*.] These inventories have been completed in all 14 states along the entire Trail; however, some additional work is needed to identify rare animal species in certain states.

Sensitive *cultural* resource areas reflected on the attached maps are based upon data obtained through inventories conducted by state universities and contractors in cooperation with the Appalachian Trail Conservancy, the Appalachian Trail Park Office, and Trail-maintaining clubs. As of 2008, these inventories are complete only in Pennsylvania and Connecticut. Additional inventories in other states are in the planning stages. [See *Map II.H.1, Inventories of Cultural Resources along the Appalachian Trail*.]



Because some of the information contained in the resource inventories is confidential, site-specific locational information about these sensitive cultural and natural resource sites is not depicted on either map (although information regarding the specific location of these sites is retained on file on the Appalachian Trail Park Office). Particularly sensitive sites are either not shown at all on the maps, or are

shown with a buffer area.

C. Management Areas for Lands Administered by the Appalachian Trail Park Office

When Congress passed the National Trail System Act, it required that the National Park Service develop a comprehensive plan for the Appalachian Trail instead of a General Management Plan. As a result, management zones on lands administered by the Appalachian Trail Park Office have not been formally identified.

The National Trails System Act further stated that national scenic trails are defined as "extended Trails so located as to provide for maximum outdoor recreation potential and *for the conservation and enjoyment of the nationally significant scenic, historic, natural, or cultural qualities of the areas through which such Trails may pass*." The *Appalachian Trail Comprehensive Plan* also clearly defines the Appalachian Trail as a backcountry recreational resource that is managed "*for travel on foot, through the wild, scenic, wooded, pastoral, and culturally significant lands of the Appalachian Mountains*." The Appalachian Trail Park Office, the Appalachian Trail Conservancy, the Trail-maintaining clubs, and their agency partners all adhere to these guiding principles, which are further outlined and elaborated upon in numerous agreements and plans, including the *Appalachian Trail Comprehensive Plan*. This document, the *Appalachian Trail Resource Management Plan*, tiers directly to these guiding principles.

Delineation of Management Areas

The Appalachian Trail Park Office proposes to identify "Management Areas" on lands it administers, in lieu of identifying formal management zones for the Appalachian Trail. (Management zones will be formally identified at such time as the Appalachian Trail Park Office updates its *Comprehensive Plan* or prepares a general management plan for the Appalachian Trail.) These Management Areas do not have any legal force or effect, nor do they have any purpose other than highlighting areas where (1) specific uses or management emphases are predominant and (2) sensitive resources should be considered in making on-the-ground planning decisions.

Descriptions of Management Areas

For the purposes of identifying Management Areas (which apply *only* to lands administered by the Appalachian Trail Park Office), the Appalachian Trail Park Office proposes to consider all lands under its administration to be within a Backcountry Recreation Area, with two exceptions. The first exception pertains to lands immediately surrounding retained structures, roads, utilities, and other non-Trail-related development, which the Appalachian Trail Park Office considers to be within a Park Developed Area. The second exception pertains to lands that are maintained as pasture or farmland. The Appalachian Trail Park Office considers these lands as being within an Agricultural Area.

These three Management Areas – the Backcountry Recreation Area, the Park Developed Area, and the Agricultural Area, are described as follows:

Backcountry Recreation Area: This area includes all Appalachian Trail Park Office lands that contribute to providing a backcountry recreation experience. All Appalachian Trail Park Office lands that are not developed or used for agriculture fall into this category. The primary use of these lands is for providing a backcountry recreation experience *to the greatest extent possible*, even if certain lands are located within a relatively urban setting. Hiking and camping are the primary uses of these lands (even though certain other uses, such as maple sugaring, are permitted under reserved rights or special use authorizations). Trail shelters and overnight-use sites are included in and managed as part of the backcountry recreational area. Approximately 96% of Appalachian Trail Park Office lands fall into this category.

Park Developed Area: This area contains developed facilities, including retained structures and existing roads, parking areas, utility lines, and communication sites, and their immediate surroundings. Most of these facilities are not related to the Trail. Park developed areas that contain roads are identified with a 50' right-of-way (25' either side of centerline); even though the actual road width and right-of-way may be somewhat smaller or larger on the ground and in legal documents. Park developed areas that contain utility lines (which include electric powerlines, oil and natural gas pipelines, water lines, sewer lines, and linear communication facilities) are depicted with a 100' right-of-way (50' either side of centerline); again, the actual right-of-way width may be somewhat smaller or larger on the ground and in legal documents. Retained structures, parking lots, and communication sites will be depicted on the maps within a circular area 100' in diameter. Again, the actual footprint of these facilities on the ground, or the area described in legal documents if rights exist to permit these uses, may be somewhat smaller or larger. Approximately 2.4% of Appalachian Trail Park Office lands fall into this category.

Agricultural Area: This area includes all areas that are used for agricultural purposes, including pasture for livestock, haying, crop-raising, or retention as open areas. Data for this analysis will be derived from aerial photographs. Approximately 1.6% of Appalachian Trail Park Office lands fall into this category.

D. Current Resource Management Capabilities

Although a variety of state and federal agencies and non-governmental organizations have resource management programs that either directly or indirectly affect the Appalachian National Scenic Trail, the purpose of this plan is to evaluate and set priorities for resource management programs developed specifically for the Appalachian National Scenic Trail by the NPS Appalachian Trail Park Office (APPA) and the Appalachian Trail Conservancy (ATC). In keeping with this purpose, the following discussion is limited to the current resource management capabilities of the APPA (with some assistance from other NPS offices) and ATC. Detailed program descriptions are provided in the following sections of this plan (Sections III.E to III.I).

1. Resource Management Capabilities at the NPS Appalachian Trail Park Office

The Appalachian Trail Park Office's resource management programs are managed primarily through three positions: an Environmental Protection Specialist, a Natural Resource Specialist, and a Physical Science (GIS) Specialist. All of the natural and cultural resource management program duties described below are carried out in close cooperation and consultation with volunteers and staff at the Appalachian Trail Conservancy. Program duties and responsibilities for natural and cultural resources are currently assigned as follows:

Environmental Protection Specialist: The NPS Appalachian Trail Park Office Environmental Protection Specialist is responsible for:

1) Reviewing, analyzing, and commenting on proposed roads, pipelines, powerlines, cell towers, communication sites, and other developments that could potentially affect the Appalachian Trail
2) Preparing environmental analyses and compliance documents for proposed projects on Appalachian Trail Park Office lands
3) Management of Appalachian Trail Park Office cultural resource programs, including serving as the Section 106 coordinator for the Appalachian Trail and coordination of cultural resource inventories, cultural landscape inventories, and other cultural resource projects and programs
4) Coordination of Appalachian Trail Park Office participation in remediation and restoration of the Palmerton Zinc Superfund Site
5) Identification of lands that need to be acquired by the National Park Service to protect the Appalachian Trail, in cooperation with the Appalachian Trail Conservancy and affiliated Trail clubs
6) General coordination with the NPS Inventory and Monitoring Networks

Natural Resource Specialist: The NPS Appalachian Trail Park Office Natural Resource Specialist is responsible for:

1) Overall coordination and management of the A.T. volunteer natural heritage monitoring program for all A.T. Lands, including training of monitors
2) Cooperation with other A.T. management partners to implement management actions that protect RTE species
3) Coordination of state natural heritage inventories for rare, threatened, and endangered species natural communities and other biological inventories for all Appalachian Trail lands
4) Administration of invasive and exotic species inventories on all A.T. lands, including coordination with three Exotic Plant Management Teams
5) Coordination with the NPS Inventory and Monitoring Network on biological resource issues
6) Administration of the NPS Research Permitting and Reporting System for all scientific research and natural resource activities on Appalachian Trail Park Office lands, ensuring that projects do not negatively impact the natural resources of the A.T.

Physical Science (GIS) Specialist: The Appalachian Trail Park Office Physical Science (GIS) Specialist is responsible for:

1) Compilation and management of GIS and spatially related digital data pertaining to the Appalachian Trail (this responsibility is shared with ATC's GIS specialist).
2) Preparation of maps, presentations, spreadsheets, and other materials to aid in Trail and resource management issues
3) Providing GIS analysis for resource management projects
4) Assists Environmental Protection Specialist with NEPA / Section 106 Compliance
5) Provide oversight and management of projects with management partners including USGS NBII, NatureServe, and NPCA
6) Producing maps and materials for Special Use Permits and Research Permits and coordination of GIS analysis and mapping in support of other programs
7) Responds to public inquiries and data requests
8) Administration and maintenance of APPA servers, computer workstations, laptops, software, and related peripherals and
9) Management of APPA local area network and shared resources
10) Management and Maintenance of GIS and GPS software and hardware

Gypsy moth suppression, rabies control, open areas management, and other natural resource management programs and projects are typically assigned by the Appalachian Trail Park Manager to one or more staff members based on expertise and workload allocation.

Support from other NPS program specialists: The Appalachian Trail Park Office receives program support for natural and cultural resource management from several other

offices of the National Park Service, including the NPS Natural Resource Inventory and Monitoring Program, the Northeast Regional Office, the Olmsted Center for Landscape Preservation, and the Washington Office.

NPS Natural Resource Inventory and Monitoring Program: The NPS Inventory and Monitoring Program provides extensive support to the Appalachian Trail Park Office in development of inventory data for natural resources and identification, tracking, and reporting on significant indicators of ecological conditions, or "vital signs," for the Appalachian Trail. The National Park Service initiated the "vital signs" monitoring program in 1998 to develop long-term monitoring of natural resources in 270 units of the national park system. The Appalachian Trail is one of these 270 natural resource park units.

The Trail passes through six NPS Inventory and Monitoring Networks: the Northeast Temperate, Eastern Rivers and Mountains, National Capitol, Mid-Atlantic, Appalachian Highlands, and Cumberland-Piedmont networks. The Northeast Temperate Network is responsible for coordinating activities related to the Appalachian Trail among the six networks. The Inventory and Monitoring Program has completed a number of studies to obtain baseline inventory information for the Trail, including a draft bibliography of all documents containing references to natural resources on the Appalachian Trail and a land use cover change analysis of ten sections of the Appalachian Trail. Several other inventories are in progress, including a vegetation mapping effort. Two small mammal inventories in the mid-Atlantic states and Maine have recently been completed.

In 2005, the NPS Inventory and Monitoring Program Northeast Temperate Network published *Appalachian Trail Vital Signs (Technical Report NPS/NER/NRTR – 2005/26)*, which documented the current status of knowledge and understanding of eleven "vital signs" for the Appalachian Trail. This report represents a critical step in the development of a full-fledged monitoring program for the Appalachian Trail.

The Northeast Temperate Network employs a full-time Environmental Monitoring Coordinator for the Appalachian Trail. This specialist plays a lead role in coordinating studies and reporting on the condition of identified "vital signs," threats to those resources, and trends in those conditions. Specific priorities for the Environmental Monitoring Coordinator include:

1) Working with the A.T. MEGA-Transect Coordination Team to develop and implement an action plan.
2) Bringing structure to the A.T. MEGA-Transect by providing overall leadership and coordination for the A.T. MEGA-Transect "Program."
3) Developing a catalog of existing projects, programs, and organizations that maintain an interest relevant to the Appalachian National Scenic Trail.

4) Regularly meeting and coordinating, in person and/or by phone, with key APPA and ATC staff as well as existing and potential cooperating individuals, agencies and organizations.
5) Serving as a scientific advisor for APPA and ATC natural resource projects, including evaluating proposed methods for research, inventory, and monitoring projects.

***NPS Air Quality Program*:** Staff at the Appalachian Trail Park Office rely on the NPS Air Resources Division and the NPS Northeast Regional Office Air Resources Coordinator for assistance with air resource issues. To date, that work has consisted of (1) development of air quality baseline data, (2) assistance in preparation of the *Appalachian Trail Vital Signs* report, and (3) assistance in preparation of this *Appalachian Trail Resource Management Plan*. In addition, as part of their regular duties, NPS Air Resources Division staff consider implications for the Appalachian Trail when reviewing relevant permit applications for new air pollution sources, proposed air quality regulations, and other policies, programs, and projects that could affect air quality on the Appalachian Trail.

***NPS Water Resources Division*:** Appalachian Trail Park Office staff also rely on the NPS Water Resources Division for assistance in planning, assembling, and analyzing data on water resources along the Appalachian Trail. The Water Resources Division plans to provide the Appalachian Trail Park Office in late 2008 with a Baseline Water Quality Inventory and Analysis ("Horizon") Report that will identify all water resources on the Appalachian Trail and known impairments to those water resources, and has committed to funding a Level 1 Water Resource Inventory that will begin late in FY 2008 and will conclude during FY 2010.

***NPS Exotic Plant Management Teams*:** The Appalachian National Scenic Trail receives support from the NPS Northeast Region Exotic Plant Management team (EPMT), the Mid-Atlantic EPMT, and the NPS National Capital Region EPMT in controlling invasive exotic plant species on Appalachian Trail Park Office lands. Thus far, the EPMT's have helped to control exotic species at around a dozen locations, particularly natural heritage sites in Virginia, Pennsylvania, and Massachusetts.

***NPS Cultural Resource Management Programs*:** The Appalachian Trail Cultural Resources Compliance Roster, consisting of cultural resources specialists with expertise in specific disciplines, provides review and support for all Section 106 actions on all lands administered by the NPS Appalachian Trail Park Office. In addition, a NPS Northeast Regional Office archaeologist and a NPS Washington Office historian provide technical guidance and support on an array of cultural resource projects and programs. A cultural landscape architect from the NPS Olmsted Center for Landscape Preservation is leading the development of a plan for conducting cultural landscape inventories on the Appalachian Trail.

***NPS Fire Management, Special Use Permitting, and Resource Protection Programs*:** The Appalachian Trail Park Office's Park Ranger is responsible for fire management on Appalachian Trail Park Office lands. The Appalachian Trail Park Office recently completed a Fire Management Plan for the Trail, which is available on the office's website (www.nps.gov/appa). The fire plan supports the current management practice of suppressing all fires on Appalachian Trail Park Office lands. The rationale for this approach is based on a number of factors, including the narrowness of the Appalachian Trail corridor and the proximity of private lands. Site-specific exceptions may be made on a case-by-case basis if needed to preserve significant resource values. The Park Ranger and the Management Assistant are responsible for administration of Special Use Permits, including permits for agricultural uses. Finally, the Park Ranger is responsible for enforcement of laws and regulations to protect park resources, including visitor use, poaching, and Archaeological Resource Protection Act (ARPA) regulations.

***NPS/ATC Exterior Corridor Boundary Survey program*:** Exterior corridor boundary surveys were conducted between 1979 and 2005 as part of the NPS land protection program. The Appalachian Trail Conservancy has accepted responsibility for maintaining corridor boundary markings on these lands, using a combination of staff and Trail club volunteers to carry out the work.

***NPS Palmerton Zinc Superfund Remediation and Natural Resource Damage Assessment Program*:** NPS staff associated with the Washington Office assist the NPS Appalachian Trail Park Office in addressing remedial activity and damage assessment and restoration of NPS lands in the Palmerton Zinc Superfund Site.

2. Resource Management Capabilities at the Appalachian Trail Conservancy

The Appalachian Trail Conservancy has assigned natural resource program responsibilities to a number of its central and regional office staff members. Several ATC staff members also have assumed critical roles in cultural resource management programs. All of the ATC natural and cultural resource management program duties described below are carried out in close cooperation and consultation with staff at the Appalachian Trail Park Office:

Director of Conservation: The Director of Conservation is responsible for oversight and direction for all ATC conservation programs, including all natural and cultural resource management programs. As of June 2008, the Director of Conservation position was based out of the Virginia Regional Office in Blacksburg Virginia.

Director of Conservation Operations: The Director of Conservation Operations provides technical expertise and support to ATC regional offices and Appalachian Trail clubs on a variety of resource management issues, including threats to the Trail and coordination

of Trail management and maintenance programs intended to reduce impacts to Trail resources. These programs include the ATC Trail Crew Program and the ATC Ridgerunner Program, and contract administration for projects ranging from demolition of incidentally acquired structures to training for volunteers in Trail skills.

A.T. MEGA-Transect Interim Program Manager: The A.T. MEGA-Transect Program Manager is responsible for oversight of the A.T. MEGA-Transect program, including the development of a business plan, sustainable partnerships and procedures for the program. As of June 2008, this is an interim one-year position.

Lands and Natural Resources Coordinator: The Coordinator manages programs to identify, conserve and steward lands adjacent to the Appalachian Trail that provide protection for the recreational, natural, scenic, and cultural values of the Appalachian Trail. The Coordinator is also the contact person for the A.T. MEGA-Transect Program and natural resources projects at Headquarters in Harpers Ferry, and works with the Conservation Director and the A.T. MEGA-Transect Program Manager on natural resources programs and projects on a case-by-case basis.

Boundary Program Manager: The Boundary Program Manager is responsible for the maintenance of the Exterior Corridor Boundary Survey markings, and for the coordination and management of the volunteer Trail club-based boundary monitoring program. Although the monitoring of the corridor boundaries is a function that was officially delegated to the clubs, the maintenance of the boundary was not delegated, so that the clubs' participation in this labor is optional.

Regional Directors and Associate Regional Representatives: ATC's regional directors, associate regional representatives, and other regional staff play an active role in virtually every resource management program on the Appalachian Trail. Although responsibilities for some program areas may shift as part of ATC's ongoing reorganization, regional staff currently carry out the following duties with respect to resource management:

1) Leadership or supporting role, as appropriate, in response to development proposals that may affect the Appalachian Trail
2) Assisting in review of state-by-state natural heritage inventories for rare, threatened, and endangered species (RTE) for the Appalachian Trail
3) Assistance in recruitment and coordination of volunteer participation in the Appalachian Trail natural heritage site-monitoring program and other volunteer-based natural resources monitoring programs (including A.T. MEGA-Transect programs)
4) Assistance in identifying priorities for natural heritage site monitoring and coordinating management activities needed to protect occurrences of rare, threatened, and endangered species (RTE) on all Appalachian Trail lands
5) Coordination of volunteer-based activities to maintain open areas

6) Technical assistance and support to volunteer Trail clubs, Trail crews, ridgerunners, agency partners, and other on-the-ground personnel in carrying out on-the-ground projects intended to protect resources, including Trail relocations, road closures, education programs, and other programs designed to protect Trail resources
7) Supervision of permittee activities carried out under Special Use Permits to maintain open areas and other agricultural uses
8) Assistance in invasive exotic species management on Appalachian Trail Park Office lands, including identification of sites where active control measures are needed and coordination of volunteer participation where appropriate
9) Support for cultural resource management studies, including overview and assessment inventories of cultural resources, site-specific archeological surveys, and interpretation
10) Coordination with the NPS Northeast Temperate Network Inventory and Monitoring Program
11) Representation of ATC and Trail club interests in the remediation and restoration processes for the Palmerton Zinc Superfund Site
12) Participation, review, and comment on planning documents, including this document, the *Appalachian Trail Resource Management Plan*
13) Removal of incidentally acquired structures and site restoration.

<u>ATC GIS Specialist: ATC's GIS specialist is responsible for:</u>

1) Compilation and management of GIS and spatially related data pertaining to the Appalachian Trail (this responsibility is shared with ATPO's Physical Science GIS Specialist)
2) Coordination and implementation of GIS mapping and analysis projects, with an emphasis on land protection, development threat and impact analysis, collection of NPS Facility Management Software System (FMSS) information, and publications
3) Produces maps, posters, presentations and other materials to aid Trail management and land conservation efforts
4) Analyzes of the potential impacts from proposed telecommunication facilities, wind towers, powerlines, roads, and other developments along the Trail
5) Creates maps for ATC publications, information services, events, and the web
6) Provides GIS and GPS training and technical support for ATC staff
7) Responds to public inquiries and data requests

E. Threats and Program Needs for Management of Geologic and Soil Resources

Threats to Geologic and Soils Resources

No threats to geologic resources have been identified in the planning process. Acid deposition and erosion resulting from recreational use have been identified as potential threats to soil resources. According to *Camping Impact Management of the Appalachian National Scenic Trail* (Marion 2003), the most common impacts occurring at overnight use sites along the Appalachian Trail include loss of vegetation cover, loss of organic litter, exposure, and compaction and erosion of mineral soils. A second study by Marion of Trail conditions along the Appalachian Trail in Great Smoky Mountains National Park identified soil erosion, multiple treads, excessive root exposure, excessive width, wet or muddy soils, and standing water on the Trail treadway as the primary adverse impacts associated with recreational use of the Trail.

Current Geologic and Soil Resources Program for the Appalachian Trail

The Appalachian National Scenic Trail passes through a number of national parks and forests that are managed by multi-disciplinary resource management staffs that often include geologists and soil scientists. However, the Appalachian Trail Park Office and the Appalachian Trail Conservancy do not currently have any staff that specialize in geology or soils, and issues pertaining to these disciplines rarely occur on Appalachian Trail lands.

Staff at the Appalachian Trail Park Office rely on the NPS Natural Resources Division for assistance with geology and soils resource issues. To date, that assistance has consisted of (1) development of baseline data, and (2) assistance in preparation of this *Appalachian Trail Resource Management Plan*.

Geology and Soils Resources Management Issues and Needs

No geologic resource management issues or needs, other than assembly of geologic inventory baseline data, have been identified in the planning process.

Soil resources data will be compiled as part of the NPS Inventory and Monitoring Program's 12 data sets. Areas affected by acid deposition need to be identified. Site-specific soil erosion and compaction problems are being identified as part of the NPS Appalachian Trail Condition Assessment being conducted by the Appalachian Trail Park Office, ATC, and the Appalachian Trail-maintaining clubs.

F. Threats and Program Needs of Biological Resources

Exotic Plants

Among the primary threats to biological resources that have been documented within the Appalachian Trail corridor are: exotic plants, insects pests, Trail maintenance, trampling, erosion, and plant succession.

One of the most common threats to rare, threatened and endangered species is the presence of invasive exotic plants, or plants that are not native to the Appalachian Mountains that can spread rapidly and negatively impact native plants. Our primary knowledge of the presence and extent of exotic plant species within the Appalachian Trail corridor comes from a survey of selected exotic plants that was conducted by thru-hiker and biologist Adam Canter in 2005. In his inventory, Canter documented the presence, extent, and GPS locations of 24 exotic plant species within 30 feet of the A.T. Though his survey did not cover all areas of the Trail equally well (some Southern areas were hiked too early in the season for exotic plant growth), it nevertheless provides the most comprehensive and most current picture of exotic plants in the A.T. corridor. Canter's inventory of exotic plants is most complete from North Carolina through Pennsylvania, where the growth of exotic plants and vegetation was at its peak when inventoried.

