The Appalachian Trail MEGA-Transect

Engaging volunteers in environmental monitoring from Maine to Georgia

APPALACHIAN TRAIL CONSERVANCY

MEGA

The Appalachian Trail Conservancy is a volunteer-based, private nonprofit organization dedicated to the conservation of the 2,175-mile Appalachian National Scenic Trail, a 250,000-acre greenway extending from Maine to Georgia. Through a formal cooperative agreement, the National Park Service delegated responsibilities specific to the maintenance and protection of the A.T. to the Appalachian Trail Conservancy.

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Back-cover image: The A.T. overlaid on a nighttime satellite image. IMAGE: Casey Reese (NPS)

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Engaging volunteers in environmental monitoring from Maine to Georgia

The Appalachian Trail MEGA-Transect

PHOTO: Timothy Cummings, Pochuck Boardwalk, New Jersey

Our mission is to establish the Appalachian Trail 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 Appalachian Trail 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 and 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.

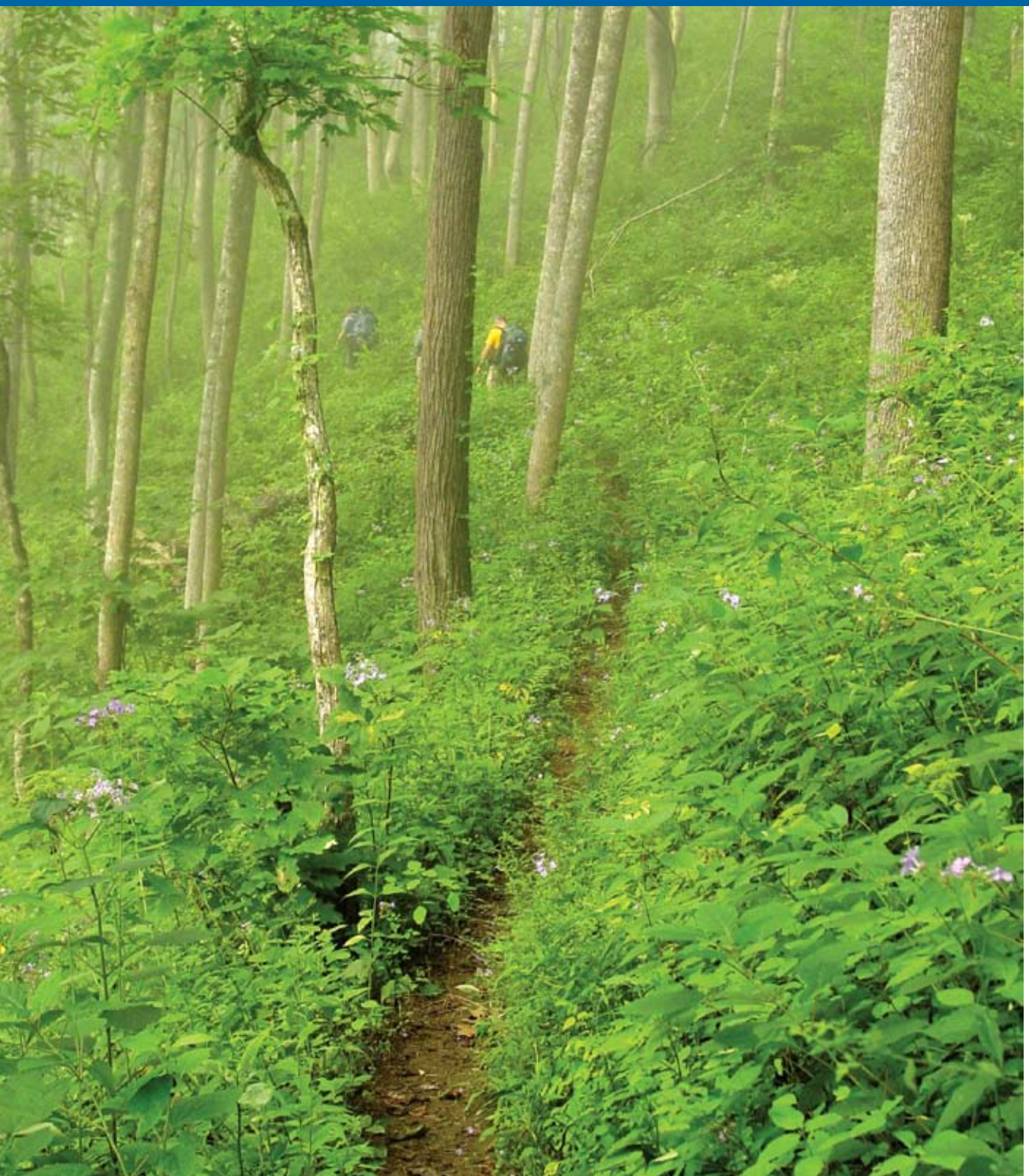

PHOTO: George Evans, Appalachian Trail near Cheoah Bald, North Carolina

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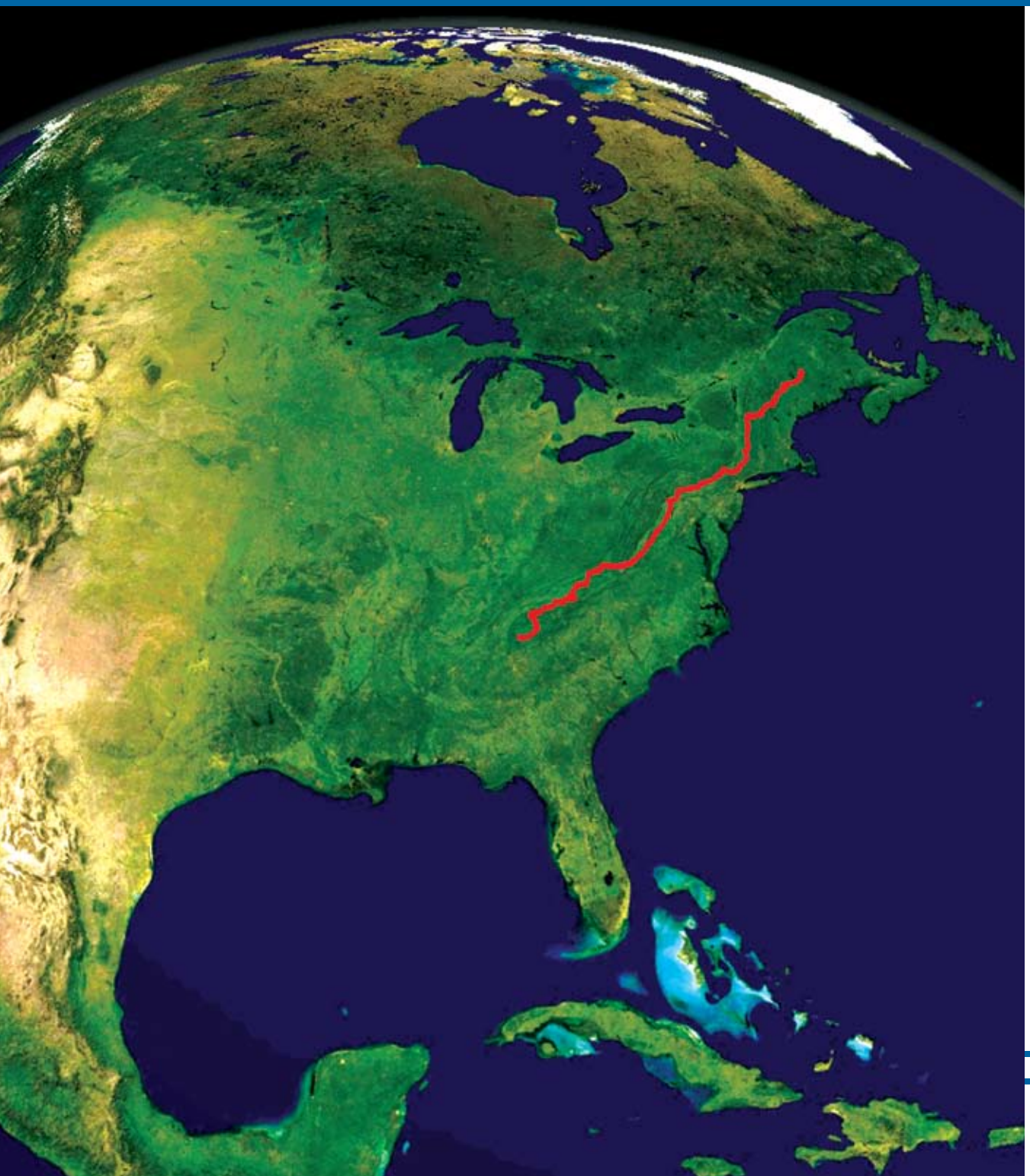


Background

Scientists often use a transect to systematically collect data on species or environmental conditions across a landscape. Coined by National Geographic's Explorer-in-Residence, Michael Fay, the term mega-transect describes a transect at a continental scale that records a whole suite of environmental variables.

The Appalachian Trail and its surrounding 250,000 acres of protected lands are a priceless ecological resource. A.T. lands harbor rare, threatened, and endangered species, encompass important water resources, and shelter wildlife. The Trail's north-south alignment across 14 states represents a cross-section of the eastern United States and offers a perfect setting for a mega-transect.

Threats to the environment of the Appalachian Trail—from encroaching development, acid rain, invasive species, polluted water, and climate change—represent threats to the health of everyone downwind and downstream of the A.T., roughly one-third of the U.S. population. This makes the Trail and its protected corridor an ideal indicator for environmental conditions that directly affect more than 120 million Americans.

The A.T. MEGA-Transect program will collect scientifically valid and relevant data on the health of the landscape and the species it harbors. This data will not only help land managers make better decisions, it will also give the American public and policy-makers the information necessary to protect their community resources and reach the goals of current environmental legislation.

In the following pages, we lay out the broad categories of environmental variables that A.T. MEGA-Transect partners are committed to studying, we explain why they are relevant to all residents of the eastern U.S., and explore how they can be studied and potentially acted upon.

Because of the magnitude of this project, volunteer engagement is vital to this effort. Citizen scientists will play an active role, participating in monitoring activities and providing policy-makers, scientists and land managers with the data needed to further protect the Trail. Interested individuals can track and sign up for volunteer opportunities via the Appalachian Trail Conservancy's web site, or by contacting megatransect@appalachiantrail.org.

This global view of the A.T. (red line) is shown on a 2002 NASA composite image from the Terra satellite. IMAGE: Elizabeth Crisfield

Engaging citizen scientists will allow us to gather large amounts of data at the scale of the entire Trail quickly and affordably, and to involve the American public in the environmental stewardship of eastern North America.

Citizen Science

The Appalachian Trail is grounded in volunteerism, from its founding and construction by Benton MacKaye, Myron Avery, and the thousands of outdoor enthusiasts they enlisted, to its continued maintenance by their followers. To this day, volunteer Trail Clubs collectively contribute nearly 200,000 hours of labor each year maintaining the Trail.

After seeing the entire 2,000+ mile treadway established in the 1930s, MacKaye prophetically suggested amateur naturalists could lead an investigation of Trail ecology. Some 75 years later, the A.T. MEGA-Transect initiative takes this vision a step further by inviting volunteers to explore the health of the Appalachian Trail environment.

Involving volunteers in gathering data for real and meaningful scientific endeavors not only serves as a means for awareness-building and outreach, it is also a way to gather large amounts of data quickly with limited costs. Citizen science has contributed successfully to projects as varied as monitoring water quality, studying diseases in bird populations, conducting inventories of all the species in national park units, and tracking butterfly migrations.

As was the case for the creation of the Trail and for its continued maintenance, volunteers are crucial to the monitoring and protection of the Trail's resources. Research scientists alone could never hope to fully investigate and understand the air quality, bird populations, and other environmental indicators on the Trail's continental scale without the help of knowledgeable and enthusiastic volunteers.

Successful citizen science projects:

- actively involve the public, often as data collectors, but sometimes as principal investigators
- involve professional scientists in order to ensure that the data gathered will be meaningful and useful
- are designed to be educational and to increase public awareness and understanding of the study system and of science in general.

Natural Heritage Program training on Saddleback Mountain, Maine. Program volunteers monitor the health of rare plant populations. PHOTO: David Field

Monitoring the health of the forests along the Trail allows us to gauge the impacts of invasive species, development, air pollution and other threats on the eastern forests of the United States.