There are a variety of other inventories that have provided additional information and data on exotic plants in the A.T. corridor. In 2002, John Lesh, a student at Appalachian State University, surveyed selected invasive exotic plants along approximately 400 miles of the A.T. corridor in NC and TN, with the exception of Great Smoky Mountains National Park. Between 2000 and 2003, botanist Ted Elliman documented many exotic plant occurrences in the A.T. corridor in NJ, NY, and MA during his inventory and monitoring work of rare, threatened, and endangered plants in these states. In 2005, Elliman inventoried invasive exotic plants in MA as part of his comprehensive inventory of botanical resources in the MA Appalachian Trail corridor. Natural heritage inventories of the A.T. corridor in each of the other A.T. states from 1989 to 2001 documented a relatively small number of exotic plant occurrences, possibly because exotic plants were not deemed to be a significant threat to rare, threatened, and endangered species at the time that the inventories occurred.

Canter's inventory of invasive exotic plants in the A.T. corridor documented a total of 472 occurrences of exotic plants at 250 sites between NC and ME. Of the approximately 15,800 acres of the A.T. corridor that he surveyed, approximately 1,450 acres, or 9.18%, were recorded as being infested with one or more of the 24 invasive exotic plants that he surveyed. If this percentage is applied to the full 270,000-acre A.T. corridor, it would mean that approximately 24,786 acres of the A.T. corridor is infested with exotic plants.

Trailwide, *Rosa multiflora* (multiflora rose) and *Alliaria petiolata* (garlic mustard) were the invasive exotic plants most frequently documented by Canter in the A.T. corridor, with each species being found at more than 80 sites. These species were followed in the number of occurrences documented by: *Lonicera japonica* (Japanese honeysuckle), with about 60 occurrences, and *Microstegium vimineum* (Japanese stiltgrass), *Ailanthus altissima* (tree-of-heaven), and *Coronilla varia* (crown vetch), each with approximately 40 occurrences documented. *Eleagnus umbellata* (Autumn olive), *Berberis thunbergii* (Japanese barberry), *Centaurea biebersteinii* (spotted knapweed), *Celastrus orbiculatus* (Oriental bittersweet), and *Polygonum perfoliatum* (mile-a-minute) were found at 10 to 20 locations Trailwide.

Georgia/North Carolina / Tennessee

Due to the earliness of the season (March), Canter's 2005 inventory did not document any invasive exotic plants in GA. In an inventory of rare, threatened, and endangered species in 2000, two occurrences of *Celastrus orbiculatus* were the only exotic plants documented within natural heritage sites along the A.T..

In NC and TN, Canter's 2005 survey documented 60 occurrences of 12 invasive exotic plant species at 34 locations within the A.T. corridor. *Rosa multiflora* was the most frequently documented exotic plant in these states (18 occurrences), followed by *Coronilla varia*, *Lonicera japonica*, and *Poulounia tomentosa* (princess tree). Approximately two-thirds of the exotic plant occurrences that Canter documented in these states were at road crossings of the A.T., with most of the occurrences extending no further than one-fourth mile from the road crossing. Canter's survey of exotics in NC and TN occurred in the early spring, so some later developing species were not observed during that survey.

In a 2002 exotic plant inventory of the A.T. in NC and TN, college student John Lesh documented 63 occurrences of 13 invasive exotic plants along 400 miles of the A.T. in these two states (excluding Great Smoky Mountains National Park). This study documented a similar number of exotic plant species and occurrences, though there were some differences in the particular species documented, partly because Lesh's study occurred during the height of the growing season in mid-summer. Lesh indicated that more than 90% of the exotic plant occurrences were found at road crossings, power lines, or other anthropogenic disturbances. All but 3 of the exotic plant species locations were found below 4,000 feet in elevation. The primary exotic species documented by Lesh along the A.T. corridor in North Carolina and Tennessee were *Coronilla varia*, which was found at 15 locations, followed by *Lespedeza cuneata* (Chinese lespedeza), *Microstegium vimineum*, *Pueraria lobata* (kudzu), *Carduus (or Circium) nutans* (thistle), and *Albizia julibrissin* (mimosa), each of which was found at 6-8 locations along the A.T.. In a 1993 natural heritage inventory, exotic plants were documented in only a single A.T. natural heritage site in NC, and in 1996, exotic plants were an observed threat in 7 of the 58 natural heritage sites along the A.T. in TN.

Virginia

In Virginia, 210 occurrences of 14 species of invasive exotic plants were documented by Canter at 116 sites in the A.T. corridor. Of the 533 miles of the A.T. in VA, approximately 863 acres, or 22% of the area surveyed (within 30 feet of the Trail tread), was documented with invasive exotic plants. Approximately 43% of the exotic plant occurrences were found to be located at anthropogenic disturbances along the A.T., primarily roads and pasture land. The most frequently documented occurrences of invasive exotic plants in the A.T. corridor of VA were *Alliaria petiolata* and *Rosa multiflora*, with about 50 occurrences each. More than one-half of the exotic plant acreage in VA was documented with *Alliaria petiolata*, and the most southerly long, continuous infestation of *Alliaria petiolata* occurred on Peters Mountain near Pearisburg. Also documented in VA were more than 20 occurrences each of *Lonicera japonica*, *Ailanthus altissima* (tree-of-heaven), and *Coronilla varia*. The most heavily infested exotic plant areas along the A.T. in VA were within Shenandoah National Park and in the area north of the park. A 1994 inventory of natural heritage sites in VA documented that 13 exotic plant species were found within 8 out of state's 73 rare, threatened, and endangered species sites within the A.T. corridor. In addition to the exotic plants noted above, populations of *Celastrus orbiculatus*, *Lythrum salicaria* (purple loosestrife), *Sorghum halapense* (Johnson grass) and *Lespedeza cuneata* were noted within natural heritage sites along the A.T..

West Virginia and Maryland

Moving north along the A.T., exotic plant occurrences were frequently documented along the relatively short sections of the A.T. in the Mid-Atlantic states of WV and MD. In WV, approximately 37% of the A.T. was documented with invasive exotic plants, and in MD, approximately 55% of the A.T. corridor was documented with exotics. In WV, 18 occurrences of 8 species of exotic plants were found, and in MD, 36 occurrences of 8 species were found. *Alliaria petiolata*, *Lonicera japonica*, *Rosa multiflora*, and *Ailanthes altissima* continued to be among the most frequently documented species, along with *Polygonum perfoliatum* (knotweed) and *Microstegium vimenium* (Japanese stiltgrass). *Alliaria petiolata* occupied long stretches of the A.T. in both WV and MD. Earlier inventories of A.T. natural heritage sites in 1996 and 2000 documented that exotic plants were found in all 8 rare, threatened, and endangered species sites in WV and in 6 of the 8 natural heritage sites in MD.

Pennsylvania

The PA portion of the A.T. corridor was also heavily infested with invasive exotic plants, with approximately 21% of the area surveyed by Canter being infested. In PA, 92 occurrences of 11 exotic plant species were documented at 36 locations along the A.T.. The five most common species documented in PA were *Microstegium vimineum*, *Ailanthus altissima*, *Alliaria petiolata*, *Rosa multiflora*, and *Lonicera japonica*. *Microstegium viminium* was the most frequently documented exotic species along the A.T. in PA, being found at about 25 locations on 116 acres in the state's A.T. corridor. More than 60% of the *Microstegium vimineum* occurrences documented along the

entire length of the A.T. were in PA. Many of the densest coverages of exotic plants were found in PA. Exotic plants have been documented in 7 of the rare, threatened, and endangered species sites in PA.

New Jersey

In NJ, 24 occurrences of 6 invasive exotic plant species were documented by Canter at 13 locations within the A.T. corridor. *Alliaria petiolata*, *Centaurea biebersteinii*, and *Microstegium vimineum* were the most frequently documented exotic plants along the A.T. in NJ. The A.T. within Delaware Water Gap National Recreation Area was relatively free of invasive exotic plants at the time of the 2005 survey. Two occurrences each of *Berberis thunbergii* (Japanese barberry), and *Lythrum salicaria* (purple loosestrife) were also documented along the A.T. in the state. In 2000, botanist Ted Elliman estimated that about 85 acres of *Alliaria petiolata* were found in several A.T. natural heritage sites in NJ. Elliman also documented populations of *Berberis thunbergii*, *Lonicera japonica*, *Lonicera morrowii* (Morrow's honeysuckle), *Microstegium vimineum*, *Rhamnus cathartica* (common buckthorn), *Rhamnus frangula* (European buckthorn), *Rosa multiflora*, and *Lythrum salicaria* in 4 natural heritage sites along the A.T. in NJ; these populations generally ranged from 1-5 acres in size.

New York

In NY, Canter documented occurrences of *Berberis thunbergii*, *Ailanthus altissima*, and *Alliaria petiolata*. *Berberis thunbergii* was very invasive south of Bear Mountain and in Harriman State Park. In 2000, Elliman documented 12 occurrences of 10 exotic plant species at 4 natural heritage sites within New York's A.T. corridor. In addition to the plants documented by Canter, Elliman observed one population each of *Phragmites australis and P. communis* (common reed), *Lythrum salicaria*, *Phalaris arundinaceae* (reed canary-grass), *Celastrus orbiculatus*, *Euonymus alatus* (winged burning bush), *Rhamnus cathartica*, and *Rosa multiflora*. Additional populations of invasive exotic plants likely occur outside of A.T. natural heritage sites in NY.

Connecticut

In CT, 12 occurrences of 4 of the invasive exotic plant species that Canter surveyed in 2005 were found at 6 locations along the A.T., with *Berberis thunbergii* and *Alliaria petiolata* the two most frequently observed plants. In addition to these two species, Elliman found *Celastrus orbiculatus*, *Euonymus alatus*, *Lonicera morrowii*, *Rhamnus cathartica*, and *Rosa multiflora* to be frequent and locally abundant in the uplands of the A.T. corridor during a 2003 survey. *Lythrum salicaria* was the only invasive exotic plant that Elliman found was a major problem in the wetlands of the A.T. corridor. *Centaurea maculosa* (spotted knapweed), *Cynanchum louisae* (black swallow-wort), and *Microstegium vimineum* were documented in low numbers in the corridor during the 2003 survey. Elliman documented exotic plants within 4 A.T. natural heritage sites in CT.

Massachusetts

In MA, botanist Ted Elliman conducted a comprehensive invasive exotic plant inventory of the full width of the A.T. corridor in the state in 2005. He documented a total of 34 invasive exotic plant species covering approximately 200 acres at 19 locations in the A.T. corridor. Elliman noted that 9 of the exotic species were widespread and problematic for rare flora and high-quality habitats. In mesic forests and woodlands, *Alliaria petiolata*, *Berberis thunbergii*, *Euonymus alatus*, and *Lonicera morrowii* were widespread, and in old fields and thickets, *Rosa multiflora*, *Celastris orbiculatus*, and *Lonicera morrowii* were widespread. In wetlands, *Lythrum salicaria*, *Phalaris arundinacea*, and *Phragmites* were the most widespread and problematic invasive exotic plants. Elliman documented that 18 of the 42 natural heritage sites in the MA A.T. corridor contained invasive exotic plants in 2005. The most frequently documented invasive exotic plants within natural heritage sites in MA were *Berberis thunbergii* (14 sites), *Alliaria petiolata* (9 sites), *Phalaris arundinacea* (8 sites), and *Lonicera morrowii* (7 sites). In an earlier 1999 survey of the A.T. in MA, Elliman documented 18 exotic plant species in only 9 of the natural heritage sites along the A.T., which confirms the spread of exotic plants along the A.T. in MA between 1999 and 2005.

Vermont, New Hampshire, and Maine

In VT, NH, and ME, invasive exotic plants were virtually absent at the time of the Canter inventory in 2005. Only four occurrences of invasive exotic plants that Canter surveyed were documented in the A.T. corridor in Vermont, and only one exotic plant occurrence was documented in New Hampshire. *Phragmites australis* and *Polygonum cuspidatum* were found at two sites each, and *Centaurea biebersteinii* and *Lythrum salicaria* were found at one site each. No invasive exotic plants were documented along the northernmost 350 miles of the A.T.. None of the 1990's natural heritage inventories of the A.T. for VT, NH, and ME documented any exotic plants within natural heritage sites.

In summary, more than 500 invasive exotic plant occurrences have been documented within the Appalachian Trail corridor. More than 80 exotic plant species have been documented along the A.T., though the number of these exotic species that are deemed to be problematic invasive exotic plants is substantially lower. The presence and coverage of invasive exotic plant species is greatest in the Mid-Atlantic states from Virginia through Pennsylvania, states in which 20% or more of the A.T. has been documented with invasive exotic plants. The presence of invasive exotic plants is minimal or does not exist at both ends of the A.T.—particularly from Vermont to Maine. The coverage of invasive exotic plants appears to be on the increase in at least some of the A.T. states. While invasive exotic plants are commonly found at road crossings of the A.T., a significant number of them are found within rare, threatened and endangered species sites. Exotic species have been documented from more than 60 rare, threatened, and endangered species sites in the A.T. corridor, where their presence has the potential to cause extirpation of some of the rare species.

Exotic Insect Pests and Diseases

Gypsy Moth

The European gypsy moth, *Lymantria dispar*, is a major defoliator of hardwood trees that was introduced into Massachusetts in the 1860's. Between 1900 and 1934, the gypsy moth spread throughout most of New England. By the 1960's it had spread into much of eastern New York and into northeastern Pennsylvania and New Jersey. The gypsy moth defoliated approximately 72 million acres from 1924 to 1996, with about one-half of the defoliation occurring between 1982 and 1992.

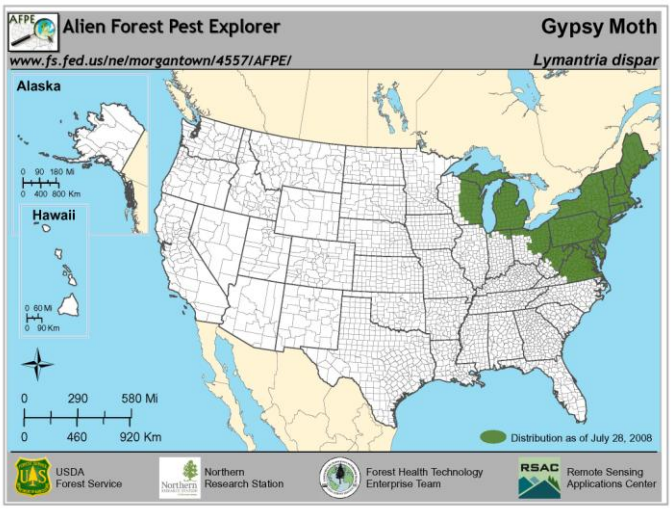
Animated Map of Gypsy Moth Infestation 1900-2005
Please Launch from digital .pdf

During the 1980's and 1990's, the gypsy moth advanced into the oak forests of Maryland, West Virginia, and Virginia. The first isolated gypsy moth infestation in Virginia was in Shenandoah National Park in 1969, but the natural spread of gypsy moths did not reach northern Virginia until about 1980. Since then, the gypsy moth has continued to move south and west and now covers more than two-thirds of Virginia. By 2010 it is expected that virtually every county in Virginia will experience some level of gypsy moth impact. Since 1984, the gypsy moth has defoliated about 4.5 million acres in Virginia and more than 1 million acres in West Virginia. While the gypsy moth larvae can defoliate more than 300 different plant species, oaks are a preferred food, and they are a dominant component of the central and southern Appalachian forests. Tree species vary in their ability to recover from defoliation, with some trees dying after one defoliation and other trees dying only after several defoliations. The defoliation and death of trees can impact plants in the understory that require shade, as well as potentially impact animals that utilize the forest.

In general, the gypsy moth is currently spreading at a rate of about 21 km/year along its border to the west and south. The rate of spread is affected by the controls implemented. Isolated infestations in NC, TN, and GA have been eradicated. If isolated infestations are not eradicated, it is predicted that 90 percent of the area from Virginia southward will become generally infested by 2010.

Eradication and the Slow the Spread Project are methods used to prevent or postpone the establishment of gypsy moth populations in areas where it currently does not exist. Eradication methods include using the chemical pesticide “Dimilin”, or the biological pesticides, *Bacillus thuriengensis* and “Gypchek”, the latter being a formulation of the naturally occurring gypsy moth virus. In 1999 the USDA Forest Service implemented the National Slow the Spread of the Gypsy Moth Project across the 1,200-mile gypsy moth frontier from North Carolina through Minnesota. Scientists believe that it is impossible to stop gypsy moth spread, but that it is possible to reduce the rate of spread by 50% or more.

Gypsy moth defoliation and subsequent tree mortality have altered forest composition and structure at many sites along the Appalachian Trail corridor in Virginia. Of particular concern are old growth forests and other significant forest communities. Rare plant and animal populations may also be adversely impacted as tree mortality results in changes to light and moisture regimes or fosters the growth of light-loving invasive plant species.



The impact of the gypsy moth on the Appalachian Trail corridor in Virginia is better documented than in other A.T. states, probably because gypsy moth infestation was active or recent at the time of the natural heritage inventory in the early 1990’s. Evidence of gypsy moths was found in 38 of the 73 natural heritage sites documented within Virginia’s Appalachian Trail corridor. The inventory recorded gypsy moth damage as far south as Apple Orchard Mountain Natural Heritage Site, and it is likely that the gypsy moth has spread further south into additional VA natural heritage sites. In many of the natural heritage sites in northern Virginia, gypsy moth damage was documented as being heavy or severe. At one natural heritage site in Shenandoah National Park, up to 90% of the oaks had been killed in local areas. The inventory noted that gypsy moth defoliation had resulted in open canopies that had allowed exotic and invasive native species to become established. At several natural heritage sites, it was stated that the gypsy moth was a threat to significant old growth forest, but that at most sites, the gypsy moth appeared to have little or no effect on a site’s rare species. However, the potential for impact to rare plant and animal populations exists, as tree mortality results in changes to light and moisture regimes or fosters the growth of light-loving invasive plant species. In addition to attacking oaks, the gypsy moth threatened the rare *Betula papyrifera* (paper birch) and *Betula*

populifolia (gray birch) at five natural heritage sites within VA's A.T. corridor.

The inventory for the Appalachian Trail corridor for West Virginia found in 1996 that the gypsy moth was not a threat in Jefferson County at the time, but that past impacts were extensive. The inventory noted that the canopy gaps created are a favored habitat for invasive exotic species.

The natural heritage inventory of the Appalachian Trail corridor in Maryland in 2000 found that defoliation of the upper canopy tree species was severe and that it threatened the overall forest community structure. State of Maryland entomologists sprayed forests along the A.T. in Maryland in the spring of 2000, but a botanist surveying for rare species along the Appalachian Trail found gypsy moth caterpillars in good numbers during the month following the spraying.

In 2007 a new outbreak of gypsy moths defoliated large segments of the Appalachian Trail from Virginia to Pennsylvania. One of the areas most heavily impacted is the northernmost area of the A.T. in Virginia, West Virginia, Maryland, and Pennsylvania. Aerial surveys and gypsy moth egg mass counts documented approximately 500 acres of heavily impacted land in VA, 500 acres in the Eastern Panhandle of WV, 600 acres in Maryland, and at least 300 acres in Pennsylvania. One of the heavily impacted areas within the A.T. Corridor is around Bears Den Shelter in VA and another area is very close to Shannondale subdivision. USDA Forest Service funds were sought to control these outbreaks using Bt; however, the funding to do this work was not approved. Other funds were sought to treat gypsy moth impacted forest, and in May 2008, approximately 600 acres of NPS A.T. land in MD were treated, 234 acres of NPS and ATC land were treated in WV, and 292 acres of NPS land were treated to suppress gypsy moths in Pennsylvania.

Almost two decades ago, the PA natural heritage inventory (1990) documented severe defoliation from gypsy moths at several natural heritage sites in the A.T. corridor, and noted in some locations that much of the forest canopy is damaged or dead. At several additional sites, the natural heritage inventory stated that insecticides used to control gypsy moths could harm several rare animal populations.

In the Connecticut Natural Heritage Inventory, there was one reference to a prior heavy gypsy moth infestation that had opened up the forest canopy, possibly benefiting an endangered species population. There were no other references to insect diseases in any of the New England inventories.

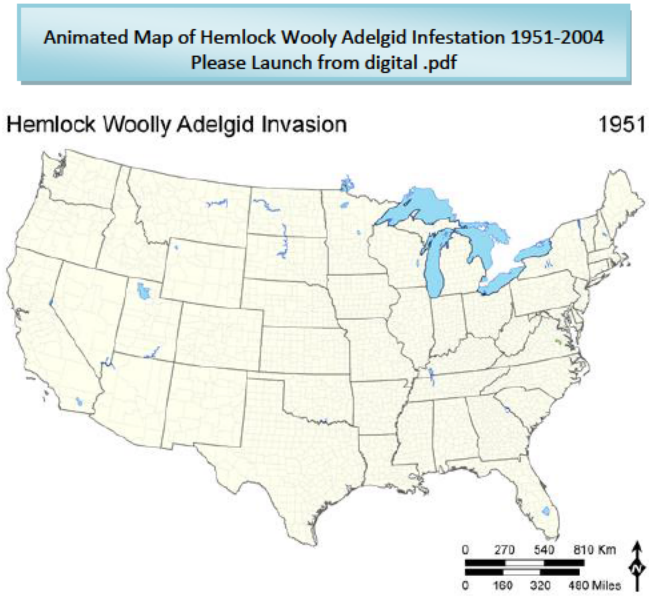
Oak Decline

In the southern Appalachians from Virginia southward, about 1.7 million acres of vulnerable oaks were found to be affected by oak decline at the time of the Southern Appalachian Assessment in 1996. North Carolina and Virginia have the highest

incidences of oak decline. About 19% of national forest land in the southern Appalachians had oak decline damage at the time, with the highest incidences in George Washington and Jefferson National Forests. Oaks will not be eliminated from decline-affected areas, but their numbers and diversity are being reduced. The area of greatest impact will be immediately behind the advancing front of the gypsy moth.

Hemlock Woolly Adelgid

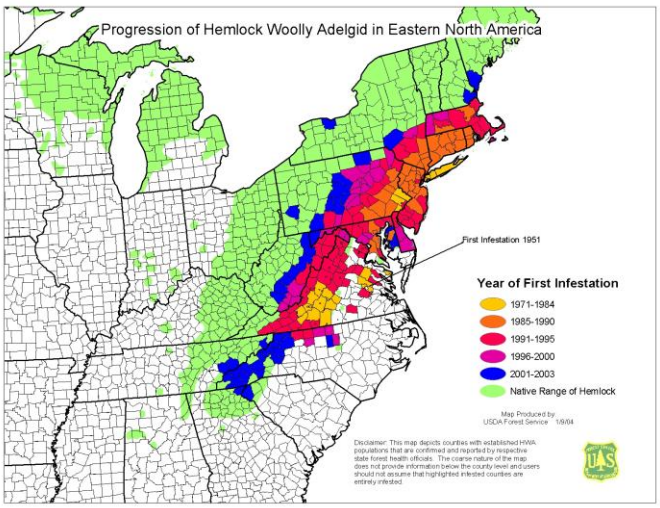
The hemlock woolly adelgid, *Adelges tsugae*, an insect species native to Asia, was first identified in the eastern United States in 1951 in Richmond, VA. It was discovered in the Shenandoah Mountains of Virginia in the 1950's. From 1970-1985, the adelgid occupied discrete areas in central and southwest Virginia, extreme southeast Pennsylvania, and Long Island, New York. From 1985-1995, the adelgid expanded westward in Pennsylvania and northeastward into New Jersey, New York, and Connecticut. During the early 1990's, the adelgid spread into most of the remaining area of western Virginia. In the late 1990's, the adelgid moved into far western Massachusetts. Within the last few years, the adelgid had spread into nearly all of western North Carolina, as well as into east Tennessee and northeast Georgia. In the next few years, the adelgid is expected to spread into northern New England and further into Tennessee and Georgia, encompassing the full the ranges of both Eastern hemlock and Carolina hemlock.



The hemlock woolly adelgid kills hemlock trees by sucking sap from the twigs of affected trees. The adelgid is spread by wind, birds, or mammals. Heavy infestations have killed trees in as little as four years, but some trees have survived infestations for more than ten years. Individual hemlock trees can be protected by spraying or soil treatments, but such treatment may be impractical for large stands of trees. Biological controls for the adelgid hold some promise for protecting hemlocks, but progress has not kept pace with the growing spread. Forest ecologists believe that the adelgid endangers the survival of both Eastern and Carolina hemlocks throughout the range of these species in the Appalachians. The loss of the Eastern hemlock will negatively impact riparian ecosystems and may result in a substantial reduction in habitat quality for birds and other wildlife. The ecological impact of losing the Carolina hemlock, which is a globally

rare species found on ridges and rock outcrops in the Southern Appalachians, is less certain.

The hemlock woolly adelgid was first reported in Virginia in 1951, and it has since spread over most of the state, infesting and killing both Eastern and Carolina hemlock. In 1994 the Virginia Natural Heritage Inventory indicated that the hemlock woolly adelgid represented a potentially severe threat to several significant old-growth hemlock forests along the Appalachian Trail in Virginia. The inventory indicated that the adelgid may also indirectly impact rare plant and animal populations in Virginia. For instance, the globally rare *Buckleya distichopylla* (piratebush) is a hemiparasite whose host species is frequently a species of hemlock. As hemlock dies out, piratebush populations that use hemlock as a host are likely to be negatively impacted. In the Virginia natural heritage inventory (1994), the only location where the hemlock woolly adelgid was observed within the Appalachian Trail corridor was at James River Gorge, where significant mortality had occurred. It has no doubt since spread to many other locations along the Trail in Virginia.



A survey of hemlock health and the presence of the hemlock woolly adelgid along the Appalachian Trail was conducted by thru-hiker Adam Canter in 2005. This survey documented that the hemlock woolly adelgid had spread as far south on the A.T. as Georgia. Of the 9 hemlock stands documented in GA, only 2 were infested with the hemlock woolly adelgid. The southernmost documentation of the hemlock woolly adelgid along the A.T. was at the U.S. 76 crossing at Dicks Creek Gap.

In NC and TN, the impact of the hemlock woolly adelgid increases significantly. Fifty-one of 78 hemlock stands (or 65%) were infested with hemlock woolly adelgid. NC and TN had the largest number of hemlock stands of any area along the A.T. In 2005, all of the hemlock stands documented on the A.T. in NC and TN were in good condition. The distribution of infested hemlock stands in NC and TN was somewhat random, with some uninfested stands sandwiched between infested areas. In these states, some of the hemlock stands contained significant numbers of Carolina hemlock, a globally rare species, which could be impacted more severely than the more widespread Eastern hemlock.

In Great Smoky Mountains National Park (TN/NC), the hemlock woolly adelgid was

discovered in April 2002, and by the fall of 2003, most areas of the park were at least lightly infested. Only the initially infested areas are showing crown thinning, and no mortality has yet been recorded. The park has nearly 5,000 acres of hemlock-dominated forests, including 700 acres of old growth hemlock. Management activities in the park include insecticide treatments and the release of *Pseudoscymnus tsugae* beetles, which are a biological control for the adelgid. In 2003 the University of Tennessee began a multi-year agreement with the park to produce *P. tsugae* for release in the park and in other nearby infested National Park Service units. Canter's 2005 inventory documented few hemlocks along the A.T. in Great Smoky Mountains National Park, primarily because the Trail follows high ridgelines in the park that are outside the normal altitudinal range of two hemlock species.

In Virginia, Canter documented that all 48 hemlock stands contained hemlock woolly adelgid. Twenty-four of the stands were good in appearance, primarily located in the southern part of the state. Eight hemlock stands were in fair condition, 8 were in poor condition, and 8 contained fully dead trees. Most of the dead hemlock stands documented were in Shenandoah National Park in northern Virginia. Tree health began to significantly decline from around Pearisburg northward.

In Shenandoah National Park, the hemlock woolly adelgid was first detected in 1988, and the presence of the adelgid soon became widespread within the park. In 1990 and 1991, hemlock woolly adelgid was found in all 94 of the park's hemlock study sites. In a 1997 study of hemlocks in Shenandoah NP, 35% had heavy infestations of hemlock woolly adelgid, 21% had medium infestations, 26% had light infestations, and 17% had no evidence of infestation. The heaviest infestations were at lower elevations, and the areas absent of the adelgid appeared to be in the park's highest elevations, possibly due to late winter and early spring cold snaps. The adelgid was absent along the A.T. between Big Meadows Campground and Fisher's Gap. Treatment of hemlock woolly adelgid with insecticidal soap began in 1999.

No hemlock stands were documented by Canter in West Virginia, except for the Mill Creek Site on the VA-WV border. Hemlocks observed in the vicinity of Harpers Ferry were either dead or in poor condition.

The hemlock woolly adelgid has been present in Maryland for about 20 years, but only recently began to affect hemlock health. The adelgid has been present at Cunningham Falls State Park near the Appalachian Trail since 1990, but hemlock only began to decline within the park in the past few years. In 2005, Canter documented only three hemlock stands, all of which were heavily infested and were fair to poor in appearance.

In November, 2007, the MD Department of Agriculture and the NPS Appalachian Trail Park Office released 500 beetles on ten hemlock trees infested with hemlock woolly adelgid. This represents the first release of biological controls to reduce the impact of the hemlock woolly adelgid on National Park Service A.T. lands outside of existing

national park units along the Trail.

In PA, Canter documented 22 hemlock stands, all of which were heavily infested. Fifteen of the hemlock stands were in fair condition and 7 were in poor condition. Some stands had up to 80% mortality.

At Delaware Water Gap National Recreation Area in PA and NJ, the hemlock woolly adelgid was detected in 1989. In 1995 it was present at about 50% of the hemlock sites examined throughout the park, and in 1999 it was documented in 95% of the hemlock sites. Between 1993 and 2002 the percentage of hemlock trees in 81 plots that were rated healthy declined dramatically from 92% to 28%. In 2002, 15% of the plot trees were dead. Crown changes became noticeable within three years of infestation; however, it was noted that crown conditions did not decline progressively each year. *Pseudocymnus tsugae* beetles were first released in the park in 2000 in an effort to control the adelgid.

In a NJ study from several years ago, hemlock mortality was over 90% in about half of the plots studied, mostly as a result of the adelgid, but also from drought and secondary pests such as hemlock borer and elongate hemlock scale. All areas in New Jersey where the hemlock is still somewhat healthy have received releases of the beetle *Pseudoscymnus tsugae.* A total of 271,000 beetles have been released at 61 sites since 1998.

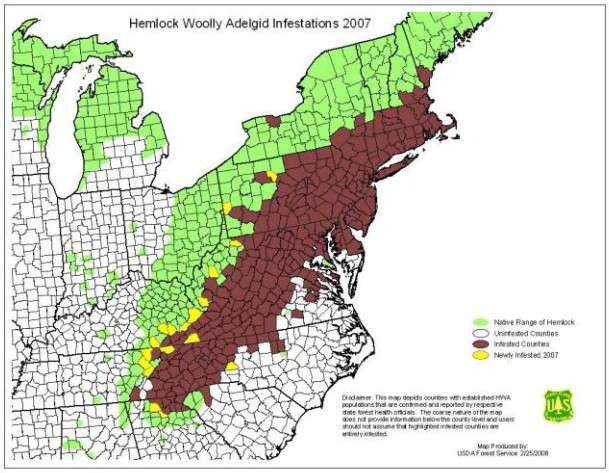
In 2000, botanist Ted Elliman, who conducted the natural heritage inventory for the Appalachian Trail in New Jersey, observed that the impact of the hemlock woolly adelgid on the Eastern hemlock was devastating along the Trail in that state. The 2005 Canter study documented only 3 hemlock stands along the A.T. in NJ, with most of the trees already experiencing mortality.

In NY, Canter documented 9 occurrences of Eastern hemlock along the A.T.. The overall appearance of stands improved from south to north, with 7 of the stands being in fair condition and 2 stands in good condition.

In central Connecticut, the impact of the hemlock woolly adelgid has been substantial. A study (Orwig, 2004) indicates that hemlock mortality has risen to over 60% in half of the stands inventoried in the region, and it has increased 5% to 15% a year since the time that plots were established in 1995. This study also notes that the health and vigor of remaining trees has deteriorated in all stands, with the majority of trees retaining less than 25% of their foliage. The beetle *Pseudocymnus tsugae* has been found to be a good biological control for the hemlock woolly adelgid, and between 1995 to 2002, 172,000 adult *P. tsugae* were released at 20 sites in Connecticut. In sites where *Pseudoscymnus tsugae* beetles were released to control the adelgid, there were low adelgid populations and some hemlock recovery. The elongate hemlock scale, *Fiorinia externa*, is also contributing significantly to the demise of hemlock health in the state.

In 2003, the botanist who conducted a natural heritage inventory of the Appalachian Trail corridor in Connecticut observed that the only location where the hemlock woolly adelgid was present within the Appalachian Trail corridor was at Schaghticoke Mountain. In 2005, Canter documented that the hemlock woolly adelgid was having a large impact in some areas of the Trail corridor, while other stands remained uninfested. Of the 9 hemlock stands documented by Canter in CT, 6 stands were infested and in good condition, and 3 stands were free of the hemlock woolly adelgid.

In a 4,000 square kilometer transect through the state of Massachusetts, over 5,000 hemlock stands with more than 10% hemlock have been mapped. Almost 50% of the 80 hemlock stands that were sampled in 2002 and 2003 had hemlock woolly adelgid, although overstory hemlock mortality is still very low. The hemlock woolly adelgid was found within a few kilometers of Vermont. In MA, Canter documented 8 stands of Eastern hemlock in 2005, and all 8 of them were free of the hemlock woolly adelgid and in good appearance.

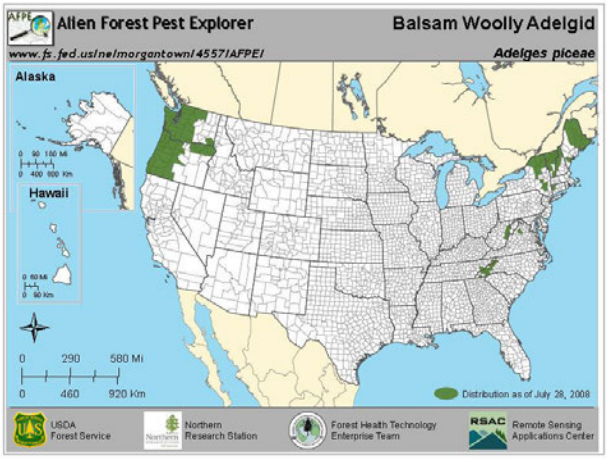


In northern New England, Canter documented that no hemlock stands were infested with the hemlock woolly adelgid in 2005. In VT and NH, Canter found that all 8 stands of hemlock were uninfested with hemlock woolly adelgid in 2005 and in good appearance. In New Hampshire, hemlock woolly adelgid has been found on native hemlock in four of the southernmost counties, far south of the Appalachian Trail corridor in the state. In Maine, Canter documented 10 hemlock stands along the A.T., and all of them were uninfested with hemlock woolly adelgid and in good condition. Long continuous uninfested stands of hemlock were observed along the A.T. in Maine.

Balsam Woolly Adelgid

The balsam woolly adelgid (*Adelges piceae*) is a non-native insect that has drastically altered the southern Appalachian spruce-fir forest ecosystem by attacking native species of fir or balsam. This adelgid is believed to have been introduced from Europe into in the southern Appalachians in the 1930's via reforestation experiments, and it was first detected in native forests in the Black Mountains of North Carolina in 1957. From that time until the early 1980's, the insect spread to all natural Fraser fir or balsam populations in the southern Appalachians, including populations along the Appalachian Trail in North Carolina, Tennessee, and Virginia. Since its introduction, approximately

64,700 acres of Fraser fir have been infested. In 2003 high populations of the adelgid were found in all infested areas. The balsam woolly adelgid produces at least two generations per year, and it is primarily disseminated by wind, but also by gravity, humans, nursery stock, and animals. Mature Fraser fir or balsam trees are most susceptible to adelgid attack, and death usually occurs within five years after first attack. Younger Fraser firs are more resistant to attack, and regeneration is good in many locations. Because not all age classes of fir are affected by the adelgid, there is some uncertainty as to whether the adelgid will cause the elimination of the species. Chemical control for individual trees is effective, but extremely costly.



The impact of the balsam woolly adelgid on the Fraser fir is more pronounced because the Fraser fir is a globally rare species that has a very limited range on a few high elevation mountain summits, generally above 5500 feet, in the southern Appalachians. At the highest elevations, the fir appears almost exclusively in pure stands, and at somewhat lower elevations, it is mixed with red spruce. A large portion of the Appalachian Trail within Great Smoky Mountain National Park passes through spruce-fir forest. The Trail also passes through spruce-fir forest in the Roan Mountain area on the North Carolina and Tennessee border and within Mt. Rogers National Recreation Area in southwest Virginia. The Roan Mountain and Mt. Rogers areas have among the highest concentrations of globally rare species along the entire Appalachian Trail, and loss of the Fraser fir forest canopy can have a high impact on some of these threatened and endangered plants and animals. One example of an animal that may be impacted is the federally endangered spruce-fir moss spider (*Microhexura montivaga*). Another species, the Fraser fir angle, is entirely dependent on the Fraser fir.

The balsam woolly adelgid is also a threat to balsam fir (*Abies balsamea*) at the summits of Stony Man Mountain and Hawksbill Mountain along the A.T. in Shenandoah National Park, Virginia. In Virginia, balsam fir is found only on these two mountains. The impact of the balsam woolly adelgid on *Abies balsamea* in New England is unknown.

Beech Bark Disease

Beech bark disease is having a substantial impact on American beech (*Fagus grandifolia*), one of the more common components of deciduous forests throughout much of the Appalachians. Beech is an important species for wildlife, providing mast and den habitat for species like black bear. Beech bark disease results from two causal agents, the beech scale insect, *Cryptococcus fagisuga*, and a fungus, *Nectria coccinea faginata*. The beech scale insect penetrates the bark, allowing the fungus to invade. The disease arrived in Nova Scotia around 1890, and it had spread southward into Maine and Massachusetts by 1932. By 1960 beech bark disease had spread throughout New England and into New York, and by 1975 the disease had spread into New Jersey and Pennsylvania. By 1980 it had spread into West Virginia, and by 1993, it was reported in Great Smoky Mountains National Park in North Carolina and Tennessee. Tree mortality has intensified around the Great Smoky Mountains and the Blue Ridge Parkway, and the disease has moved into Nantahala and Pisgah national forests in North Carolina and Roan Mountain State Park in Tennessee. The disease has also spread into several counties of far western Virginia. The presence of beech bark disease within the Appalachian Trail corridor has been observed in Massachusetts and Connecticut, and the disease is likely present along the corridor in other states as well.

Animated Map of Beech Bark Disease 1935-2006
Please Launch from digital .pdf

Southern Pine Beetle

The Southern pine beetle (*Dendroctonus frontalis*) is considered the most serious insect pest of pine in the South. In contrast to the other insect pests noted, the Southern pine beetle is a native insect, with a broad range from Pennsylvania to the Gulf Coast. While infestations of this insect come and go across its range, the insect is almost always epidemic somewhere in its range. From 1999 to 2002, infestations were concentrated in the southern Appalachians, but the beetle outbreak subsided dramatically in 2003. The Southern pine beetle can attack and kill all species of pines, but prefers shortleaf,

Virginia, pond, pitch, and loblolly pines. White pine losses have also been heavy in the southern Appalachians. The specific impact of the Southern pine beetle on pines within the Appalachian Trail corridor is not known.

Other Exotic Pests

Among the other notable insect pests that are impacting native plant species in the Appalachians are butternut canker, dogwood anthracnose, dutch elm disease, and chestnut blight. Butternut canker is a fungus that has killed at least 75% of the butternut (*Juglans cinera*) trees in the southern Appalachians during the past three decades. Dogwood anthracnose is a fungus that was first reported in New York in 1978, and it has since caused significant mortality to the native *Cornus florida* throughout much of its range from Georgia to southern New England. Chestnut blight is an exotic fungus that between 1900 and 1940 killed most mature American chestnut (*Castanea dentata*) trees throughout its range. The chestnut was a dominant tree in the Appalachians that has since been replaced by oaks and other hardwoods. Chestnut root sprouts will often live for five or ten years before being killed by the blight, and occasionally chestnuts will reach the size of a small tree.

Trail Maintenance

Many of the 14 state natural heritage inventories for the Appalachian Trail corridor have indicated that Trail maintenance is among the most frequently mentioned impacts to rare, threatened, or endangered (RTE) species along the Trail. Approximately 200 occurrences of RTE species at 145 natural heritage sites have been identified as being immediately adjacent to the Appalachian Trail (within approximately three feet of the Trail tread) and thus could potentially be impacted inadvertently by Trail maintenance activities. Some impacts of Trail maintenance on RTE plant species have been documented, but the potential for impacts is present at a much greater number of locations.

The potential for Appalachian Trail maintenance to impact RTE species has been most frequently documented in Tennessee and North Carolina. In these two states, approximately 90 occurrences of RTE plant species at 63 natural heritage sites were documented as being potentially threatened by Trail maintenance. Among the sites where the potential for Trail maintenance impact is greatest are: Roan Mountain, TN/NC; Doll Flats, TN; Laurel Fork South, TN; Canute Place, TN, Dennis Cove, TN, and Big Rock Spring, NC. The potential for impact to RTE species from Trail maintenance is particularly significant in the Roan Mountain to Hump Mountain area because of the large concentration of RTE species there. More than one-half of the species threatened by A.T. maintenance in North Carolina and Tennessee are globally rare species. Among the RTE species potentially impacted by Trail maintenance are trees such as *Tsuga caroliniana* (Carolina hemlock), shrubs such as *Buckleya distichophylla* (piratebush), and herbaceous plants such as *Geum geniculatum* (bent avens) and *Prenanthes roanensis*

(Roan rattlesnake root), all of which are globally rare.

In Georgia, 18 RTE plant occurrences at 16 natural heritage sites are located within the zone of potential Trail maintenance impact. As in NC and TN, the majority of the RTE occurrences within the Trail maintenance zone are globally rare species. Most of the RTE occurrences that could be impacted by Trail maintenance in Georgia are herbaceous plants or vines, but a few are shrubs.
In Virginia, 38 RTE plant occurrences are located beside the A.T. in 20 natural heritage sites within the zone of potential Trail maintenance impact. Many of the occurrences are of globally rare species. Eight of the RTE occurrences within the zone of Trail maintenance impact are within Shenandoah National Park. Sixteen of the RTE species occurrences subject to Trail maintenance impact are located within the Pine Mountain, Mt. Rogers, and Whitetop Mountain natural heritage sites within Mt. Rogers National Recreation Area

In the Mid-Atlantic states, there are smaller numbers of RTE plants that could be potentially harmed by Trail maintenance. In Maryland, there are seven RTE plants that are adjacent to the Trail, some of them along that portion of the A.T. that follows the Chesapeake and Ohio Canal Towpath, where maintenance may not be necessary. In Pennsylvania, seven RTE species that could be damaged by Trail maintenance are located at Mt. Minsi, Big Offset Barren, Bernheisel Bridge, Big Flat Barren, Little Gap Barrens, and Hunters Run natural heritage sites. Two of these sites, Big Offset Barren and Hunters Run, have globally rare species immediately beside the Trail. In New Jersey, only three RTE plant species might be harmed by Trail maintenance, and in New York, six RTE plants might be damaged by Trail maintenance.

In New England, there are 38 occurrences of RTE plants located beside the A.T. that could be impacted by Trail maintenance. These occurrences are found in 30 natural heritage sites. The largest number of RTE plant occurrences documented beside the Trail are in Massachusetts, where 18 occurrences have been noted at 16 natural heritage sites. In Connecticut, only five RTE plant occurrences are potentially subject to Trail maintenance impact. In Vermont and New Hampshire, three RTE plant occurrences in each state could be damaged by A.T. maintenance. In Maine, nine RTE plant occurrences could potentially be damaged by Trail maintenance.

Trampling

Because of their location beside the Appalachian Trail tread, many of the RTE species occurrences that could be damaged by Trail maintenance damage are also subject to damage by trampling. The state natural heritage inventories for the A.T. have documented approximately 131 natural heritage sites with RTE plant species that have been or could be impacted by trampling. This represents about one-fourth of the total number of natural heritage sites documented along the full length of the A.T.. It is possible that some RTE species in the Trail tread may have already been extirpated by

trampling, such as *Phlox amplifolia* (large-leaved phlox) in southern Virginia. At some locations, such as viewpoints at mountain summits, trampling may be the most serious potential impact at a site. The states where trampling has been most frequently reported as a threat to RTE species are Virginia, North Carolina, and Georgia.