Forest Health

Forest health describes the condition and diversity of trees and associated vegetation, soils, and water, as well as ecological processes like cycling nutrients in soils and plants and purifying our air and water. Healthy forests provide habitat for many species of animals and plants, keep soils fertile, and help regulate the climate. Forests also provide valuable recreational opportunities and essential renewable resources for fuel, lumber, and paper.

The A.T. passes through some of the largest and least fragmented forest blocks remaining in the eastern United States, including uncommon and fragile high elevation communities like the spruce-fir forests of the Southern Appalachians.

Because of its north to south route and its passage through most eastern forest ecosystems, monitoring forest health along the Appalachian Trail will provide a better understanding of the overall condition of eastern forests. This research will help us understand the impacts of air pollution and forest pests and diseases on some of the continent's most important forest ecosystems.

At left: fall foliage on Webster Slide Mountain in New Hampshire. PHOTO: Fred Shirley.

At right: ATC staff, Caroline Dufour, measuring "diameter at breast height" near Harpers Ferry, WV. PHOTO: Jesse Melton

Air pollution, including ground-level ozone and acid rain, is widespread across much of the A.T. lands and is increasingly killing sensitive species, including red spruce and sugar maple trees.

Destructive insects and diseases from other parts of the world are also killing native forest trees including American beech, Eastern hemlock, Fraser fir, butternut, and flowering dogwood. These exotic forest pests and diseases must be detected early and monitored closely to control their spread and the damage they cause.

For example, Eastern hemlock is an important forest and timber tree along the A.T. This species is under attack by the exotic hemlock woolly adelgid, an insect that can kill adult hemlock trees in just a few years. This pest was first noticed on the East Coast in Pennsylvania in the late 1960s, and it is currently spreading north, south, and west, dramatically altering the forests wherever Eastern hemlocks exist.

Overall, studies show substantial decline in forested land in the Mid-Atlantic States and in Virginia from the late 1980s to the early 2000s, as well as increased fragmentation in the northeastern U.S. Tracking trends in the increase or decrease of forested lands is important because of the scenic and ecological services these forests provide and because of the economic importance of forests for communities.

Monitoring will alert land managers, members of surrounding communities, and policy makers to the health of eastern forests to ensure that planning and protection is tied closely to the future health of the Appalachian forests.

Evidence of hemlock woolly adelgid infestation is most obvious at the base of the needles where a white "woolly" secretion covers the insect as it feeds on the sap of the tree. PHOTO: Elizabeth Crisfield

Monitoring invasive plants along the Trail will help us control their spread and limit their damage to our forests and native plants.

Invasive Plants

Invasive plants spread uncontrollably and crowd out native species. Most invasive plants are exotic, introduced by people into a natural ecosystem, but not all exotic plants out-compete native plants. Invasive plants cause ecological damage and create economic problems including:

- out-competing native plants for necessary resources (light, water, or nutrients) and often reducing biodiversity
- altering habitats and impacting wildlife,
- interfering with essential ecosystem functions such as water filtration
- affecting our native ecosystems' ability to sustain economic activities like forestry, fisheries and agriculture.

Some invasive plants are deliberately introduced because they are thought to have value for wildlife, horticulture, or agriculture; others are imported in cargo and accidentally released. Invasive species (plants, animals, insects, pathogens) are one of the top four threats to the health and sustainability of America's forests.

In 2005 an Appalachian Trail thru-hiker surveyed a 60-foot corridor along the Trail, documenting the presence of 24 species of invasive plants within 30 feet of the A.T. Invasive plants occupied a total of 1,379 acres or 9 % of the total acreage within 30 feet of the Trail. Although these species were found along the Trail from Georgia to New Hampshire, they were most frequent and covered the greatest area in the Mid-Atlantic region.

The impacts of invasive plants are significant and growing. Each year untreated infestations become larger, new infestations are discovered, and unfortunately, new invasive exotic plants enter the Appalachian region.