In Georgia, trampling was documented at 10 of the 41 natural heritage sites identified along the Trail in the year 2000. Trampling was a problem at popular Blood Mountain, which is the most significant natural heritage site along the Trail in Georgia. The rock outcroppings that provide views for hikers are the habitat for most of the site's rare species, some of which are globally rare. While many of the rare plants in rock crevasses appeared to be untrampled, there was some damage noted to populations of *Potentilla* (or *Sibbaldiopsis*) *tridentata* (three-toothed cinquefoil) and *Paronychia argyrocoma* (silverling) on rock outcrops near the Blood Mountain summit and Trail shelter. At Little Bald Knob Natural Heritage Site, moderate trampling of *Juncus gymnocarpus* (naked fruit rush) was observed at the Coward Gap spring and in the Trail/roadbed. Other natural heritage sites in Georgia where trampling was noted as an existing or potential threat are Brookshire Gap, Liss Gap, Rocky Mountain, Snake Knob, Bird Gap, Plumorchard Gap, Wheeler Knob, and Tray Mountain.

In North Carolina, hiker trampling has been reported as a threat to RTE resources at 16 natural heritage sites, many of them rocky outcrops or balds. Among the sites where trampling is a threat are three of the seven natural heritage sites in the very significant Roan Mountain area on the North Carolina-Tennessee border. Trampling has also been documented as a threat at the important Standing Indian and Hot Springs natural heritage sites. Other natural heritage sites where trampling is an identified threat are Whiterock Cliffs, Walker Gap, Cheoah Bald, Rocky Bald, Bald Mountain, Chestoa, Yellow Mountain, High Rocks, Standing Indian Shelter, Big Butt/Albert Mountain, and Pinnacle Mountain. At Big Butt/Albert Mountain Natural Heritage Site, trampling was evident, even though a fence was present at the site. In Tennessee, trampling was a potential or existing impact at Laurel Fork Bluff, Iron Mountain Shelter and Spring, Lindy Camp Bog, Stony Creek Bog, and John's Cranberry Bog.

In Virginia, hiker trampling was identified as a threat at 31 natural heritage sites. The impact of hiker trampling was found to be greatest in glades and on rock outcroppings, because of the views that they often afford. The Virginia natural heritage inventory indicated that trampling is particularly severe along the A.T. in Shenandoah National Park, where recreational use is high. Among the natural heritage sites where trampling was an identified impact in Shenandoah National Park are Mt. Marshall, Hogback Mountain, The Pinnacle/Mary's Rock, Stony Man Mountain, Little Stony Man, Hawksbill Mountain, Franklin Cliffs, and Hightop. The inventory reported that the cliff-top overlooks at Stony Man Mountain and Little Stony Man were almost denuded. The plant most frequently impacted by trampling along the A.T. in Virginia is *Solidago simplex* var. *randii* (Rand's goldenrod), whose habitat is rock outcrops. Trampling is a threat to glade communities at Overall Run Falls, Stony Man Mountain, and Hawksbill

Mountain. In addition to trampling, the Hawksbill Mountain Natural Heritage Site has a wide array of other identified threats, including deer browsing, exotic plants, gypsy moth, balsam woolly adelgid, succession and interspecific competition, and possibly air pollution and acid rain.

North of Shenandoah National Park, hiker trampling was identified as a threat at Reservoir Hollow and Moore Run on ATPO land. On USDA Forest Service land south of Shenandoah National Park, trampling was a threat on the rock outcrops of Three Ridges Mountain (Hanging Rock and Flattop), Mt. Pleasant, and Dismal Creek. At Kelly Knob, trampling and Trail maintenance may have eliminated the population of *Phlox amplifolia*. Damage to vegetation from campfires and impromptu campsites was a threat at Cedar Cliffs, Three Ridges Mountain, and Spy Rock natural heritage sites. Hiker trampling was also identified as a problem at the major natural heritage sites at Mt. Rogers and Whitetop Mountain. At Pine Mountain, Mt. Rogers, and Whitetop Mountain within Mt. Rogers National Recreation Area, trampling by cattle and ponies was identified by the Virginia natural heritage inventory as a major threat to RTE plant species.

In Maryland, trampling was noted at four of the eight natural heritage sites along the Trail, one of which is the rock outcrop community at Weaverton Cliffs. In West Virginia, trampling was identified as a major threat along the Potomac and Shenandoah rivers near Harpers Ferry.

In Pennsylvania, hiker trampling was an identified threat at the majority of the 15 natural heritage sites identified in the 1990 A.T. natural heritage inventory. Among the sites where trampling was an observed or potential threat are: Mt. Minsi, Big Offset Barren, Little Gap Barrens, Rausch Gap, and Bernheisel Bridge. At Big Offset Barren, the A.T. bisects the population of the globally rare *Carex polymorpha* (variable sedge); however, the Trail edge may provide good habitat for this species due to increased light.

In New Jersey, the A.T. natural heritage inventory reported in 2000 that trampling was a threat at Maple Hill, Price's Switch and Dunnfield Creek natural heritage sites. At the Dunnfield Creek site, three populations of RTE species were identified as vulnerable to trampling, and one of them (*Aristolochia serpentaria* or Virginia snakeroot) has since been extirpated. In New York, trampling is a recently documented threat at Buchanan Mountain, Arden Mountain, Black Mountain, and Cat Rocks natural heritage sites.

In New England, trampling is a threat noted at 30 natural heritage sites. In Connecticut, a 2004 natural heritage inventory of the Appalachian Trail corridor documented trampling impact at Lion's Head and Wachocastinook Ravine, Bear Mountain, Great Falls, and Bulls Bridge natural heritage sites. At the very significant Bulls Bridge Natural Heritage Site, several of the site's rarest species are threatened by trampling, and at least one subpopulation of *Onosmodium virginianum* (Virginia false-gromwell) appears to have been extirpated by trampling. In Massachusetts, trampling was documented at

Upper Sherman Brook, Greylock Summit, Old Adams Road, Kitchen Brook Drainage, Crystal Mountain, Cady Brook, April Hill Farm, Jug End Road, and Mt. Race natural heritage sites. Two of the plants most threatened by trampling in Massachusetts are *Luzula parviflora* var. *melanocarpa* (black-fruited woodrush) and *Solidago simplex*, var. *randii* (Rand's goldenrod).

In Vermont, trampling was noted as a threat at three natural heritage sites: Perkins Road, Stratton Mountain, and Glastenbury Mountain. In New Hampshire, trampling was noted as an existing or potential threat at Holts Ledge, Mt. Moosilauke, Mt. Garfield, Eagle Lakes, Lakes of the Clouds and Monroe Flats, Mt. Madison, and Mt. Success natural heritage sites. Off-Trail hiking in the extensive alpine area of the Presidential Range is a threat to rare plant populations there. Rock climbing was noted as a potential impact at the Holts Ledge. In Maine, trampling impact on natural heritage sites is most prevalent on mountain summits with good vistas, including Mt. Carlo, Goose Eye Mountain, Mahoosuc Mountain, Baldpate Mountain, and Moxie Bald Mountain. On some of these summits, trampling impacts the very rare alpine plant community. Trampling is also a threat to rare plant populations at Grafton Notch State Park and Little Wilson Falls natural heritage sites.

Erosion

Another threat that sometimes results from high recreation use is erosion. Erosion of the Appalachian Trail was cited as a threat at approximately 25 natural heritage sites Trailwide. In North Carolina, erosion was having an impact at Grassy Ridge, Unaka Mountain, Cherry Gap, Temple Ridge, Bald Mountain, and Hot Springs/Lover's Leap. In Tennessee, erosion was observed to be a problem at Laurel Falls, Blackman Branch Campsite, Iron Mountain Vista, and Highway 91South natural heritage sites. In Virginia, erosion was noted as a threat at Mount Pleasant, Whitetop Mountain, and Whitetop Laurel Slopes natural heritage sites. In Pennsylvania, erosion was noted at Little Gap Barrens and Rattling Run Seep natural heritage sites. In Massachusetts, erosion was having an impact at Cady Brook Natural Heritage Site.

In New Hampshire, erosion was impacting rare plant populations at Mt. Garfield, Mt. Eisenhower, and Lakes of the Clouds and Monroe Flats. In Maine, erosion was identified as a threat at Mount Carlo, Mahoosuc Mountain, Whitecap Mountain, Potaywadjo Ridge, and Northern Nahmakanta natural heritage sites.

Sedimentation

Sedimentation was noted as an actual or potential threat to natural heritage resources at more than ten sites in North Carolina and two sites in southern Virginia. Erosion, trampling, camping, and logging were given as the causes of sedimentation at natural heritage sites within the A.T. corridor. The species most frequently impacted by sedimentation is the globally rare aquatic lichen *Hydrotheria venosa*. Sedimentation may be a problem along the A.T. in other states as well.

Logging

Logging was identified as a potential threat at more than 40 natural heritage sites in the A.T. corridor, particularly in Vermont, New Hampshire, Maine, and North Carolina. At some locations, the natural heritage inventories noted that the threat of logging outside of a natural heritage site could have an impact within the site, especially when the site is a wetland or fen. At some locations within the A.T. corridor, logging may be a reserved right on some tracts of land.

Collection and Poaching

Collection of rare, threatened, and endangered plants and poaching of animals was noted as a threat at more than 30 natural heritage sites Trailwide. *Panax quinquefolius* (ginseng) was the species most frequently cited as being threatened by collection. Other species cited as being subject to collection are *Cypripedium* species (lady slippers), *Listera smallii* (kidney-leaved twayblade), other orchids, *Iris verna* (dwarf iris), and *Trillium* species. One globally rare species whose collection has been observed is the globally rare *Lilium grayi* (Gray's lily), a species that is currently being considered for Federal Threatened or Endangered status. The animal species that is most frequently noted as being subject to poaching and killing is *Crotalus horridus* (timber rattlesnake). Rare salamander species are also listed as being subject to collection.

Plant Succession

Plant succession was listed as a threat to rare, threatened, and endangered species at more than 20 natural heritage sites Trailwide. In Massachusetts, plant succession was noted as a threat to *Amelanchier bartramiana* (Bartram's shadbush) at Mt.Williams and to *Ribes triste* (swamp red currant) at Tully Mountain. In Pennsylvania, plant succession was given as a threat to the *Prunus pumila* (sand cherry) populations at Mt. Minsi and Totts Gap and the *Carex polymorpha* population at Big Offset Barren. Plant succession was also listed as a potential or existing threat at Rausch Gap and Big Flat Barren natural heritage sites in Pennsylvania. In Virginia, plant succession was listed as a threat to *Betula papyrifera* (paper birch), *Alnus incana* ssp. *rugosa* (speckled alder), and *Carex polymorpha* (variable sedge). Plant succession was also listed as a possible threat to the federally endangered *Plethodon shenandoah* (Shenandoah salamander) and the state endangered *Thryomanes bewickii altus* (Appalachian Bewick's wren). In North Carolina, plant succession may encroach on the grassy balds at Big Bald and in the Roan Highlands area, which are the habitat of numerous rare, threatened and endangered species.

Deer Browsing

In Pennsylvania, deer browsing has been a threat to the globally rare *Euphorbia purpurea* (glade spurge) at Hunters Run and to *Prunus pumila* (sand cherry) at Mount Minsi. At Hunter's Run, all populations of *Euphorbia purpurea* were fenced in 2002 to counter the threat of deer browsing, and the individual plants have become much more vigorous. In Virginia, deer browsing was noted as a threat at more than ten natural heritage sites along the A.T. in Shenandoah National Park. In Tennessee, John's Cranberry Bog Natural Heritage Site was receiving some impact from deer.

Other Threats

The state natural heritage inventories have documented a wide range of other existing or potential threats to natural resources in the A.T. corridor, though they are not as frequently cited as the threats previously mentioned.

Various types of development are noted as threats along the Trail, including ski Trail development (Pico Peak and Shrewsbury Peak, VT and Saddleback Mountain, ME), housing developments (Buzzard Rock to Wilson Gap and Crescent Rock, WV), landscaping and maintenance along a railroad line (Housatonic River, CT and Hunters Run, PA), and utility line clearing (Beartown Woods and Little Gap Barren, PA). Roadwork and maintenance were noted as threats at Upper Crabtree, VA; Whitetop Laurel, VA; High Rock/Sams Gap, NC; Warner Hollow, MD; Millbrook, NJ; and roadside mowing was noted as a threat to natural heritage resources at Hazeltop Ridge, Horsehead Overlook, and Whitetop Mountain in VA, and Vossburg Hills, MA. Other developments that could impact natural heritage resources along the A.T. include Crawford Path-Mt. Washington, NH, and Mt. Greylock, MA. Trail relocations, shelter construction, and vista clearing were noted as threats to natural heritage resources at a few locations along the Trail.

Recreation use other than hiking was listed as a threat to natural heritage resources at some locations along the A.T.. Off-road vehicles have been documented as problematic at Doll Flats, TN; Bear Mountain, CT; Hunters Run, PA; Whitetop Mountain, VA; Hughes Gap, NC; Temple Ridge, NC; Cheoah Gap, NC; and Dalton Gap, ME. Several of these sites are among the most important natural heritage sites along the A.T.. Horse use along the Trail was documented as a threat at Taylor Hollow and Unaka Mountain in NC. Grazing or trampling by horses and cattle was noted as threats to natural heritage resources at the important Mt. Rogers and Pine Mountain natural heritage sites in Virginia and at Bishop Hollow Natural Heritage site in Tennessee. Rock climbing was noted as a threat to rare species at a few locations along the Trail. Overfishing was noted as a potential threat at Bald Mountain Pond and Rainbow Lake along the A.T. in Maine.

Competition from invasive native plant species, such as blackberry and poison ivy, was noted as a threat to natural heritage resources at Stover Branch and Turkeypen Gap, TN;

Roan Mountain, NC/TN; Upper Goose Pond, MA; and Blue Ridge Gap, GA.

Damming by beavers was noted as an existing or potential threat to rare plants and natural communities in New Hampshire, Vermont, Massachusetts, and Virginia.

A variety of threats to water resources were noted in the natural heritage inventories. Groundwater contamination was noted as a potential or existing threat at Reservoir Hollow, Calf Mountain Springs, McCormick Gap, Dripping Rock, and Hickory Spring in VA and at Lindy Camp Bog and Rich Knob in TN. Groundwater withdrawal or alteration of site hydrology were noted as possible threats at several of these same sites, as well as at hiker huts adjacent to natural heritage sites in New Hampshire's White Mountains. Other water-related threats noted at one or more natural heritage sites in the A.T. corridor are agricultural drainage, dumping, wetland drainage, flooding, and lake eutrophication. The use of herbicides or pesticides was noted as a potential threat at some sites, including several in northern Virginia, where the globally rare Blue Ridge Mountain amphipod is found. Poor sanitation or human waste were noted as problems at a few natural heritage sites, including the important Bulls Bridge site in Connecticut.

Air pollution or acid rain are known or suspected threats to natural heritage resources at several locations along the A.T., including Great Smoky Mountains National Park, NC/TN; Roan Mountain, NC/TN, and Shenandoah National Park, VA.

Fire suppression was noted as a threat at several natural heritage sites along the Trail, where plant communities or individual species are believed to be fire dependant.

Current Biological Resources Programs for the Appalachian Trail

1. Natural Heritage Inventory Program

Between 1989 and 2001, natural heritage inventories were completed in each of the 14 states through which the Appalachian Trail passes. These inventories, which were conducted by state natural heritage programs or contractors using the state's natural heritage program inventory protocols, documented rare, threatened, and endangered (RTE) species and rare or exemplary natural communities on all Appalachian Trail lands (defined as all Appalachian Trail Park Office land and other public lands within 500 feet of the Appalachian Trail footpath). All 14 of the Appalachian Trail natural heritage inventories documented vascular plants on Appalachian Trail lands, and all of them documented some rare or exemplary natural communities. However, documentation of RTE vertebrates on Appalachian Trail lands varied significantly from state to state. In a few states, non-vascular plants and selected invertebrates were inventoried. The natural heritage inventory reports prepared for each state describe and map each species and natural community, and list threats and management recommendations to protect them. The State Natural Heritage Offices and independent biological

contractors conducted the inventories and prepared the inventory reports.

Initially, the Appalachian Trail Park Office (APPA) and the Appalachian Trail Conservancy (ATC) shared responsibilities for coordinating the effort. Between 1989 and 1997, ATC assumed responsibility for the program. From 1997 to the present date, the APPA Natural Resource Specialist has coordinated the program. The contract or cooperative agreement administrators for the Appalachian Trail natural heritage inventories have been the APPA Natural Resource Specialist and/or the ATC Regional Representatives and Trail Management Director. The APPA Natural Resource Specialist, ATC regional staff, other agency staffs and Trail club volunteers have reviewed the inventories. Funding for the inventories has come from many sources: APPA, ATC, the USDA Forest Service, the National Forest Foundation, state agencies, corporate sponsors, and a variety of private, non-profit foundations and organizations.

See *Table III.E.1, Inventories of Natural Heritage Resources along the Appalachian Trail, by State*.

Information from the natural heritage inventories was initially input into TREAD, a relational database developed by the Appalachian Trail Conservancy to store and analyze Trail management data. In 2002 and 2003, the data from the A.T. natural heritage inventories were exported into an Access database. Locations of RTE species occurrences from each of the A.T. inventories have been entered into a geographic information system by the APPA Physical Science (GIS) Specialist and several interns.

2. Natural Heritage Monitoring Program

The primary purpose of the Appalachian Trail natural heritage monitoring program is to track the status and trends of the rarest or most threatened plants, animals, and natural communities located along the Appalachian Trail. Each of the natural heritage inventories for the 14 Appalachian Trail states recommended that many of the RTE species and sites be monitored on a regular basis. After the completion of each inventory, volunteer monitors were sought from the Appalachian Trail clubs and trained during one-day monitoring workshops to conduct some basic monitoring of the rarest or most threatened species within their club's section of the Appalachian Trail. APPA natural resource staff, along with staff from the State Natural Heritage Offices, the USDA Forest Service, botanical contractors, and ATC have provided training to the Appalachian Trail natural heritage monitors. Similar data are recorded in all states, though the monitoring form has been modified several times during the last few years. Monitoring workshops for natural heritage resources in Pennsylvania, New Hampshire, Vermont, Connecticut, and North Carolina were held during the early 1990s, and workshops for each of the remaining states were held from 1998 to 2004. Additional natural heritage monitoring workshops have been held in most of the A.T. states since 2001.

Since 1990, approximately 160 volunteer natural heritage monitors have been trained to monitor RTE plants, animals, and communities at approximately 30% of the 515 natural heritage sites identified on Appalachian Trail lands. More than 95% of the occurrences placed in the monitoring program are of rare plants, with only a few rare animal species (birds) or plant communities placed into the program. The monitoring of rare birds has met with less success than the monitoring of rare plants. Most volunteer natural heritage monitors have been from Trail clubs, though in recent years, monitors from outside the Trail clubs (*e.g.*, Sierra Club and New England Wild Flower Society) have been sought.

A monitoring coordinator coordinates the volunteer monitors within each state or region. Primary responsibilities of the monitoring coordinators include seeing that the assigned volunteers monitor their sites and submit their reports annually, as well as seeking replacement monitors for sites that need new monitors. State coordinators for the Appalachian Trail volunteer natural heritage monitoring program currently include staff from the ATC regional offices, the Appalachian Mountain Club, and the New York-New Jersey Trail Conference, as well as volunteer monitoring coordinators from the Maine Appalachian Trail Club, the Appalachian Mountain Club, the Potomac Appalachian Trail Club, and the Georgia Appalachian Trail Club. The APPA Natural Resource Specialist is responsible for overall coordination of the Appalachian Trail natural heritage monitoring program.

For many years, monitoring data from the volunteer natural heritage monitoring reports were put into the TREAD database at ATC. In 2002 and 2003, these data were exported into Access. Data from the monitoring reports have been entered primarily by ATC volunteers, but also by ATC staff.

Approximately 50-60% of the 130 natural heritage sites in the Appalachian Trail natural heritage monitoring program are typically monitored each year. Monitoring success is usually good after a workshop, but declines over the years as volunteers move or lose interest. To maintain a strong program, new monitors need to be recruited by the state and club monitoring coordinators and trained regularly by natural resource staff at ATPO, ATC, or by the contract botanists who conducted the inventories. Improvements in data collection and management also needs to occur. Though the same monitoring form is utilized Trailwide, there is considerable variation in the thoroughness of the data that are collected by volunteers.

In 2002 and 2003, a botanical contractor monitored approximately 50 priority natural heritage sites (about 25 each year) in Maine, New Hampshire, Vermont, Massachusetts, Connecticut, New York, New Jersey, and Pennsylvania. This monitoring effort provided a professional botanical evaluation of the status, trends, and threats of the sites that were monitored. At a number of sites, the botanist assisted a volunteer natural heritage monitor in locating the species to be monitored. Funding for this project was provided by the APPA.

3. Natural Resource Management Projects

The natural heritage inventories that were prepared for each of the 14 Appalachian Trail states between 1989 and 2001 documented the status of and threats to more than 2,100 RTE species and rare or exemplary natural communities. Taken as a whole, the inventories contained several thousand management recommendations to protect RTE species and rare or exemplary natural communities. Among the most frequently cited management recommendations are: monitoring the site, informing Trail maintainers of plants that could be damaged during Appalachian Trail maintenance, controlling exotic species, vegetative manipulation to remove competing species, relocating the Trail, controlling erosion, using ridgerunners to discourage inappropriate or illegal uses, and use of signage to educate users.

Other than monitoring, one of the most frequent management recommendations in the natural heritage inventories was to inform Trail maintainers of the presence and location of threatened and endangered species so that they would not inadvertently harm them during their maintenance work. To address this recommendation, in 2001 the APPA Natural Resource Specialist and ATC volunteers and staff prepared approximately 200 rare plant identification sheets of RTE plants that had been documented immediately beside the tread of the Appalachian Trail. Each rare plant identification sheet included an illustration and color photo of the plant, along with a non-technical description of the plant, the best time to identify the species, and a topographic map showing the location of the plant along the Appalachian Trail. The rare plant identification sheets were distributed through Appalachian Trail club leaders to those maintainers on whose Trail sections these plants are found, along with an instruction sheet explaining the project and how to avoid harming the rare species.

Along with monitoring, controlling invasive exotic plants (described below), and informing Trail maintainers of RTE plants by the Trail tread, other management recommendations from the Appalachian Trail natural heritage inventories have been implemented to protect RTE species along the A.T.. At one natural heritage site in Massachusetts, a short Trail relocation was made so that the Appalachian Trail would avoid passing through a population of the state endangered *Agrimonia parviflora* (agrimony). In Pennsylvania, fencing was erected around five subpopulations of the globally rare *Euphorbia purpurea* (glade spurge) to protect the plants from herbivory by deer or other wildlife. Signage informing hikers of rare plants has been erected in Maine. Scree walls have been constructed on either side of the Trail footpath on alpine summits in New Hampshire to restrict visitor use. Several areas, including the Roan Mountain area of NC/TN, are maintained as open areas through mowing or grazing. Ridgerunners also educate hikers in appropriate backcountry use, to minimize

recreational impacts on natural resources, including rare plants and animals. Management projects have been implemented by the APPA Natural Resource Specialist, ATC regional staff and volunteers, and by a contract botanist funded by the APPA.

4. Invasive Exotic Species Management Program

The APPA Natural Resource Specialist has been responsible for overall coordination of the Appalachian Trail Exotic Species Program. Additional coordination has been provided by ATC regional staff. Utilization of NPS Exotic Plant Management Teams has been critical to accomplishing invasive exotic species control along the A.T..

Interest by ATC staff and volunteers in the management and control of invasive exotic plant species began to grow about ten years ago. In 2001, the ATC Board of Managers adopted a three-pronged policy on invasive exotic species: education, monitoring, and control. Priority for controlling invasive exotic species is given to RTE species occurrences that are threatened by exotics and to locations that would have the highest likelihood of successful treatment. Several workshops have been held at ATC Biennial Conferences during the past seven years to educate ATC members about the invasive exotic species problem and what can be done about it. Workshops at ATC gatherings have been provided by the APPA Natural Resource Specialist, the NPS Exotic Plant Management Team Liaison for the National Capital Region, and a USDA Forest Service botanist. Over the last few years, volunteers from Trail Clubs and environmental groups have become increasingly interested in tackling the invasive exotic species problem along the A.T.. In 2008, approximately 20 monitoring events utilizing more than 150 school and environmental group volunteers have performed invasive exotic plant control along the A.T., mostly in northern Virginia.

Knowledge of where invasive plant exotic species are located on Appalachian Trail lands has been growing rapidly. Some of the state natural heritage inventories prepared for the Appalachian Trail between 1989 and 2001 documented the presence of many invasive exotic species, especially some of the more recent inventories. Since 1997, a botanical contractor has documented invasive exotic plant occurrences on Appalachian Trail lands in Massachusetts, New York, New Jersey, and Connecticut, particularly where they are co-located at rare, threatened, and endangered species sites. In 2002 an Appalachian State University student documented the presence of exotics along 400 miles of the Appalachian Trail in North Carolina and Tennessee (excluding Great Smoky Mountains National Park), and he found that most occurrences of exotic plants were located at road crossings of the Appalachian Trail. In 2005, Virginia Tech graduate Adam Canter completed a survey of 24 invasive exotic plant species on the entire Appalachian Trail. The Canter survey documented a total of 472 occurrences of exotic plants at 250 sites along the A.T.. This study found that the greatest percentage of the A.T. to be impacted by exotic species coverage occurred in the Mid-Atlantic states.

For several years beginning in 2002, a monitoring program of invasive exotic plants on

and adjacent to Appalachian Trail lands began in the southern Appalachians. Utilizing APPA and other funding, the Southern Appalachian Man and the Biosphere (SAMAB) Program trained and managed groups of volunteers to document and monitor the presence of 15 invasive exotic species from northeast Georgia to southwest Virginia. In 2008 a group from the Georgia A.T. Club conducted an inventory of invasive exotic plants along a 40-mile stretch of the A.T. in GA.

Also in 2002, the APPA Natural Resource Specialist sought assistance from the NPS National Capital Region Exotic Plant Management Team (EPMT). That EPMT mapped exotic species occurrences at three RTE species sites in northern Virginia and southern Pennsylvania, and the team has since undertaken herbicide control at two of the sites. In 2004, APPA began coordinating additional exotic plant control projects in Pennsylvania with the NPS Northeast EPMT, and in 2008 this EPMT, along with a Weed Team from the Student Conservation Association, began invasive exotic plant control at five RTE species sites in MA. In 2006, the Mid-Atlantic EPMT began to do exotic plant control along a segment of the A.T. in northern VA. In 2007, the Mid-Atlantic EPMT program expanded to coordinate student and environmental volunteer groups to physically remove exotic plants from the A.T. corridor in northern VA. Also in 2008, The Nature Conservancy is controlling invasive exotic plants at several sites on NPS Appalachian Trail lands in MA and CT

In 2002 and 2003, a contract botanist funded by the APPA undertook some small-scale manual removal of invasive exotic species at a handful of RTE species sites along the Appalachian Trail from New Jersey to Massachusetts. The botanist was occasionally assisted by ATC volunteers.

5. Botanical Inventory Work in Connecticut and Massachusetts

In 2003, Ted Elliman, a botanical contractor funded by the APPA, inventoried all vascular plant flora found on Appalachian Trail lands in Connecticut. This botanist also documented all vegetation community types within the A.T. corridor in CT. RTE species populations were re-inventoried. A report on this work was completed in 2004.

In 2005, Elliman undertook a similar comprehensive field survey of all vascular plant flora, RTE species occurrences, exotic plant occurrences, and all vegetation community types within the A.T. corridor in MA. Invasive exotic species were found to be a threat at more than one-half of the RTE species sites along the A.T. in MA. Thirty-one vegetation community types were documented within the A.T. corridor in MA. A report on this work was completed in 2007.

This comprehensive botanical work that has occurred in CT and MA could be duplicated along the A.T. corridor in additional states, either on all A.T. corridor lands or only in states where NPS A.T. land is located.

6. Open Areas Management Program

Approximately 4,490 acres of open areas need to be maintained to provide habitat diversity and scenery. Roughly 955 acres are kept open under agricultural special use permit arrangements; and another 300 acres, on average, are mowed annually by contractors and volunteers. However, numerous former fields and pastures are being lost to succession. Funding is needed for equipment and contract personnel

Biological Resource Management Needs

Evaluate threats and management recommendations in the Appalachian Trail natural heritage inventories for the highest priority RTE species and sites on Appalachian Trail Park Office land. The 2,100 RTE species and community occurrences and 515 natural heritage sites have been prioritized Trailwide, based on their global and state rarity and federal and state status. More than 300 RTE species occurrences on Appalachian Trail Park Office land have also been prioritized. The 100 highest priority RTE species occurrences on Appalachian Trail Park Office land have been evaluated for the level of threat to those occurrences, based on the information provided in the Appalachian Trail natural heritage inventories. However, many of those threats have not been assessed in the field for a decade or more. An on-the-ground evaluation of the current threats and management options for protecting these species needs to occur, with a decision made as to what management actions should be implemented at each site. Discussions and coordination with managers of other Appalachian Trail lands could occur regarding the protection of RTE species that are not on Appalachian Trail Park Office land.

Implement management actions to protect the highest priority RTE species occurrences and sites on Appalachian Trail Park Office land. Among the management actions that could be implemented are exotic plant control, vegetative manipulation to remove competing species, placement of scree walls to define the Trail and reduce trampling, relocating the Trail, controlling erosion, and placement of signs to educate users. Implementation of many management actions would rely heavily on the use of ATC and other volunteers. Additional staff and volunteer resources are needed to evaluate, coordinate, and implement management actions at RTE species sites on Appalachian Trail Park Office land. In some cases, if management actions are not taken, some RTE species occurrences will be lost due to a variety of threats.

Additional expertise in wildlife biology or zoology is needed in order to address wildlife management issues on the Appalachian Trail. Approximately 200 occurrences of RTE vertebrates and invertebrates have been identified on Appalachian Trail lands in the few states where inventories of some RTE animals have occurred. Many more RTE vertebrates are likely to be identified in future RTE inventories of the Appalachian Trail. At the present time, almost no monitoring is occurring for any vertebrates or

invertebrates on Appalachian Trail lands. A wildlife biologist would be able to establish a wildlife monitoring program for the Appalachian Trail and evaluate and implement wildlife management recommendations from the Appalachian Trail natural heritage inventories.

Monitoring of rare and exemplary natural communities on Appalachian Trail lands is needed in order to assess vital signs, trends, and threats to those communities. Currently, almost no monitoring of rare or exemplary communities occurs on Appalachian Trail lands. Management actions to protect these natural communities could also be assessed and implemented on Appalachian Trail Park Office land. In addition, there could be additional collaboration with other federal and state agencies regarding the protection of natural communities on land that they manage. The state natural heritage inventories identified more than 450 occurrences of rare and exemplary natural communities on Appalachian Trail lands, so there is no shortage of significant resources to be monitored and protected. Among the rare natural communities that have been identified on Appalachian Trail lands are alpine tundra, subalpine krummholz, subalpine spruce fir forest, grassy balds, fens, calcareous seepage swamps, and pitch pine-scrub oak barrens. The only alpine area in the national park system in the Eastern United States is located on NPS A.T. land in Maine. The A.T. passes through nine diverse ecosystems along its route from GA to ME.

Continue to develop a program to inventory and monitor exotic plants and insect pests on Appalachian Trail lands. Though many invasive exotic plant species were documented along the A.T. corridor from GA to ME in 2005, that survey was not as complete in GA and from NJ to MA. The presence, extent, and threat level at individual exotic species sites should be documented for GA, NJ, NY, and CT. Exotic species occurrences have been documented in only a handful of occurrences in VT, NH, and ME, and additional inventory work in these states could confirm whether invasive exotic plants have become an increasing problem along the A.T. corridor there. Concentration on inventory and monitoring of exotics could be given to Appalachian Trail Park Office lands or to sections of the Trail with the highest priority RTE species occurrences. A primary goal of this inventory and monitoring work would be to prioritize RTE species sites on Appalachian Trail Park Office land for exotic species control. The inventory and monitoring of exotic species could also provide early warnings to land managers regarding new occurrences of exotic species that might be easily controlled.

Control exotic species at high priority sites on Appalachian Trail Park Office land. The presence of invasive exotic plants has been documented on several thousand acres in the A.T. corridor, and its presence continues to grow and expand into new areas. Mapping and control of invasive exotic plants currently utilizes three NPS Exotic Plant Management Teams (EPMTs) to a limited degree. Generally, only about two sites per year can receive exotics control by each of three NPS EPMTs. Exotic species can be removed by chemical, physical, or biological means, but the NPS EPMT's largely rely on the use of herbicides. In order to more quickly protect a greater number of RTE species

and rare or exemplary communities from invasive exotic plants, an Appalachian Trail Exotic Plant Management Team could be established to control invasive exotic plants solely on Appalachian Trail Park Office land. Exotic species could also be controlled at locations where they have just begun to invade an area. An EPMT dedicated to the Appalachian Trail could control a much greater number of exotic plant sites before RTE species sites are severely impacted.

Additional staff resources are needed to coordinate the inventory, monitoring, and management of invasive exotic plants and insect pests that are impacting Appalachian Trail biological resources. Inventory and monitoring of exotic plants and insect pests could occur Trailwide, but control of exotics would occur only on Appalachian Trail Park Office land. This person would be responsible for prioritizing exotic plant sites for control. They could also take the lead in establishing an EPMT for Appalachian Trail Park Office lands. This individual also would develop an Integrated Pest Management Program for Appalachian Trail Park Office lands. They would identify locations that have been invaded by the gypsy moth, hemlock woolly adelgid, and other insect pests and would evaluate those occurrences for control. This person would take the lead in controlling exotic insect pests at high priority locations on Appalachian Trail Park Office land. They would also coordinate with other agencies that wished to control insect pests on Appalachian Trail Park Office land. A program to monitor health threats, such as West Nile Virus and Lyme Disease, on Appalachian Trail lands could also occur.

Inventories of RTE vertebrates are needed in many Appalachian Trail states. Inventories for RTE vertebrates are incomplete and vary from state to state. For example, some states such as Massachusetts and Virginia inventoried RTE species in each of the four vertebrate groups (mammals, birds, reptiles and amphibians, and fish), while other states such as New Jersey and Maryland did not inventory any RTE vertebrate groups. Funding is needed to complete an inventory of RTE vertebrates in states with Appalachian Trail Park Office land that have not received inventories of all vertebrate groups. These inventories would provide knowledge of the presence of and threats to RTE vertebrates on Appalachian Trail lands, which is needed in order for these resources to be protected. An inventory of small RTE mammals in Pennsylvania, New Jersey, New York, and Connecticut was completed in 2007, and an inventory of small mammals, bats, and lynx was completed in Maine in 2008. Additional RTE mammal inventory work will likely be needed in the A.T. corridor in these and other states. Inventories of all RTE mammals are needed in Massachusetts, Maryland, West Virginia, and a portion of Virginia. Inventories of RTE birds on NPS Appalachian Trail lands are needed in Maine, Connecticut, New York, New Jersey, Pennsylvania, Maryland, and West Virginia. Inventories of RTE reptiles and amphibians are needed in Maine, Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Maryland, and West Virginia. Inventories of RTE fish may be needed on NPS Appalachian Trail lands in order to provide a complete picture of RTE vertebrates along the Trail. Some limited inventory work on vertebrate groups has been done in some states, but a thorough inventory of all vertebrates has not been completed in any state. Inventories on non-Appalachian

Trail Park Office land in Virginia could also occur. Particularly in the southern Appalachian states, there is good potential for finding occurrences of RTE vertebrates, since the region has such a high number of globally rare species.

Additional monitoring of high-priority RTE species occurrences on Appalachian Trail lands is needed in order to understand the status, trends, and threats to those resources. The Appalachian Trail Natural Heritage Monitoring Program was evaluated in 2007 and 2008, and a large number of recommendations were made to improve and expand the program. The evaluation identified program strengths and weaknesses in recruitment, training, monitoring, and support of volunteer monitors, as well as in data collection and analysis. Many high priority RTE species sites are currently without an active monitor, and some sites that are monitored need to be assessed more thoroughly. Increased staff and volunteer resources are needed to implement many of the recommendations in the recent evaluation of the A.T. Natural Heritage Monitoring Program. Additional monitoring of RTE species sites by staff, a contract biologist, and volunteers is one of the many monitoring recommendations made in the evaluation report. Another recommendation is to increase consultation with other Appalachian Trail land management agencies and state natural heritage offices regarding monitoring of RTE species within the A.T. corridor.

A vegetation map of Appalachian Trail lands is needed, particularly for those sections of the Trail located on Appalachian Trail Park Office land. Vegetation mapping will provide a more complete picture of the plant communities that are found on Appalachian Trail lands. Completing a vegetation map for the Appalachian Trail will also fulfill one of the twelve basic natural resource inventories of the NPS Inventory and Monitoring Program. Vegetation maps also would provide useful information on agricultural use, development, and impervious surfaces on or adjacent to the Trail. Initial work to prepare for vegetation mapping of the A.T. was begun in 2007 in a cooperative agreement with NatureServe, but a large amount of funding will be needed to actually do the aerial photography and vegetation mapping of the A.T. corridor

Species lists to determine 90% of vascular plant and vertebrate species need to be prepared to meet one of the goals of the NPS Inventory and Monitoring Program. Thus far, an inventory of all vascular plants has been conducted on Appalachian Trail lands in only two states, Connecticut and Massachusetts. A cost assessment and comparison for doing this work should be prepared to determine whether this Inventory and Monitoring goal should be completed for 1) all Appalachian Trail lands, 2) states containing Appalachian Trail Park Office lands, or 3) solely Appalachian Trail Park Office land.

Open areas need to be maintained. Approximately 4,490 acres of open areas need to be maintained to provide habitat, diversity, and scenery. Roughly 955 acres are kept open under Special Use Permits administered by the Appalachian Trail Park Office; and another 300 acres are mowed annually by volunteers or contractors. However,

numerous fields and pastures are being lost to succession. Funding is needed for equipment and contract personnel.

An integrated GIS-supported database of RTE occurrences needs to be updated and matched with state natural heritage program data. Data needs to be entered, corrected, mapped, and matched with state natural heritage program data.

G. Air Resources

Air Resource Threats

There are currently four major air quality threats on the Appalachian National Scenic Trail:

(a) Regional haze adversely affects visibility. Views, vistas, and scenery are key components of the recreational opportunities provided by the Appalachian National Scenic Trail. Visibility is seriously degraded along much of the Trail. Degradation is a result of a variety of factors, but is principally due to the presence of fine sulfate particles in the air. Recent IMPROVE data indicates that sulfates are responsible for 60 to 75 percent of visibility impairment in the eastern United States. In their 1990 State of Science and Technology report on acid rain, the National Acid Precipitation Assessment Program (NAPAP) estimated that under natural conditions, without the influence of human-caused air pollution, visual range in the eastern United States is approximately 90 miles. Median annual visual ranges in Shenandoah National Park and Great Smoky Mountains National Park have been measured at 24 miles or less, with median summertime visual ranges of 12 miles or less. Visual ranges have been measured in Great Smoky Mountains National Park at one mile or less during severe haze episodes.

(b) Elevated nitrate and sulfate levels contribute to acid deposition, which can adversely affect streams, water bodies, soils, and terrestrial and aquatic organisms. The Appalachian Mountains receive some of the highest deposition rates in North America. Deposition effects have not been studied on the Appalachian Trail; however, acidification and associated adverse effects have been observed at Great Smoky Mountains National Park, Shenandoah National Park, and a number of National Forests in the Appalachian Mountains. Therefore, there is a high probability that soil and surface water acidification, soil nutrient imbalance, and plant and animal species loss is occurring on the Trail as a result of acid deposition.

(c) Poor air quality can adversely affect the health of visitors and workers on the Appalachian Trail. High ozone concentrations cause respiratory problems in humans and are a particular concern for those who are engaging in strenuous aerobic

activity, such as hiking or Trail maintenance. High ozone levels can be dangerous for people with respiratory problems like asthma, and can even temporarily reduce lung function in healthy individuals. Data collected at nearby ozone monitors indicate that summertime ozone concentrations reach levels on many sections of the Appalachian Trail that are harmful to humans.

(d) High levels of ozone adversely affect vegetation. Ozone damages sensitive plant species by causing a visible spotting or "stipple" on the upper surface of the leaves. Ozone can affect plant physiology by reducing growth, increasing susceptibility to disease, and increasing senescence. Some plant communities along the Appalachian National Scenic Trail may be threatened by increases in ozone. Ozone can cause reduced photosynthesis, reduced growth, premature aging, and leaf loss with or without the occurrence of foliar injury. A list of ozone-sensitive species found on the Appalachian Trail is provided in *Appendix E, Ozone Sensitive Species Found on the Appalachian Trail*. A recently-completed risk assessment indicates ozone concentrations on many sections of the Trail likely reach levels that are harmful to these sensitive plant species. Therefore, plant communities along the Appalachian National Scenic Trail may be threatened by current or increased levels of ozone. This is a particular concern for high-elevation, ridge-top communities, where elevated ozone concentrations are frequently more prevalent.

Current Air Resource Programs on the Appalachian Trail

The Appalachian National Scenic Trail passes through a number of national parks and forests with well-established air quality monitoring programs. In addition, numerous air quality monitoring stations are located proximate to the Trail.

However, the Appalachian Trail Park Office and the Appalachian Trail Conservancy do not currently have any staff dedicated to air resources and have not actively participated in, reviewed, or commented upon air quality issues affecting the Appalachian Trail. Staff members at the Appalachian Trail Park Office rely on the NPS Air Resources Division, the NPS Northeast Regional Office Air Resources Coordinator, and the NPS Air Quality Ecological Effects Coordinator for assistance with air resource issues. To date, that assistance has consisted of (1) development of air quality baseline data and (2) assistance in preparation of this *Appalachian Trail Resource Management Plan*. In addition, as part of their regular duties, the Washington Office and Northeast Regional Office Air Resources personnel evaluate the potential effects of air pollution sources when reviewing relevant permit applications.

The Appalachian Trail Conservancy has initiated a pilot program to expand upon the Appalachian Mountain Club's VizVol Program in New England. This program, which is being administered by ATC's environmental monitoring coordinator, is still under development. Viz Vols provides volunteers with cameras to document visibility and ozone monitors to measure ozone levels. Data are compiled by Appalachian Mountain

Club staff. In addition, the Conservancy follows and occasionally participates in national air quality issues through coordination with the Hikers for Clean Air coalition.

Air Resource Management Issues and Needs

The overriding needs for managing air resources along the Appalachian Trail are (1) to develop a coherent, comprehensive process for measuring air quality and air pollution effects along the entire Appalachian Trail and (2) to retain sufficient staff capability to analyze and report on air quality conditions along the Trail to the public, the department, the Environmental Protection Agency, and Congress.

Given that one of the purposes of the Appalachian National Scenic Trail is to preserve scenic qualities along the Trail, visibility impairment should be an area of particular concern for Appalachian Trail managers. Monitoring visibility impairment along the Appalachian National Scenic Trail could be accomplished by combining particle data from existing (and potentially new) IMPROVE sites with photographic data from existing (and potentially new) Webcam sites along the Trail. A series of monitors at key locations along the Trail would allow Appalachian Trail managers to document the range of visibility conditions, determine trends in visibility degradation, and compare and contract visibility parameters at different points on the Trail.

Trail managers need to have a better understanding of ozone levels along the Trail, as well as the potential risks that ozone concentrations may cause for hikers and Trail workers. In addition, based on 1995-1999 interpolated SUM06 ozone values, ozone concentrations along the Trail are high enough to cause foliar injury and/or growth effects of ozone-sensitive vegetation. Such effects are likely to occur anywhere except those segments of the Trail in upper Massachusetts, Vermont, New Hampshire, and Maine. Species with documented sensitivity to ozone occur on the Trail; however, to date, ozone injury surveys have not been conducted. Surveys need to be conducted along the Trail that focus on good bioindicator species (i.e., species with well-documented symptoms), using accepted protocols and concentrating on areas with a high likelihood of injury (e.g., high SUM06 values and high soil moisture). The program would establish long-term monitoring plots, document the extent of injuries to vegetation, verify cause and effect relationships, and prepare credible scientific documentation of effects.

Finally, acid deposition is a potential threat to Trail aquatic and terrestrial resources. Trail managers need to survey Appalachian Trail soils and surface waters to determine their sensitivity to acid deposition, then monitor changes in soil and water chemistry, species composition, and population densities in acid-sensitive areas.