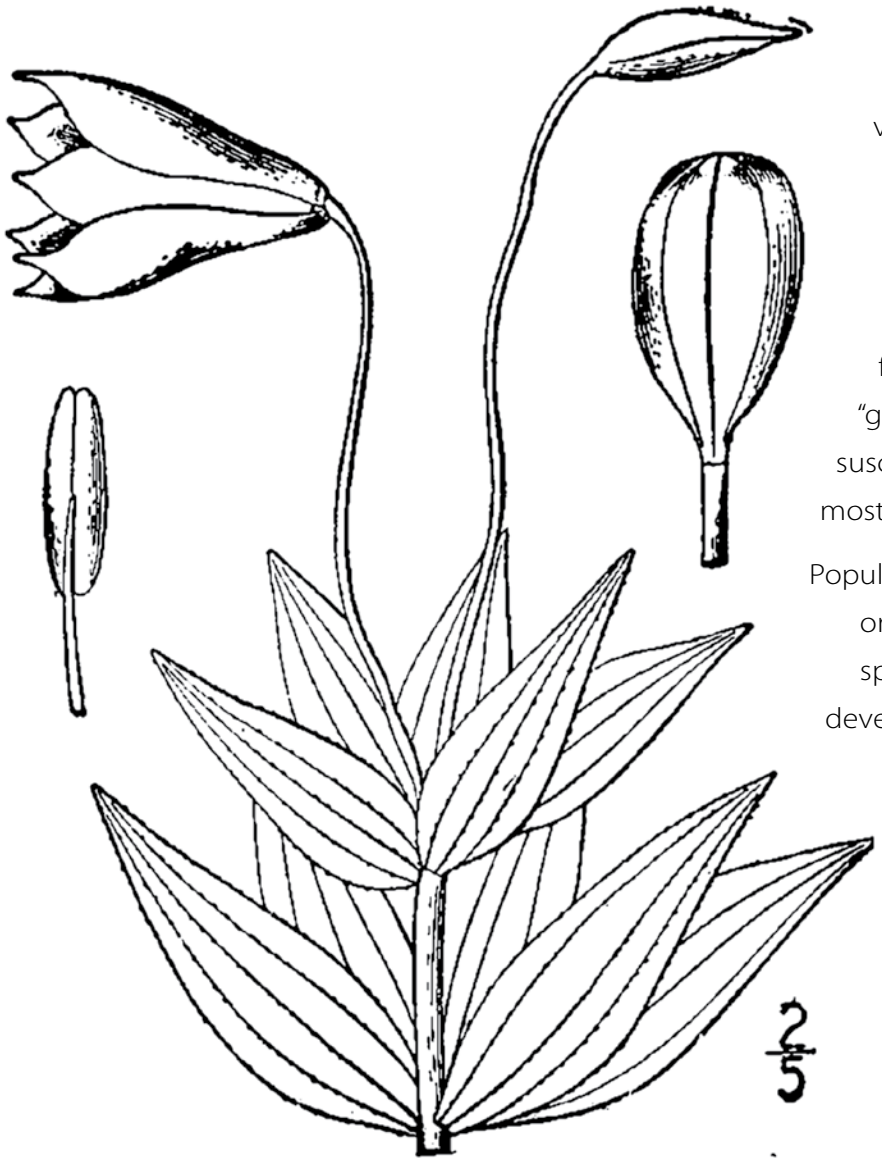
In New England alone, more than 100 plant species are listed as potentially invasive on the regional list produced by the Invasive Plant Atlas of New England. Volunteers trained to recognize these exotic plant species in the Trail's environment would likely find them in even greater numbers.

Fighting invasive plants will require volunteer labor, public and private funding, as well as policy decisions that help prevent and repair the damage caused by invasive plants.

Volunteer Joel Bassett removes invasive exotic oriental bittersweet vines in Hot Springs, North Carolina PHOTO: Lindsay Majer, Equinox Environmental Consultation & Design, Inc.

Volunteers monitor the status of the rarest and most threatened species along the Trail and enable the Appalachian Trail Conservancy, the National Park Service, and other land managers to take action to protect them.

Rare, Threatened & Endangered Species



Rare, threatened and endangered species are plants and animals that are very limited in either their numbers or range. Rarity is relative depending on the geographical scale; a species may be rare in one State, yet common in several others. Some species are only found in a few locations worldwide: these "globally rare" species are typically the most susceptible to ecological change and are most at risk of extinction.

Populations of rare species can be damaged or extirpated by threats such as invasive species, pollution, poorly planned development and climate change. Protecting individual populations of rare species is one of the ways to ward off species extinctions and help maintain global biodiversity and ecosystem health.