H. Water Resources

Water Resource Threats

There are four general threats affecting Appalachian National Scenic Trail water resources:

a. Climate Change. Annual variation in climatic conditions is normal, however, a growing body of evidence suggests a trend toward warmer climatic conditions and that the rate of climatic change may be increasing. Water resources, just like every other resource type are susceptible to climate change and may be dramatically altered as a result of modified climatic conditions. For example, if atmospheric moisture levels increase and result in higher levels of precipitation, base and storm water levels will likely increase and may cause alterations to stream morphology. There are a number of scenarios that may occur depending on what climatic changes manifest themselves. If stream temperatures rise, conditions that support fish populations that are currently at the edge of their range may cease to exist and those populations may become extirpated. Likewise, if temperatures rise sufficiently, the forms of precipitation may shift with snow becoming less common in southern high elevation areas; the duration of snowpack may decrease; and, ice free days may increase for lakes and ponds. Given that some amount of change is likely to occur, some alteration in aquatic and vegetative species composition and stream and lakeshore morphology is likely. Species composition alteration or mortality may affect water quality.

b. Wet and dry deposition. The Appalachian Mountains receive some of the highest nitrate, sulphate, and heavy metal deposition rates in North America. Although deposition effects have not been studied along the Appalachian Trail specifically, acid deposition and associated adverse effects have been studied in Great Smoky Mountains National Park, Shenandoah National Park, the Adirondack Park and a number of National Forests in the Appalachian Mountains. Based on the results from these investigations, it is reasonable to anticipate that soil and surface water acidification, soil nutrient imbalance, as well as plant and animal species loss may be occurring within the Appalachian Trail region. While sulfur deposition has decreased since the 1990 Clean Air Act standards were enforced, ecosystem recovery along the Appalachian Trail is not well understood and may be happening more slowly than expected. Episodic acidification has been demonstrated during spring snowmelt and rain events, which is a stress to the aquatic environment.

c. Nutrient enrichment. Waters that receive high levels of nutrients, usually nitrogen and phosphorus, typically show high levels of primary productivity. Highly productive systems are termed eutrophic, whereas systems characterized by low productivity are termed oligotrophic. Eutrophic conditions are more

common where the native soils have higher natural levels of nutrients and/or in systems that are located relatively 'low' in their respective watersheds. Conversely, waters that are positioned higher in a watershed are typically less nutrient rich than waters positioned lower in the same watershed. Two leading anthropogenic causes for eutrophic conditions include agricultural and development activities, and under extreme circumstances affected waters may be deemed hyper-Eutrophic. The Appalachian Trail, which is typically positioned high in the watersheds through which it passes may be less affected by either these two leading causes of nutrient enrichment than by atmospheric inputs of nutrients and human waste disposal because it is positioned 'above' these sources. Waters that are typically impacted by agriculture or development are positioned "downstream" of the impacts, thus, the impacts that threaten the Appalachian Trail region must either arrive atmospherically or with the users of the Trail itself. Increased inputs of nutrients at higher elevations, either through atmospheric deposition (e.g., ammonium) or by imprudent human waste disposal (e.g., privies located too close to a stream or pond) may dramatically alter stream species composition by favoring species that are better able to utilize the increased nutrient concentrations; and, may cause public health concerns related to increased levels of fecal bacteria.

d. Erosion. Like the other potential threats, erosion is a natural process, and under normal conditions natural erosional forces help enforce stream stability, provide a natural source of nutrients, and provide material for land formation. However, unlike the aforementioned three threats, erosion is the consequence of other activities and not the cause itself. Increased rates of erosion may destabilize streams and may result in the loss of land, including Trails and properties and may be the result of causes such as: increased inputs of water into an otherwise stable system (i.e., a severe storm event); problems with bridges or crossings (i.e., improper positioning or sizing of culverts or bridges); physical disturbances to banks or shorelines; or soil compaction (i.e., concentration of foot traffic leading to increase in soil density and water runoff versus water infiltration). Changes to natural erosion patterns may be episodic or incremental, but in either case they may lead to habitat alteration within the water resource itself, or in the case of more dramatic events to adjacent lands. Increased sediment load may change stream substrate and impact breeding and refuge opportunities.

Current Water Resource Programs on the Appalachian Trail

The Appalachian National Scenic Trail passes through a number of national parks and forests with well-established water quality monitoring programs. In addition, numerous water quality monitoring stations are located proximate to the Trail. However, the Appalachian Trail Park Office and the Appalachian Trail Conservancy do not currently dedicate any resources solely to water resources and have not actively participated in,

reviewed, or commented upon water quality issues affecting the Appalachian Trail. Staff members at the Appalachian Trail Park Office rely on the NPS Water Resources Division (WRD) and the NPS Northeast Regional Hydrologist for water resource issues for guidance and input on water resource related issues affecting the Trail.

The Appalachian Trail Conservancy and the Appalachian Trail Park Office have jointly administered a volunteer Water Quality Monitoring Program. Data from the volunteer effort is relatively wide-spread and not targeted toward a specific resource type or concern. Volunteer monitoring is and economical and essential component of the A.T. water monitoring program, and like any such program it will require stringent QA/QC, data archival, and periodic review.

The NPS Water Resource Division is currently funding (FY 2008) a Level 1 Water Resource Inventory for the Trail that will help resource managers identify areas of concern and data gaps; locations to target for future monitoring; and, will help set a baseline for future water quality monitoring activities. The Northeast Temperate Network is also funding an effort to review existing volunteer appropriate water quality monitoring protocols with the intention of adapting one or a combination of several protocols to develop a single water quality monitoring protocol that will be implemented along the Trail.

Water Resource Management Issues and Needs

The overriding needs for managing water resources along the Appalachian Trail are (1) to develop a coherent, comprehensive process for measuring water quality and associated ecological effects along the entire Appalachian Trail and (2) to analyze and report on water quality conditions along the Trail to the public, the department, the Environmental Protection Agency, and Congress.

I. Threats and Program Needs for Cultural Resources

This section identifies threats to and issues concerning management of cultural resources, describes the status of cultural resource management programs for the Appalachian National Scenic Trail, and describes overall cultural resource management program needs.

Cultural Resource Management Threats

(a) Significant Trail features may be adversely affected by Trail use and management. In some circumstances, the Trail footpath and facilities themselves are significant. Approximately 20 Trail shelters constructed by the Civilian Conservation Corps (CCC) survive, and perhaps a dozen more constructed by Trail clubs during the early years

of the Trail project still exist. The CCC also built sections of the Appalachian Trail footpath itself in the 1930s. Historically significant Trail sections and contributing features need to be identified, so that they are not inadvertently destroyed.

(b) Cultural resources are deteriorating as a result of natural and man-made causes, without programs or actions in place to protect and stabilize them. A significant (though largely unknown) number of structures, sites, and artifacts are or will be in poor condition in the next ten years, due to the effects of weather and environmental conditions. Structures are particularly vulnerable.

Sites that need immediate attention (as well as evaluation for their potential eligibility for the National Register) including the Canopus Hill Inoculation Station in Dutchess County, New York, several lime kilns in Massachusetts and Connecticut, ironworks in New York and northern New Jersey, and the Yellow Springs Village, Inclined Plane, Mine Works, and Stone Tower in east-central Pennsylvania. Several other structures, such as the Prosper Hill Ski Tow in Woodstock, Vermont, and the Rocky Run Shelter in Washington County, Maryland, has been stabilized, but additional funds may be needed to fully restore them.

Twenty-one potentially significant sites listed in the Cultural Resource Survey of the Appalachian Trail in Connecticut were identified as deteriorating, due to environmental and human impacts. An unknown number of additional sites on Trail lands in other states also are deteriorating as a result of environmental and human impacts.

(c) Cultural resources are being vandalized, relic-hunted, or removed from Trail lands. Some sites, such as the site of the Battle of South Mountain at Fox's Gap, have been the focus of relic hunters. An ARPA violation that occurred at the site in 2002 is still under investigation. Signage and monuments at the site have been vandalized or covered with graffiti.

Seven culturally significant sites listed in the *Cultural Resource Survey of the Appalachian Trail in Connecticut* showed indications of relic-hunting or pot-hunting; and 25 potentially significant sites listed in the inventory were identified as being vandalized or vulnerable to vandalism.

Public interest in other sites, such as the Ring Quarry Prehistoric Mining District in New Jersey and the Canopus Hill Inoculation Station in New York, has been encouraged by local avocational historians and cultural resource enthusiasts, which may lead to additional incidents of vandalism or relic-hunting. An unknown number of additional sites on Trail lands in other states also are subject to vandalism and relic-hunting.

(d) Cultural resource sites are affected by illegal uses, including off-road vehicle use, in

culturally sensitive areas along the Trail. Off-road vehicles were identified as a threat to 34 cultural resource sites (primarily roads and charcoal hearths) in the *Cultural Resource Survey of the Appalachian Trail in Connecticut*. An unknown number of additional sites on Trail lands in other states also are subject to illegal off-road vehicle use.

(e) Some archaeological sites are affected by public use of the Trail and Trail facilities in culturally sensitive areas along the Trail. Recreational uses of the Trail, particularly in overnight use areas, can adversely affect historic and prehistoric resources. Five cultural resource sites were identified in the *Cultural Resource Survey of the Appalachian Trail in Connecticut* as being adversely affected by camping and hiking activities. Relocations of the Trail were proposed to mitigate ongoing impacts to two sites. An unknown number of additional historic sites on Trail lands in other states also are subject to adverse impacts from Trail use.

(f) Cultural landscapes in many areas along the Trail are potentially affected by residential, commercial, industrial, and infrastructure developments on adjacent lands. In its 14-state traverse, the Appalachian Trail passes through many different cultural landscapes – most of which face development pressure that threatens to change the character of the landscape and the Trail. Although a corridor of land has been acquired to protect the Trail, the sights and sounds of civilization intrude upon the Trail environs in many areas. This is particularly true in heavily developed areas in the Mid-Atlantic Region, where a relatively narrow corridor of land protects the Trail. For example, in 2004, a 400,000-square foot commercial warehouse was constructed immediately adjacent to the Appalachian Trail in the Cumberland Valley of Pennsylvania, converting a view of woodlands and farm fields to a view of a parking lot and the side of a warehouse. Another example is a proposed racetrack that would be located within 2,000 feet of the Appalachian Trail in east-central Pennsylvania. If built, the facility would change a comparatively remote woodland setting for the Trail into a near-urban environment. While some local governmental agencies are well aware of the Trail and make land use decisions that consider Trail values, others do not.

Current Cultural Resource Management Programs

The Appalachian Trail passes through many places that have well-established cultural resource protection and interpretation programs like Harpers Ferry National Historical Park and Pine Grove Furnace State Park. Each National Forest and National Park crossed by the Appalachian Trail has an established cultural resource management program, as do many of the state park units for parks with a cultural emphasis.

For much of the Trail, however, management programs for cultural resources are few and far between, particularly on recently acquired Appalachian Trail Park Office lands. On these Appalachian Trail Park Office lands, cultural resource management programs

and projects are carried out by the Environmental Protection Specialist as an ancillary duty, with significant project-level assistance and expertise provided by the NPS Northeast Regional Office, the NPS Washington Office, the Appalachian Trail Conservancy, and other federal, state, and non-governmental organization partners. This team has completed the following programs and major projects in the past five years:

- *Cultural Resource Overview and Assessment of the Appalachian Trail in Pennsylvania*, D. Snow and S. White, The Pennsylvania State University Department of Anthropology (1999; updated 2002)
- *Historic Context for the Appalachian National Scenic Trail*, R. Grumet, National Park Service Northeast Regional Office (2002)
- *Appalachian Trail: Status of Cultural Resources*, R. Grumet, National Park Service Northeast Regional Office (2002)
- *A Gap in Time: Context, Archaeological Inventory, and Management Recommendations for the Fox Gap Section of the South Mountain Battlefield*, J. Baker, Indiana University of Pennsylvania (2003)
- Cultural Resource Survey of the Appalachian Trail in Connecticut, N. Bellantoni, K. Keegan, W. Keegan (2004)
- Cultural Resource Training Program for Appalachian Trail Volunteers in the Mid-Atlantic Region, J. Barnes (2004)
- *An Archaeological Assessment of the Brown Mountain Community*, J. Barnes (2005 – 06)
- *Methodology for Inventorying Cultural Landscapes of the Appalachian Trail (draft)*, Margie Coffin Brown, Maciej Konieczny (2006)

The cultural resource context for the Appalachian National Scenic Trail, a summary of applicable laws and policies affecting cultural resources, and an overview of cultural resource studies that have been conducted on Appalachian Trail lands are provided in two documents prepared by Dr. Robert Grumet of the NPS Northeast Regional Office, titled *Appalachian National Scenic Trail Historic Contexts* (2002) and *Appalachian Trail: Status of Cultural Resources* (2002).

The cultural resource surveys in Pennsylvania and Connecticut contain data on resource location, significance, condition, and threats for approximately 450 Archaeological Site Management Information System (ASMIS) records.

In addition, the Appalachian Trail Park Office conducts thorough compliance reviews for all project-level undertakings on Appalachian Trail Park Office lands and consults with the appropriate State Preservation Office in accordance with Section 106 of the National Historic Preservation Act. Surveys are conducted by qualified archaeologists, historians, and other cultural resource specialists as appropriate, and Forms for Assessment of Actions Having an Effect on Cultural Resources are prepared for each project, circulated

for review and approval by the appropriate specialists listed on the Appalachian Trail Cultural Resource Management Roster, signed by the Park Manager, forwarded to the appropriate State Preservation Office, and kept on file as part of the administrative record. Typically, between ten and 20 federal actions (distributed among eight to ten states) of small scope and area of potential effect are processed each year. The combined area affected by these proposed actions and surveys is typically less than five acres per year.

However, significant needs remain in every aspect of cultural resource management to adequately protect, manage, and interpret cultural resources along the Appalachian National Scenic Trail. Table III.I.1 below describes the current status of cultural resource documentation:

Table III.I.1 Status of Cultural Resource Documentation for the Appalachian National Scenic Trail

Historic Context for the Appalachian Trail	completed 2002
Park Administrative History	not done*
Historic Resource Survey	not done
Archaeological Overview and Assessment	in progress
Cultural Landscape Inventory	In progress
Cultural Landscape Reports	not done
List of Classified Structures	not done
Museum Catalog Records for the National Catalog	not done
Ehtnographic Overview and Assessment	not done
National Historical Landmark and National Register identification and documentation	completed only for specific sites
Section 106 compliance	completed for all projects
Curation agreement	done**

*Archival records on the design and construction of the Appalachian Trail are maintained and catalogued by the Appalachian Trail Conservancy

**An arrangement currently exists with the NPS National Capitol Region Museum Resource Center for curation of artifacts and objects located during archaeological surveys on the Appalachian Trail

Cultural Resource Management Needs

The Appalachian Trail Park Office and the Appalachian Trail Conservancy need to develop Trail-wide resource management programs (such as conducting systematic state-by-state inventories of cultural resources along the entire Appalachian Trail or a Cultural Landscape Inventory for the Appalachian Trail), as well as site-specific cultural resource management programs and projects on lands administered by the Appalachian Trail Park Office. The following program and project needs have been identified:

(a) Comprehensive data on the location, condition, and significance of cultural resources along the Trail is not available. The primary shortcoming facing managers of cultural resources on the Appalachian National Scenic Trail is the lack of systematic, comprehensive inventory data on a Trail-wide scale. With a few notable exceptions (the cultural resource inventories in Pennsylvania and Connecticut, and several other studies that have been conducted by other agencies or volunteers using different methodologies), the Appalachian Trail Park Office has only limited and sporadic data on archaeological resources derived from project specific surveys on Appalachian Trail Park Office lands. One of the primary needs for Trail managers is to conduct similar inventories in the remaining 12 Trail states from Maine to Georgia, so that managers can make informed decisions and establish protection priorities for cultural resources. Although the Appalachian Trail Park Office and the Appalachian Trail Conservancy initiated a program in 1999 to obtain consistent, comprehensive data about cultural resources along the Trail, only two inventories have been completed and funding for additional inventories has been difficult to obtain.

(b) National Register nominations need to be undertaken for a number of significant cultural resources, including the Appalachian Trail itself.

Two National Historic Landmarks and 19 National Register of Historic Places properties have been identified along the Appalachian National Scenic Trail corridor. None of these sites, with the exception of portions of the Trail located within the Boiling Springs Historic District and the Falls Village District, are located on lands administered by the NPS Appalachian Trail Park Office. However, perhaps hundreds of potentially eligible sites along the Trail – from the site of the last stand of Shay's Rebellion to several prehistoric rock shelters in central Virginia – exist and await National Register nomination.

In addition, there is little question that the Appalachian Trail is eligible for the National Register of Historic Places. Benton MacKaye, a regional planner and visionary of the early twentieth century, articulated his vision for the Trail in 1921. The Appalachian Trail Conservancy has guided development and promotion of the Trail since 1925. The Appalachian Trail, which is heralded as one of the first major acts of regional planning promoting the concept of a linear protective corridor or greenway, was initially completed in 1937.

No study of the potential eligibility of the entire Appalachian Trail has ever been conducted. Remarkably, only one section of the Appalachian Trail – in northern New Jersey – has been nominated to the National Register of Historic Places. However, even that nomination is somewhat questionable. Despite several attempts, no documentation has ever been found that supports the nomination other than the nomination form itself. Further, the nomination form identifies the location of the

Appalachian Trail at its former location, along a county road, instead of in its current location within a protected corridor.

(c) Section 106 surveys need to be done for Trail-management projects in a timely manner. Until 2003, the NPS Valley Forge Center for Cultural Resources provided the majority of available services for conducting Section 106 compliance. Harpers Ferry National Historical Park also contributed services. However, since 2003, the Center was unable to assist in review of Trail-management projects. The Appalachian Trail Park Office has obtained the services of Harpers Ferry National Historical Park staff and private contractors on an as-needed basis, but there is little assurance that these arrangements will continue. Funding for an archaeologist is needed to conduct Section 106 clearances for approximately six to 10 structure-removal projects per year. Funding also is needed for a historian or architectural historian (or funds to contract for the regular services of an historian/architectural historian) to conduct Section 106 clearances for approximately six to 10 structure-removal Trail projects per year. Although the Appalachian Trail's Cultural Resource Management Section 106 Advisory Roster is currently fully staffed, it will need to be maintained over time.

(d) Cultural resource data needs to be stored, managed, and protected in GIS, as well as entered into NPS cultural resource databases. Existing data that has been obtained through state-by-state cultural resource inventories, Section 106 reviews, and other projects needs to be collected and entered into a the NPS Archaeological Site Management Information System (ASMIS). In addition to entering the data that currently exists on these 450 records, a data entry specialist could enter data on new records as additional studies are conducted. More importantly, a GIS is needed to provide a spatial reference for all cultural resource data.

(e) A Cultural Landscape Inventory (CLI) needs to be conducted to provide a comprehensive approach to guide management decisions regarding historical documentation, analysis of existing conditions, and treatment alternatives. A CLI would provide baseline information for cultural landscapes along the Trail, including location, resource identification, historical development, landscape characteristics and features, and management. The CLI database structure is designed to address landscapes of varying scale and physical complexity. Since the Appalachian Trail is an aggregation of land ownerships, the CLI would be entered into the NPS Servicewide database for those areas where NPS has or plans to acquire legal interest. To be consistent and comprehensive for the entire Trail, however, the CLI methodology can be applied to the entire Trail. Ideally, baseline cultural landscape database information would be linked to a GIS map for the entire Trail. An initial survey could focus on baseline information for landscapes, while more in-depth inventories could be prioritized for component landscapes and features.

(f) A List of Classified Structures needs to be prepared. Although few incidentally

acquired structures along the Trail appear likely to have historic significance, a number of Appalachian Trail shelters constructed by Trail clubs or the Civilian Conservation Corps in the early days of the Appalachian Trail project are likely to be historically significant. A study of these structures needs to be conducted to provide managers with baseline data on the location, description, and historical significance of historic structures that have historical, architectural, or engineering significance.

(g) Ethnographic data does not exist. An ethnographic study or an ethnographic landscape study needs to be prepared to identify significant associations with cultures and, if appropriate, identify landscape features of significance to those cultures.

(h) Intensive surveys need to be conducted at a number of sites, particularly at sites that are threatened by natural or human factors. More than 400 archaeological sites listed in the Connecticut and Pennsylvania inventories alone require further field investigation. While most of these sites are not threatened by any imminent proposed development, the Fox Gap Site of the Battle of South Mountain, the Ring Quarry Prehistoric Mining District, the Canopus Hill Inoculation Station, and dozens of other sites need further investigation before critical data is lost or destroyed.

(i) HABS/HAER drawings or other documentation needs to be conducted on a number of Appalachian Trail-related structures, including several Adirondack-style shelters built by the CCC. An inventory of Trail shelters prepared by a volunteer in 2003 identified 93 Trail shelters along the Appalachian Trail that the Civilian Conservation Corps constructed or reconstructed in the 1930s and early 1940s. Although the Trail has been relocated away from some of these shelters and many other shelters have been removed or abandoned, several dozen still remain. Most of these have been extensively renovated or rebuilt by Appalachian Trail-maintaining clubs as part of their ongoing maintenance of the Appalachian Trail. Some, however, are relatively unmodified. In 1998, the Appalachian Trail Park Office and the NPS Northeast Regional Office conducted a comprehensive photo-documentation project for the Piazza Rock Shelter in west-central Maine, which needed replacement due to environmental concerns. In 2003, the Appalachian Trail Park Office and Appalachian Trail Conservancy facilitated the production of HABS/HAER drawings for the Rocky Run Shelter, a shelter located on Maryland Department of Natural Resources lands that is currently being restored by the Potomac Appalachian Trail Club under a grant from Preservation Maryland.

Approximately 143 structures that were acquired as part of the protection program for the Appalachian Trail still remain on Appalachian Trail Park Office lands. The vast majority of these structures are residential buildings, garages, outbuildings, swimming pools, and farm buildings. At least 139 of these incidentally-acquired structures, which have no connection to the Appalachian Trail and which are not needed for Trail management, are slated for removal. Prior to removal, a review is

conducted to evaluate each structure for its potential significance in accordance with Section 106 of the National Historic Preservation Act. To date, no structures with any historical significance have been identified that will be removed; however, should any be identified in the future, HABS/HAER drawings or other appropriate documentation will be needed.

(j) Interpretation of cultural resources along the Trail needs to be coordinated. Since its inception in 1925, the Appalachian Trail Conservancy – in concert with its Trail-maintaining clubs – has provided visitors to the Trail with guidebooks, maps, and a vast array of other information about the Appalachian Trail. Until recently, ATC's guidebooks provided only general, summary information about cultural resources along the Trail, as well as locational information to specific locations by mileage reference. In 2001, ATC began using a new format in its guidebooks that provides more detailed interpretive narratives about individual scenic, natural, and cultural features of the Trail. ATC and its affiliated Trail clubs have indicated a strong desire to work with the Appalachian Trail Park Office in interpreting cultural features that have been identified through the cultural resource inventories, where interpretation is appropriate. Although much of this effort is volunteer-based, additional resources are needed to assist volunteers in preparing interpretive themes and information.

(k) Visitors should be provided with opportunities to become informed and educated about the historic significance of the Appalachian Trail, the landscape crossed by the Trail, and the historic role of the Appalachian Trail Conservancy and its Trail-maintaining clubs in creating and preserving the Trail. The vast majority of hikers on the Appalachian Trail and the vast majority of the public know little or nothing about the history of the Trail itself, or the critical roles that the Appalachian Trail Conservancy and its member clubs have played in its development, protection, and management. Additional interpretive staff is needed to assist volunteers in developing interpretive measures to enhance the public's experience and appreciation for the Trail.

(l) An agreement for curation and archival storage of museum artifacts obtained during surveys of Appalachian Trail Park Office lands has not been established. Although the National Park Service's Museum Resource Center in Landover, Maryland, has accepted a limited number of archaeological resources from the site of the Battle of South Mountain at Fox's Gap for curation and storage, no central archive or repository for artifacts removed from Appalachian Trail Park Office lands currently exists. The Appalachian Trail Park Office needs to negotiate with the Museum Resource Center or another facility for additional storage of museum objects.

(m) The Appalachian Trail Conservancy currently stores archival records pertaining to the development of the Appalachian Trail in its headquarters office in Harpers Ferry, West Virginia. The storage area is not suited for permanent document storage. A more appropriate, climate-controlled facility and an archivist are needed to

catalogue, organize, digitize, and preserve archival records.

(n) Cultural resource management programs need to be integrated with ongoing Trail-management and natural resource management programs. Cultural and natural resources are often managed independently, instead of interdependently. A coordinated approach is needed to ensure that all resources are managed with an awareness and appreciation for other resources.

(o) Field personnel are needed to identify and process ARPA cases to provide adequate protection for cultural resources, deter vandalism, and prosecute ARPA violations. The Appalachian Trail Conservancy has increased its management presence along the Trail significantly through its Ridgerunner and Caretaker Program and the Appalachian Trail Park Office has added an additional law enforcement ranger. However, the sheer expanse of the Appalachian Trail land base makes it exceedingly difficult to monitor or respond to reports of vandalism of cultural features. Personnel and funding shortfalls present additional problems in the protection of remote areas from resource vandalism and destruction. Funds are needed to pursue existing ARPA violations and deter new ones. Funds also are needed to develop a cadre of trained volunteer cultural resource monitors that are able to recognize signs of cultural resource looting and report incidents to law enforcement personnel.

(p) Educational and interpretive programs are needed to ensure that visitors are aware of and respectful of cultural resources along the Trail. Interpretive media are needed to enhance vistors' knowledge and understanding of significant cultural resources on Appalachian Trail lands. ATC guidebooks in particular could be used to highlight significant cultural features and elaborate on historic events and cultural landscapes.

CHAPTER IV: A COMPREHENSIVE PROGRAM FOR MANAGEMENT OF RESOURCES ON THE APPALACHIAN TRAIL

A. Introduction

The Appalachian National Scenic Trail is like no other place on earth. There are few, if any, national parks or national forests that pass through five major geologic provinces, eight ecological sections, and 20 ecological subsections, or that have a latitudinal differential of thousands of miles, or a range of vegetation that extends from northern hardwood, spruce-fir and alpine krummholz to southern Appalachian oak forest and high-mountain southern balds. Certainly, few parks or forests contain more than 2,100 occurrences of rare plant and animal species and rare or exemplary natural communities, 4,500 acres of open areas and mountain vistas, nine National Natural Landmarks, 19 properties that are listed on the National Register of Historic Places, hundreds of additional sites that are eligible for the National Register, thousands of other cultural resource sites, and five Class I airsheds. The Appalachian Trail, in its traverse of the Appalachian Mountain chain, contains all these resources and much more.

In fact, the Appalachian Trail contains so many outstanding natural, cultural, and scenic features that it sometimes seems impossible to protect and manage them all. Fortunately, the job does not fall to any one agency or organization. The A.T. Cooperative Management System, which is described in Chapter I, includes more than 100 public and private partners. These agencies and organizations carry out many of the tasks that are needed to preserve the Appalachian Trail's remarkable array of natural and cultural resources.

Nevertheless, despite the contributions of these agencies and organizations, a huge job still remains to be done. The responsibility for fulfilling these remaining responsibilities falls to the Appalachian Trail Conservancy and the Appalachian Trail Park Office. Thousands of individual actions need to be undertaken to protect rare plant or animal species from being lost or destroyed. Open areas need to be maintained on a regular basis, or they will be lost to succession. Air quality needs to be monitored, and decisions need to be made to protect hikers and vegetation from adverse effects of poor air quality. Water quality should be monitored, and data should be analyzed and conveyed back to managers in the field. Cultural resources need to be identified along the entire length of the Trail, so that limited funds and volunteer and staff time can be directed to preserve the most significant and most vulnerable. The Trail itself needs to be studied to determine whether it – or at least sections of it – are eligible for the National Register of Historic Places.

Why protect the Trail's natural and cultural resources? Well, it's not just that these resources need to be protected to comply with federal and state laws and policies. These resources represent our nation's natural or cultural heritage, and if they can't be preserved in a protected landscape like the Appalachian Trail, they probably can't be preserved anywhere. Their presence also enhances the experience of the millions of people who visit, hike, and enjoy the Appalachian Trail, and the knowledge and appreciation of people who don't visit the Trail but still value its existence. But there's another reason to monitor, manage and protect the Trail's resources that may be more important than anything else. The Appalachian Trail – by virtue of its geographic expanse, its location on the heights of land across the Appalachian Mountain range, its icon status, and its cornucopia of natural and cultural resources has the unique potential to provide scientists, researchers, visitors, educators, and the general public with a better understanding of the health of the environment throughout the Appalachian Mountains and the Eastern United States.

B. Resource Management Strategies

The intent of this resource management plan is to develop a strategy that provides some over-arching direction to the Appalachian Trail Conservancy and the Appalachian Trail Park Office, so that their managers, staff, and volunteers can make objective decisions and implement appropriate actions to protect, preserve, and interpret significant natural and cultural resources along the Appalachian Trail. The following discussion outlines the Conservation Strategy of the Appalachian Trail Conservancy and the resource management strategy of the Appalachian Trail Park Office.

C. Resource Management Program Priorities

In February 2005, Appalachian Trail Conservancy and Appalachian Trail Park Office staff participated in a series of three priority-setting exercises designed to identify which resource management programs and projects were most important. Trail managers identified 38 programs and projects that could be implemented to respond to the resource management threats, issues, and program needs identified in Chapters I, II, and III. The rationales that were given for establishing priorities varied considerably, but three or four themes dominated reviewers' priorities. In general, people who participated in the priority-setting process felt that priority should be given to:

- programs and projects that respond effectively to direct and immediate threats to Trail resources (*i.e.*, the "triage" approach)
- data management, which is an essential function that supports all resource management programs

- ongoing resource management programs and projects that have been initiated but that are not fully operational
- inventories of resources and threats to those resources, so that decisions about programs could be made based on a broader understanding of the relative importance of various resources and threats to those resources
- programs that leverage new partners and engage new constituents
- programs that engage visitors and volunteers and communicate resource issues and threats to the general public are essential to the protection of Trail values

In the program and project descriptions that follow, salary and benefit costs have been incorporated into the annual and total program and project costs. These costs have been estimated using Federal salary and benefit costs in 2008 dollars (specifically, they have been derived from the Office of Personnel Management Salary Table 2008-DCB).

These estimates reflect the salary costs for carrying out programs and projects using federal employees at the full performance level and maximum step level for the position, plus 30% for benefits. Actual salary and benefit costs may be much lower, particularly if positions are filled within the Appalachian Trail Conservancy instead of the National Park Service. Substantial additional savings also may be realized if volunteers assume greater portions of the roles and responsibilities.

Contract and other direct costs are estimated based on previous contracts for similar projects on the Appalachian Trail or in other National Park units to the greatest extent possible. If this information was not available, estimates are based on the professional judgment of staff.

The Appalachian Trail Park Office has already submitted Operations Formulation System (OFS) statements and Project Management Information System (PMIS) statements for many of the programs and projects listed in this section. Where applicable, the OFS or PMIS statement is noted in the descriptions of these programs and projects.

Table IV.A, Potential Resource Management Programs and Projects on the Appalachian Trail, 2009 - 2019 depicts estimated costs and staff requirements for each program or project. These 32 programs and projects are divided into five major program areas: **cultural resource management**, **natural resource management**, **environmental monitoring**, **GIS development**, and **Trail protection**, and are listed in order of priority. Priorities were established for management programs and projects within each of the program areas, based on policies that guide the National Park Service Appalachian Trail Park Office and the Appalachian Trail Conservancy, and input received from program specialists, members of the scoping teams, Appalachian Trail Conservancy Board and committee members, agency partners, Trail club members, and the general public.

[Note: Please keep in mind as you review this section that this plan is not a strategic plan, a land use allocation plan, or an implementation plan. It is a programmatic plan that is designed to analyze resource conditions, threats, program capabilities, needs, and priorities for management of resources along the Appalachian Trail.]

Table IV.A, Potential Resource Management Programs and Projects on the Appalachian Trail 2009 - 2019

Program or Project Name	Estimated First Year Cost	Estimated Annual Cost	Estimated Total Cost (Over Ten Years for OFS Requests)	Priority	Potential Start Date
Cultural Resource Programs and Projects					
Development of a Cultural Resource Management Program for the A.T. (OFS)	$126,000.0	$126,000.0	$1,260,000.0	**VH**	**2010**
National Register Nominations for the A.T. and Significant Cultural Resources (PMIS)	$60,000.0	$60,000.0	$240,000.0	**H**	**2009**
List of Classified Structures for A.T. Park Office Lands (PMIS)	$60,000.0	$60,000.0	$180,000.0	**M**	**2013**
Survey and Rehabilitation of CCC-Constructed Shelters on the A.T. (PMIS)	$36,000.0	$36,000.0	$144,000.0	**L**	**>2019**
Natural Resource Programs and Projects					
Appalachian Trail Mega-Transect Program (OFS)	$238,000.0	$238,000.0	$2,380,000.0	**VH**	**2009**
Monitor and Manage Rare, Threatened, and Endangered Species on Appalachian Trail Lands (OFS)	$206,400.0	$206,400.0	$2,006,400.0	**M**	**2011**
Inventory Appalachian Trail Lands for Exotic Plants and Insect Pests (PMIS)	$28,800.0	$28,800.0	$28,000.0	**M**	**2011**
Control Exotic Plants on A.T. Lands (PMIS)	$108,000.0	$108,000.0	$972,000.0	**H**	**2010**
Trail Protection					
Boundary Maintenance Program for the A.T. (OFS)	$160,000.0	$160,000.0	$1,600,000.0	**H**	**2009**
Geographic Information System (GIS) and Information Management					
Appalachian Trail Data Management Program (OFS)	$150,000.0	$150,000.0	$1,500,000.0	**VH**	**2010**
A.T. Corridor Mapping Project (PMIS)	$37,500.0	$37,500.0	$150,000.0	**H**	**2010**
Total, all potential resource management programs and projects, 2009 to 2019					

** although these programs benefit the Trail, funding for these programs is allocated to other National Park Service offices

Chapter IV.B

Program and Project Statements for Cultural Resources

The following statements describe programs and projects that could be implemented or enhanced to manage cultural resources on the Appalachian National Scenic Trail. See *Table IV.A.1, Potential Resource Management Programs and Projects on the Appalachian Trail 2008 – 2015*, for a comparative summary of all programs and projects.

1. Development of a Cultural Resource Management Program for the Appalachian Trail: Protect and Interpret Cultural Resources Through Partnerships

OFS Number: currently a component of 11549A

Estimated Cost: $126,000 annually

Cost Break-out: $102,000 for a cultural resource specialist; $12,000 for administrative costs; and $12,000 for GIS support.

Full-time staff required (cost included in estimated cost above): 1.0 full time employee (cultural resource specialist)

Program Description: This funding would permit the Appalachian Trail Park Office and the Appalachian Trail Conservancy to develop a cultural resource program for the Appalachian National Scenic Trail. The funding would be used to work with local communities, historical societies, educational institutions, and Trail partner organizations to protect and interpret the vast wealth of historic resources that exist along the Appalachian Trail. The requested full-time employee (FTE) may be shared with another park unit or used to fund services provided by non-profit management partners. The incumbent would serve as a program coordinator for all cultural resource programs on the Trail. Duties would include serving Section 106 coordinator; coordinating work on cultural landscape inventories, a list of classified structures, and cultural resource overview and assessments; assisting in resource protection activities; and managing programs and projects to protect, restore, and interpret significant cultural features and sites on the Appalachian Trail.

Justification: Currently, the Trail does not have any staff that are dedicated to cultural resource management. Cultural resource programs and projects are handled by the environmental protection specialist as an ancillary duty. Identified needs are extraordinary. In 2004, a study of archaeological resources along the 55 miles of the Appalachian Trail in Connecticut alone identified 382 archaeological resource sites and features, dozens of which are likely to be

eligible for the National Register of Historic Places. Cultural resource management needs include the need to:

- identify, locate, manage, and protect cultural resource sites, cultural landscapes, and historic structures along the Appalachian Trail in 14 states;
- educate management partners, the public, and communities along the Trail about the value of cultural resources and the rich history of the Appalachian Trail itself, and foster a sense of pride and protective ownership for these resources;
- enrich the experiences of hikers, visitors, tourists, and members of the communities along the Trail; implement projects to stabilize and protect the most vulnerable cultural resources; and
- and conduct Section 106 clearances in a timely manner.

2. National Register Nominations for the A.T. and Significant Cultural Resources

PMIS Number: new

Estimated Cost: $240,000

Cost Break-out: $60,000 per year for four years, from FY 2009 to FY2013

Full-time staff required: 0.0 employees (program would be administered by the Environmental Protection Specialist or a Cultural Resource Specialist)

Project Description: The Appalachian Trail Park Office and the Appalachian Trail Conservancy would hire a contractor to evaluate the Appalachian National Scenic Trail and up to a dozen other likely candidate sites for their potential eligibility for the National Register of Historic Places. The contractor also would be asked to proceed with nominating those sites that qualified for the Register. In addition to the Appalachian Trail itself, the contractor would be required to analyze existing inventory data and select up to twelve other sites for evaluation, based on likely significance, condition, land ownership, geography, and other criteria and constraints. The contractor would then follow the prescribed National Register evaluation and nomination process and submit each nomination, as appropriate, to the state historic preservation offices and the Advisory Council on Historic Preservation.

Justification: According to cultural resource specialists, the Appalachian National Scenic Trail without question is eligible for the National Register of Historic Places. However, at this time the only section of the Trail that has been determined to be eligible is a short section of the Appalachian Trail in New Jersey. National Register status would ensure that the cultural value of the Appalachian Trail is recognized, and that the Trail receives some degree of protection from activities that would adversely affect that cultural significance.

3. List of Classified Structures for Appalachian Trail Park Office Lands

OFS Number: currently a component of 11549A

Estimated Cost: $180,000

Cost Break-out: $60,000 annually for contracts, for three years (2009, 2010, and 2011)

Full-time staff required: 0.0 full-time staff (program would be administered by the environmental protection specialist or a cultural resource specialist, working in cooperation with ATC regional staff)

Project Description: This funding would permit the Appalachian Trail Park Office and the Appalachian Trail Conservancy to inventory all historic structures along the Trail, including Trail shelters and incidentally acquired structures. Virtually all of these structures are 19th and 20th century structures. At least 20 of the 95 Appalachian Trail shelters originally constructed by the CCC are still in existence. Further, more than a dozen other shelters constructed by Trail clubs and other organizations (such as the Works Progress Administration) are believed to be historically significant. In addition, at least three incidentally-acquired structures (the Prosper Mountain Ski Tow Cabin in Woodstock, Vermont, the Mid-Atlantic Regional Office in Boiling Springs, Pennsylvania, and the Kegley Farmhouse in southwest Virginia) are being retained by the National Park Service because of their historical significance. Funds would be used to contract an historical architect or architectural historian to:

a) conduct an inventory for all structures (including Trail shelters) on ATPO-administered lands in accordance with established List of Classified Structures procedures;
b) determine the condition, cost, management, treatment, and historical information for all extant structures that qualify for the List of Classified Structures; and
c) develop management recommendations for protection and stabilization of all structures with historic significance on ATPO-administered lands; and
d) enter data into the List of Classified Structures Database

4. Survey and Rehabilitation of CCC-Constructed Shelters and Other Facilities along the Appalachian Trail

PMIS Number: new

Estimated Cost: $144,000

Cost Breakout: $36,000 per year for four years (from FY 2009 to FY 2012, following the completion of the List of Classified Structures)

Full-time staff required: 0.0 employees (project would be administered by the environmental protection specialist or a cultural resource specialist)

Project Description: The Appalachian Trail Park Office and the Appalachian Trail Conservancy would use these funds to hire a contractor to evaluate and document the condition of all CCC-constructed facilities along the Appalachian National Scenic Trail. The contractor would be required to develop detailed rehabilitation plans and materials lists. Follow-up rehabilitation work would be carried out by the responsible Appalachian Trail-maintaining club, with assistance as necessary from the Appalachian Trail Conservancy's Trail Crew Program.

Justification: At least 20 of the 95 Appalachian Trail shelters originally constructed by the CCC are still in existence. Many are believed to be in sub-standard condition, and some are slated for removal or replacement. This program would ensure that CCC-built structures are retained and rehabilitated if possible, or that appropriate HABS/HAER documentation procedures are followed if structures are slated for removal or replacement.

Chapter IV.C

Program and Project Statements for Natural Resources

The following statements describe programs and projects that could be implemented or enhanced to manage natural resources on the Appalachian National Scenic Trail. See *Table IV.A.1, Potential Resource Management Programs and Projects on the Appalachian Trail 2009 – 2019*, for a comparative summary of all programs and projects.

5. The Appalachian Trail Mega-Transect

OFS Number: 26207A

Estimated Cost: $238,000 annually

Cost Breakout: $178,000 annually for contract services; $35,000 annually for report preparation, public outreach, volunteer coordination; $25,000 for GIS and data management support.

Full-time staff required: 0

Program Description:
Scientists with the NPS, the USGS, Smithsonian, educational institutions, and non-profit conservation organizations held a symposium in 2006 to propose the Appalachian Trail (A.T.) as an indicator of the environmental health of the Eastern U.S. With significant planning in 2007, the Appalachian National Scenic Trail (APPA) and its partners (including the Appalachian Trail Conservancy and the NPS Inventory and Monitoring Program) are now prepared to establish the Appalachian Trail Environmental MEGA-Transect program to monitor, understand and respond to changes in the environment; engage partners, communities and visitors in shared stewardship of the Trail and its wealth of natural resources; increase the number of volunteers involved with the Trail; and tell the story of the health of the A.T. and surrounding lands to visitors, neighbors, and the American public. Funding would allow APPA and Appalachian Trail Conservancy (ATC) to hire an overall coordinator for the Appalachian Trail Environmental MEGA-Transect, implement programs to monitor air, water, and biological resources along the Trail, and provide for data management and GIS support.

Supporting Information:

The world-renowned Appalachian National Scenic Trail is uniquely positioned to serve as a beacon for engaging thousands of citizens and students in natural resource stewardship of the Appalachian Trail and understanding the environmental threats that face our national parks and forests. The 2,175-mile Trail is protected by an unbroken thread of 250,000 acres of public land, spread out on a long traverse along the crest of the Appalachian Mountains through 14 states, 6 other national park units, 8 national forests, 1 national wildlife refuge, and multiple state lands from Maine to Georgia (ME-GA). These 250,000 acres hold one of the greatest assemblages of temperate zone species in the world, with more than 2,000 occurrences of rare plant and animal species. This thread of public land also traverses the headwaters of many of the major rivers and streams in the eastern United States; crosses the summits of most of the highest mountains in the eastern United States; and stands downwind of many of the major air-polluting sources and upwind of many of the most densely populated areas in the eastern United States. Its resources are threatened by the same activities that threaten many of our national parks: air pollution, water pollution, invasive species, off-road vehicles, adjacent land development, and climate change. The Trail has a culture of cooperation and partnership, and is known to millions as one of the last great places in America. The Appalachian Trail's history is a dramatic story of successful civic engagement and stewardship, involving tens of thousands of American citizens in a grassroots protection effort dating back more than 85 years and continuing to this day.

National Geographic Explorer in Residence J. Michael Fay coined the term "mega-transect" in 1999 as he surveyed resources of the Congo river basin of Africa during a 2,000 mile trek. The three-day symposium for 70 scientists, land managers, and policy makers to explore the potential for the Appalachian Trail to serve as an "environmental mega-transect", held in November 2006, was a huge success. Fay expressed his support for the project, as did most of the organizations represented at the Symposium. The Symposium and the concept of an "Appalachian Trail Environmental MEGA-Transect" received nation- and world-wide attention. In addition, the participants created an entire framework for inter-agency collaboration and citizen and volunteer involvement in the project (For more information on the Symposium, please see: http://www.appalachiantrail.org/site/c.jkLXJ8MQKtH/b.2264999/k.9C7C/AT_MegaTransect.htm). For all of the above reasons, we believe that the Appalachian Trail Environmental MEGA-Transect Program exemplifies the five overarching goals guiding the Centennial Challenge including: Lead America in preserving and restoring treasured resources; Demonstrate environmental leadership to the nation; Offer superior recreational experiences where visitors explore and enjoy nature and the great outdoors; Foster exceptional learning opportunities connecting people to parks, especially children and seniors; and Achieve

management and partnership excellence to match the magnificence of the treasures entrusted to us.

Further, this program supports the specific performance goals of the Centennial Challenge by improving the natural resources as measured by vital signs inventories, increasing the volunteer hours, and attracting more visitors, volunteers, and supporters. This Program also already has the firm commitment of our primary partner, the Appalachian Trail Conservancy, who is willing and able to contribute to the success of the Centennial Challenge. Finally, the Centennial Challenge seeks imaginative, innovative, and collaborative programs that benefit multiple parks and contribute to national initiative all things that the AT Environmental MEGA-Transect program will accomplish.

The Appalachian Trail Environmental MEGA-Transect will encourage citizen science involvement in understanding environmental change, managing natural resources, fostering an appreciation for conservation, and tell the story of the health of the Appalachian Trail and surrounding lands to visitors, neighbors, and the American public. The A.T. Environmental MEGA-Transect will coordinate a diverse collection of programs along the length of the 2,175-mile Appalachian Trail from ME to GA, analyze their results, and convey significant findings to the public. Federal and state agencies, local environmental organizations and citizens groups, research universities, and schools and youth groups will all contribute valuable information about the Appalachian Trail environment through this project.