The A.T. corridor may harbor more rare, threatened and endangered species than any other National Park

Gray's Lily is found along the southern sections of the A.T. from Georgia through Virginia. It is considered endangered in Tennessee and threatened in North Carolina. PHOTO: Robert G. Shaw. The illustration showing the bud, bloom, seed, and leaf structure is from USDA-NRCS PLANTS Database / Britton, N.L., and A. Brown. 1913. An illustrated flora of the northern United States, Canada and the British Possessions. Vol. 1: 503

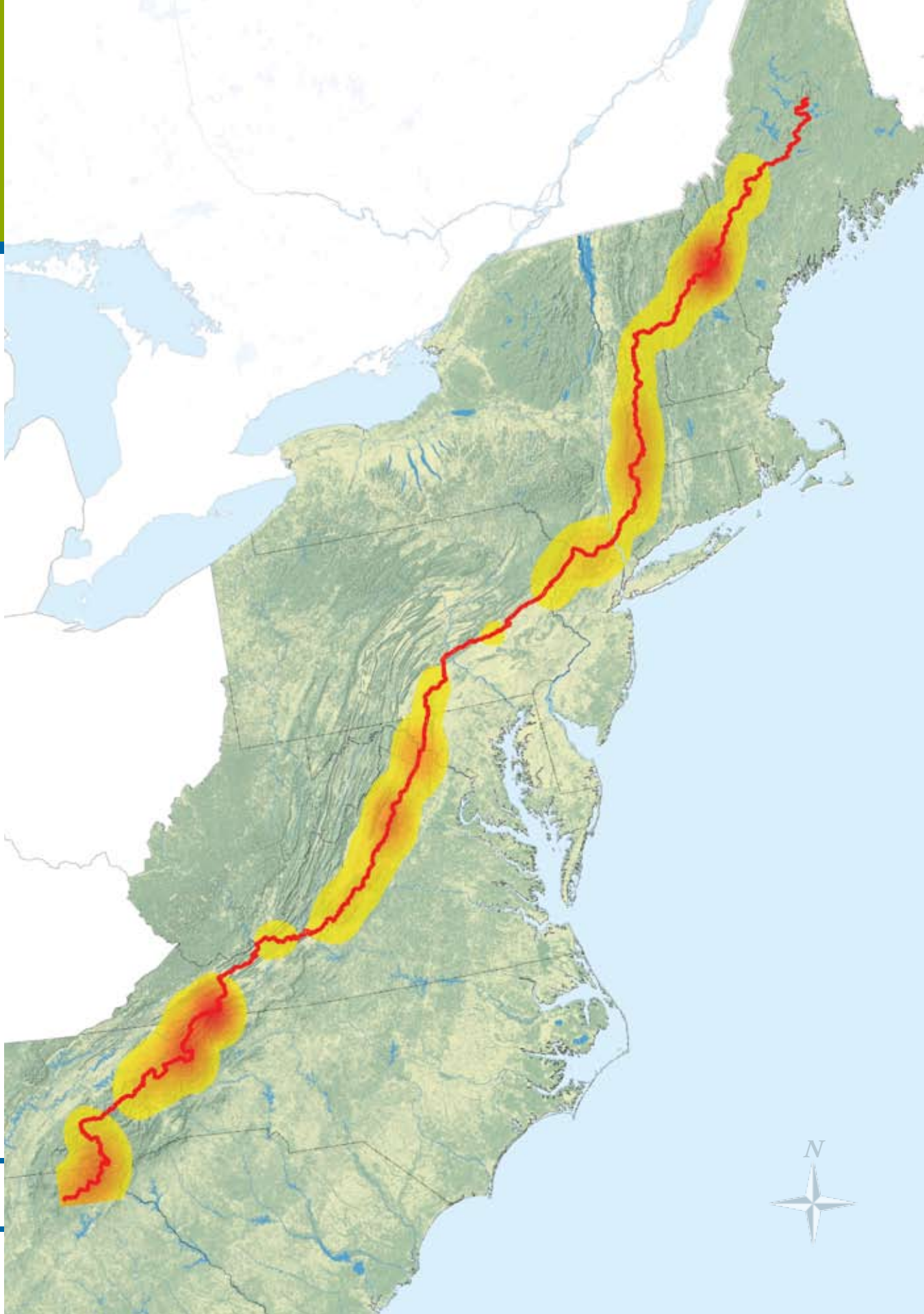
Service unit. Most of those species are plants, but rare animals are also found along the Trail. A.T. lands support more than nine federally-listed and 360 state-listed species of plants and animals. Perhaps most impressively, the A.T. also harbors more than 80 globally rare species. In total, more than 2,000 populations of these rare, threatened, and endangered species are found on A.T. lands.