Protocols for specific A.T. Environmental MEGA-Transect monitoring programs will be developed with a special emphasis on using citizen science and volunteers. Within the first year, a water quality monitoring program will be designed, reviewed, approved, and implemented. The program, which will involve approximately 800 volunteers, will be modeled upon the methodology used in World Water Monitoring Day. In addition, a new natural heritage site monitoring program involving approximately 100 trained volunteers will be implemented to assess the health of rare plant species occurrences at more than 100 sites along the Appalachian Trail. Thirdly, an expanded wildlife monitoring program involving approximately 120 volunteers will be implemented, using protocols developed in cooperation with the Smithsonian Institute. Finally, an air quality monitoring program also will be designed and approved, which is likely to involve another 100 to 200 volunteers. All four monitoring initiatives will be fully functional at the completion of the pilot program. Coordination with the National Park Service's Inventory and Monitoring Program will ensure that monitoring protocols and results are scientifically valid and measurable.

In addition to highlighting the importance of the environment of the Trail to the Appalachian Trail community's 1,000,000+ supporters, 100,000+ members, and 5,000-plus active volunteers, the Appalachian Trail Environmental MEGA-

Transect will reach and involve new groups and individuals in stewardship of the Appalachian Trail and promote volunteerism by building a strong sense of stewardship of the Trail and its bountiful natural resources. The Appalachian Trail Conservancy, the National Park Service, and other partners will use the A.T. Environmental MEGA-Transect to emphasize the messages of conservation and stewardship in publications, newsletters, and electronic media.

6. Monitor and Manage Rare, Threatened, and Endangered Species on Appalachian Trail Lands

OFS Number: 13270A (modified)

Estimated Cost: $206,400

Cost Breakout: $187,800 for salary and benefits and $18,600 for GIS and data management support

Full-time staff required: 2.0 full time employees (one biologist, one coordinator)

Program Description: Funding would allow for monitoring of some rare, threatened and endangered species by NPS or cooperator resource biologists and would allow for greatly increased implementation of many of the more than 2,000 management actions identified in the A.T. natural heritage inventories. Completed natural heritage inventories for the Appalachian Trail corridor in 14 states have identified more than 1,700 occurrences of more than 300 rare, threatened, and endangered (RTE) plant and animal species within the A.T. corridor. Approximately 90% of these occurrences are of RTE plants. The RTE species occurrences have been prioritized so that monitoring and implementation of management actions can begin on the rarest and most threatened occurrences first. Funding would also allow for implementation of many of the recommendations of the recently completed natural heritage program review. More time could be given to supporting the natural heritage site monitoring program of A.T. volunteers. Additional staff would be able to prepare and administer contracts to inventory RTE and other vertebrate species in A.T. states that have not yet been inventoried. Recommended additional staff would be one botanist and one zoologist or one biologist and one monitoring program coordinator, who could concentrate on expanding the natural heritage monitoring program and then implementation of management actions. These positions would also allow increased time for coordination with natural resource professionals and land management staff in other federal and state agencies that manage A.T. land.

Justification: The more than 1,700 occurrences of RTE plant and animal species are believed to be the highest number of state and federal RTE species of any NPS unit nationwide. More than 300 of these occurrences are of globally rare species. Among the globally rare species are the Peaks of Otter salamander, Weller's salamander, Virginia northern flying squirrel, spruce-fir moss spider, Blue Ridge amphipod, spreading avens, Gray's lily, Roan Mountain bluet, glade spurge, variable sedge, Fraser fir, and rock gnome lichen. Some of these RTE occurrences within the A.T. corridor are known from less than five locations worldwide, and many other RTE occurrences are known from less than 20 locations worldwide. Approximately 15 of the occurrences are of federally endangered and threatened species, six of which are plants and nine of which are animals. There are more than 2,000 management actions that have been recommended to protect these 1700 RTE species occurrences. More than 300 of the RTE plant and animal occurrences are on NPS A.T. land, and the remaining 1,400 occurrences are on the A.T. corridor land of other federal and state agencies. Some of these RTE species occurrences will likely become extirpated if management actions are not taken to protect them. A few occurrences of RTE species within the A.T. corridor are already believed to have become locally extirpated. The addition of a zoologist or wildlife biologist to the A.T. resource management staff will allow for the study, monitoring and management of RTE vertebrates and invertebrates, filling a need that is currently being unmet.

7. Exotic Species and Integrated Pest Management Program

OFS Number: new program

Estimated Cost: $114,000 annually

Cost Breakout: $102,000 annually for a biologist; $12,000 annually for GIS and data management support.

Full-time staff required: 1 full time employee (biologist)

Program Description: A specialist in exotic species and integrated pest management (IPM) is needed to manage the growing exotic species program for the Appalachian National Scenic Trail in all 14 states through which the A.T. passes. Primary duties of this position would be to:

1) coordinate with four existing NPS Exotic Plant Control Teams (EPMTs) to have them control exotic plants in a few locations on ATPO land each year;

2) direct inventories of exotic species and insect pests along the A.T. corridor in all 14 A.T. states;
3) prioritize sites for exotic species treatment;
4) seek funding to establish an EPMT specifically for the Appalachian Trail;
5) seek assistance from and coordinate with other organizations such as The Nature Conservancy, the New England Wild Flower Society, and the Southern Appalachian Man and the Biosphere (SAMAB) to control exotic species along the A.T. and to develop a regional perspective on the control of exotics;
6) coordinate with ATC and the Trail clubs to seek and train volunteers to assist in the removal of exotic plants within the A.T. corridor;
7) coordinate with state agencies and other jurisdictions to control gypsy moth and other insect pests;
8) examine the potential to utilize biological means to control the hemlock woolly adelgid and other insect pests;
9) prepare all environmental compliance related to exotic species and integrated pest management actions on Appalachian Trail Park Office lands;
10) manage other IPM issues such as West Nile Virus, rabies, and rodent control; and
11) develop an Integrated Pest Management program for the Appalachian Trail.

Justification: Exotic plants and insect pests are a major threat to RTE species and other biological resources along the Appalachian National Scenic Trail. Though we do not yet have a complete picture of the severity of the threat Trailwide, natural heritage inventories of the Appalachian Trail completed over the past 15 years have documented the presence of both exotic plants and insect pests in many of the states through the Trail passes. In Massachusetts, New Jersey, and New York, exotic plants cover an estimated 1,500 acres within Appalachian Trail natural heritage sites. More than 55 exotic plant species have been documented at more than 40 natural heritage sites along the A.T. corridor, though most of the corridor has not yet been surveyed for exotic plants or insect pests. In a 2002 survey in North Carolina and Tennessee, exotic plants were found at 66 locations along a 400-mile segment of the Trail. The gypsy moth has had a severe impact on biological resources along the A.T. in Virginia. The balsam woolly adelgid has severely impacted the Fraser fir in Virginia, Tennessee, and North Carolina, and the hemlock woolly adelgid has severely impacted A.T. lands in New Jersey and probably in other states as well. Current A.T. natural resource staff have only been able to devote 0.1 FTE to the inventory, monitoring, and management of exotic plants and insect pests along the Appalachian Trail. This amount of time has allowed only for limited exotic plants coordination with the SAMAB program and with four NPS Exotic Plant Management Teams, which have assessed and/or controlled exotic species at four sites Trailwide during the past two years. A full-time biologist dedicated to the inventory, monitoring, and management of exotic plants and insect pests would result in greatly expanded

protection of RTE species and other significant natural resources at a much greater number of sites on A.T. lands. This biologist would also allow for the development of a comprehensive Integrated Pest Management program for the Appalachian Trail.

8. Inventory the Appalachian Trail Corridor for the Presence and Extent of Exotic Plants and Insect Pests

PMIS Number: new project

Estimated Cost: $4,800 (interns) to $28,800 (NPS seasonal employees)

Cost Breakout: An estimated 70% of the cost would be personnel costs, which may be interns, Student Conservation Association employees, or seasonal Appalachian Trail Conference or National Park Service employees. An estimated 30% of the cost would be for transportation and lodging. There might be a relatively small training and equipment cost.

Project Description: This project would hire student interns, Student Conservation Association employees, or seasonal Appalachian Trail Conference or National Park Service employees to survey the Appalachian Trail corridor for the presence of exotic plants, insect pests, and other diseases impacting biological resources within the A.T. corridor. The key states to be inventoried would be those states where there is ATPO land: Virginia, West Virginia, Maryland, Pennsylvania, New York, New Jersey, Connecticut, Massachusetts, and Maine. The primary insect pests and other diseases to be surveyed are: hemlock woolly adelgid, balsam woolly adelgid, gypsy moth, and dogwood anthracnose. The inventory would include GPS locations, acres, and Trail distances of individual exotic species occurrences. The estimated time to complete such a survey would be about twelve months, or four employees for three months each. Because of the intermixed land ownership pattern of land within the A.T. corridor, state land along the A.T. would be included in the inventory. Land in other national parks, such as Shenandoah National Park and Delaware Water Gap National Recreation Area, could be excluded from the survey. The time needed to complete such a survey is based on an intern who documented the presence of exotic plants along 400 miles of the A.T. corridor in North Carolina and Tennessee during a two- to three-month period in 2002. The inventory should occur during the summer months, when the greatest number of plant species can be identified.

Justification: The Appalachian National Scenic Trail currently has a limited knowledge of the presence of exotic plants and insect pests within the A.T. corridor. From what we do know, exotic species are one of the major threats to rare, threatened, and endangered (RTE) species and other biological resources within the Trail corridor. Based on surveys of RTE species in the A.T. corridor during the last 15 years, exotic plants have been noted at more than 40 natural heritage sites in the A.T. corridor. Based on an inventory of RTE plants in New Jersey, New York, and Massachusetts, an estimated 1,500 acres of exotic plants are found within natural heritage sites in these three states. More than 55 different exotic plants have been documented within the A.T. corridor; however, most sections of the corridor have not been surveyed, and no area has been mapped for exotic plants, except in North Carolina and Tennessee. In North Carolina and Tennessee, exotic plants were found at 66 locations along a 400-mile segment of the A.T. corridor. No portion of the A.T. corridor has been surveyed for insect pests and other diseases, though it has been observed that the hemlock woolly adelgid has had a major impact along the Trail in New Jersey and that the gypsy moth has had a major impact along portions of the A.T. in Virginia. An inventory of exotic species is needed to help document this threat to biological resources along the A.T. and to help prioritize areas for exotic species treatment. Documentation of the presence of exotic species might also help to estimate how long treatment would take at individual sites. The inventory would also help fulfill one of the twelve data sets of the NPS Inventory and Monitoring program.

9. Control Exotic Plants on the Appalachian Trail

PMIS Number: 108221 (with major revision)

Estimated Cost: $108,000 a year

Cost Breakout: The estimated cost for an outfitted Student Conservation Association (SCA) team is $96,000-$108,000, though this estimate is not specific to the Appalachian Trail. This estimate would include a vehicle, equipment, travel and lodging costs. Included in this is the personnel cost for staffing a SCA team to control exotic species, estimated at $67,200. This would provide funds for a team leader for six months and four field personnel for three months.

Project Description: This funding would allow for control of exotic species at priority natural heritage sites and other priority locations along the Appalachian Trail where exotic plants threaten rare, threatened, and endangered (RTE) species. RTE species sites and species have been prioritized Trailwide. Exotic plants have been identified at more than 40 Appalachian Trail natural heritage

sites, though some survey work is more than a decade old and exotic species may now threaten many more sites. The presence and extent of exotic species at natural heritage sites in Massachusetts, New Jersey, and New York has been estimated at 1,500 acres. There are probably several thousand additional acres of exotic species at RTE species sites in other A.T. states. It has been estimated that the maximum acreage of exotic species that can be controlled by an Exotic Plant Control team is about 500 acres a year. For this project, control of exotic species would occur solely or primarily on NPS Appalachian Trail land in Virginia, West Virginia, Maryland, Pennsylvania, New Jersey, New York, Connecticut, Massachusetts, and Maine. The control of exotic species would be by chemical or physical removal, though biological control might also be utilized. Appalachian Trail volunteers might be utilized to assist in the physical removal of exotic plants.

Justification: For the past three years, there has been very limited treatment of exotic species on Appalachian Trail lands. The NPS National Capital Region Exotic Plant Management Team (EPMT) has treated exotic species at one natural heritage site in Virginia and one in Pennsylvania. There has also been some physical removal of exotic species by a contract botanist at a handful of natural heritage sites in New Jersey and New York. The existing EPMTs may be able to treat only one or two sites along the A.T. a year.

It is possible that some RTE species will be locally extirpated in the near future due to competition from exotic species. For example, at a natural heritage site along the A.T. in Virginia, a rare trillium (*Trillium cernuum*) has almost been lost from a natural heritage site, probably due to the abundance of exotics at the site. At another natural heritage site in Pennsylvania, the globally rare *Carex polymorpha* (variable sedge) is being reduced while the exotic plant *Microstegium vimineum* (Japanese stilt grass) is increasing in abundance. Funding this project would allow a stepped-up treatment of exotic plants before a RTE species is lost or before an exotic plant(s) becomes too prolific to control.

Chapter IV.D

Program and Project Statements for Trail Protection

The following statements describe programs and projects that could be implemented or enhanced to protect the Appalachian National Scenic Trail. See *Table IV.A.1, Potential Resource Management Programs and Projects on the Appalachian Trail 2009 – 2015*, for a comparative summary of all programs and projects.

10. Establish Comprehensive Boundary Management Program

OFS Number: 28076A

Estimated Cost: $160,000 annually

Cost Breakout: $120,000 for a boundary maintenance; $20,000 volunteer support; $10,000 Land Survey Support; $10,000 GIS and Data Management Support.

Full-time staff required: 0.0 FTE

Description: Funding is requested to establish a sustainable boundary management program for Appalachian NST to ensure the long term protection of the $149M investment in the NPS owned A.T. corridor lands. In addition, $9M has been expended in surveying, marking, and mapping 111,000 acres of NPS lands with 1,373 miles of boundary line in 11 states. Despite an ongoing volunteer effort to maintain the integrity of the lines, currently 80% of the boundary surveys are now more than 10 years old and the original boundary line markings risk being lost to time, vegetative growth, and encroachments from neighboring landowners. A well-marked boundary is critically important to the Appalachian Trail because of its very narrow land base and the increasing development pressures experienced in the densely populated eastern region. This funding would go to directly to supporting the efforts of our partner organization, the Appalachian Trail Conservancy, to recruit, train, and retain volunteers to monitor and maintain the boundary and corridor lands, provide for funding to survey disputed or lost boundary lines, address illegal boundary encroachments, and develop a sustainable GIS-based system for managing a complex lands database.

Justification: The 2,175 mile-long Appalachian National Scenic trail is the nation's longest-skinniest National Park. As a result of the linear nature of this park, the A.T. has more miles of surveyed boundary that Yellowstone National Park. With a corridor of protected lands averaging only 1,000 feet wide, the A.T.

is particularly vulnerable to illegal encroachments from neighboring land owners. Encroachments include timber harvest, dumping, construction of buildings, driveways, pools, patios on NPS lands, deer stands, ATV access, and resource theft. A clearly defined boundary line is the first line of defense against these types of encroachments. With more rare, threatened, and endangered species than any other National Park Service unit, it is imperative that encroachments are minimized to prevent the destruction of these critical resources.

Since 1978 the NPS has embarked on, what has widely been acknowledged, as one of the most complex land acquisition programs in the history of the NPS. To date, more than $149 million has been invested in acquiring a publicly owned and protected corridor for the footpath of the A.T. Further, more than $9 million has been expended to survey these newly acquired lands, set NPS boundary monuments, clear and paint the boundary, and map the location of the land parcels and boundary survey information. It cannot be understated how important it is to maintain these boundary lines in order to protect that significant investment in land and surveys. The cost to resurvey neglected boundary line lost to encroachments or lack of maintenance is extremely high.

Despite ongoing efforts to provide adequate maintenance, it is apparent that at the current rate of clearing and re-painting approximately 80 miles of boundary per year utilizing limited project funding, significant portions of the boundary are at risk of being lost.

A small but dedicated cadre of volunteers provide some support in the maintenance of the boundary line, however as the boundary becomes less apparent and overgrown, it is becoming increasingly difficult for volunteers to provide adequate maintenance. In fact, less than 5% of the more than 200,000 volunteers hours contributed annually to A.T. are devoted to the boundary. Additional resources are necessary to bring the boundary up to a condition that will allow the volunteers to maintain the boundary in a sustainable manner.

In addition to simply maintaining the boundary, much of the effort also involves reaching out to the thousands of neighbors that share the NPS boundary. Successful outreach can enhance neighbor relations and head-off potential issue before they arise. If an encroachment is found, it is necessary to follow-up with the land owner, either informally or through law enforcement efforts, to address any issue. NPS has an obligation to protect its interest in the lands it owns and the boundary maintenance program is a way to proactively provide both a visual boundary and a way to interact with neighbors.

Specifically, this funding will allow the NPS to provide support to our primary partner, the Appalachian Trail Conservancy (ATC) through our existing and long-standing Cooperative Agreement. ATC will be able to enhance its field level staff to provide the additional resources necessary to; increase the number of miles of

boundary maintained each year; recruit, train, and retain additional volunteers; follow-up and address illegal encroachments; enhance neighbor outreach; and produce survey and land ownership maps utilizing a GIS-based platform. In addition, the funds will be used to enhance the existing GIS and database systems to accommodate the complexity of managing lands, survey, and maintenance tracking data. Further, the funding will also go to support contracted surveys of disputed boundary lost due to encroachments or neglect.

The funding of the sum of the above components would contribute to the successful implementation of a sustainable comprehensive boundary management program on the Appalachian National Scenic Trail.

Chapter IV.E

Program and Project Statements for GIS and Information Management

The following statements describe GIS and information management programs and projects that could be implemented or enhanced to manage of natural, cultural, and scenic resources on the Appalachian National Scenic Trail. See *Table IV.A.1, Potential Resource Management Programs and Projects on the Appalachian Trail 2005 – 2015*, for a comparative summary of all programs and projects.

11. Appalachian Trail Data Management Program

OFS Number: not developed

Estimated Cost: $150,000 annually

Cost Breakout: $115,000 for a data manager and clerical support, and $35,000 in IT support, equipment, and software licensing

Full-time staff required: 1.0 FTE for a data manager and 1.0 FTE for clerical support

Description: This program would integrate and manage critical resource management data for the Appalachian Trail. Multiple databases have been developed over the last ten years to manage Trail-related information. These databases, which include Land Ownership, Trail Assessment, Corridor Monitoring, Natural Diversity, Structures, Open Area Management, Cultural Resource, Environmental Monitoring, Membership and contact information, are in a current state of dormancy, where information is currently not being maintained through appropriate data management practices. The resulting data are inadequate to properly manage to trail. This program also would establish appropriate data management practices, which include:

- The use of rational directory structures and file naming conventions to ensure that data files can be found when needed;
- Ensuring system and data integrity and security measures to protect the data against accidental or intentional damage or destruction, or unauthorized access or use;
- The use of standardized updating procedures to ensure data integrity and to enforce built-in quality assurance and quality control practices;

- Maintaining a working data model that develops links and associations between databases to reduce the number of data systems in place;
- Expanding and customizing the functionality of the database to maximize efficiency in data entry and reporting;
- Coordinating the flow of information so that information is collected ina timely manner and is in proper format; and
- Developing up-to-date reports and summaries for trail managers

Implementing these practices into a functional program would necessitate hiring one full-time database manager/programmer and one data entry clerical position that could potentially be filled by A.T. volunteers or qualified interns.

Justification: The geographic extent and geo-political complexity of the Appalachian National Scenic Trail present significant challenges for managers who need to make well-informed management decisions. These decisions are highly dependent upon obtaining and utilizing the most current and up-to-date information, much of which is held in-house in various data systems and databases. Up-to-date data systems and databases that accurately reflect the current status of the trail's resources are an essential component in stewarding such a dynamic resource. Building the capacity to update, manage and analyze trail-related information is an essential component in developing a functional resource management program.

12. Appalachian Trail Corridor Mapping Project (PMIS)

OFS Number: not developed

Estimated Cost: $37,500 annually for four years

Cost Breakout: $37,500 for contract services

Full-time staff required: 0.0 FTE

Description: Over the last 25 years, the National Park Service (NPS) has spent over $149 million and protected 111,269 acres to ensure that the Appalachian National Scenic Trail (A.T.) has an adequate protective buffer along its entire length of over 2,100 miles. NPS has paid an additional $9 million to contract professional surveyors to monument, mark, and map over 1,373 miles of exterior corridor boundaries in 11 states from VA to ME. In partnership with NPS, the Appalachian Trail Conservancy's (ATC) Boundary Program helps to ensure the long term protection of this investment by coordinating and

conducting the monitoring and maintenance required to preserve this vulnerable corridor of land.

Under contract with the NPS Appalachian Trail Land Acquisition Field Office (ATLAFO) in Martinsburg, WV, twenty-two separate firms surveyed the exterior corridor boundary along the A.T. At present, more than half of these surveys are at least 15 years old. Well over 60 percent date back to the pre-AutoCAD era and only exist as mylar originals, which are stored at ATLAFO. ATC Boundary field staff and trail club volunteers use 36" x 24" paper copies of these mylars to monitor and maintain the boundary.

Justification: At present, neither NPS nor ATC have a common database to effectively record and organize the monitoring and maintenance work performed annually along the A.T. corridor boundaries. Incorporating the boundary line and monument locations into a GIS, along with their existing conditions, maintenance data, and known encroachments, will enable ATC to more effectively fulfill their role as "guarantor" to NPS, ensuring that the corridor lands are being properly managed.

Using this information will also enable ATC Boundary staff to plan more effectively. It will allow them to determine what areas are most threatened by probable encroachment, what areas are most in need of maintenance and boundary line reclamation, and where annual staff time and resources should be allocated to ensure the longevity of the surveyed boundary lines and the corridor lands they protect.

This GIS information will also increase our ability to prevent encroachments by providing a format that can be shared with adjacent landowners. Many timber companies have the capacity to use GIS data to locate their property boundaries. Being able to share the exact location of the A.T. corridor with adjacent timber companies will improve our relationships with them and decrease the possibility of timbering on NPS corridor lands. The age and deteriorating condition of many boundaries in areas such as Maine and New Hampshire increase the probability that adjacent landowners would be unable to recognize where their land stops and the A.T. corridor begins. Providing neighboring landowners with this GIS information is an important part of the Boundary Program's plan to prevent serious encroachments.

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