To help protect these rare species populations, the Appalachian Trail Conservancy and A.T. Park Office coordinate a volunteer-based monitoring program that tracks the rarest and most threatened plant populations. Volunteers are trained to recognize the rare species as well as some of the likely threats, and asked to report their results after their site visits. More than 200 monitors have been trained since 1991, and tracking rare species along the A.T. would not be practical without them.

If populations are found to be struggling, the ATC and its land-managing partners take action to address the problem. For example, the Trail has been relocated away from populations of dwarf cinquefoil to protect them from hiker trampling, rare plants have been fenced in to protect them from deer browsing, and invasive species have been pulled out before they destroyed entire rare plant populations.

ATC and A.T. MEGA-Transect partners are also aiming to develop monitoring programs to address rare, threatened, and endangered animal species on the Trail.

In this map, areas where there are high densities of rare, threatened and endangered plants along the A.T. (red line) are highlighted in red-orange. Sections of the A.T. that stand out as harboring rare species are Roan Mountain along the North Carolina–Tennessee border and the Presidential Range near the New Hampshire–Maine border. IMAGE: Casey Reese (NPS)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The mountain forests traversed by the Trail are critical to many already threatened bird species, and will be among the first affected by climate change.

Mountain Birds

The A.T.'s 250,000 acres of protected lands are home to countless bird species: game birds like the wild turkey, non-game birds including many warblers, woodpeckers, and sparrows, and rare, threatened and endangered species like the peregrine falcon.

In some cases, these birds have little habitat left outside of A.T. lands, or use the A.T. as a migration corridor. Monitoring can help us better understand and protect them.

Mountain forests of the eastern United States are very important to the region's variety of bird species. Many birds found in mountain forests use only this type of habitat and cannot be found at lower elevations. Examples include Bicknell's Thrush in the Northern Appalachians, Canada Warbler in the central mountains, and Golden-winged Warbler on shrubby summits extending into Georgia.

Mountain ecosystems that are rich in birdlife, like those along the Appalachian Trail, are among the most sensitive indicators of environmental change. Mountains are more susceptible than low-lying areas to the effects of global warming, atmospheric pollution, and certain land uses such as wind farming and mountaintop mining. Continued research must be done to understand the full impact these changes will have on mountain bird habitats and populations.

The limited information available through existing bird surveys indicates cause for concern, revealing sharp declines in several high-elevation bird species such as the Magnolia Warbler and Bicknell's Thrush.

Monitoring bird populations along the Appalachian Trail will help determine which species are at risk, which factors influence bird species' distribution and population numbers, how rapidly population numbers are changing, and how the birds will fare in the face of climate change or other stressors. With this information, land managers and policy-makers will be better able to protect the birds' habitat to ensure their continued survival.

A.T. MEGA-Transect partners intend to use the Vermont Center for Ecostudies' Mountain BirdWatch program as a template for a Trail-wide effort. Mountain BirdWatch is a volunteer-based citizen science program that relies on hikers to track mountain bird populations in the northeastern U.S.

Bicknell's Thrush is a rare songbird that breeds in the high elevation spruce-fir forests along the A.T. in New York, Vermont, New Hampshire, and Maine — 24% of the bird's suitable habitat occurs within one mile of the Appalachian Trail. The red and white leg bands seen in the photo are used by researchers to track birds so we can better understand behavior, habitat use, and reproductive success. PHOTO: Sarah Frey

Monitoring the timing of flowering in sensitive high-elevation species along the entire Trail will help us understand the global and regional impacts of climate change in the eastern U.S. and beyond.

Seasonal Life Cycles

Plants, animals, and insects living in seasonal environments have developed life patterns that allow them to survive and thrive through seasonal weather cycles. Such seasonal life cycles include plant and tree flowering, the opening of buds, the migration of birds, the hatching of insects, the falling of leaves, and countless others. The study of biological life cycles and of their timing is called phenology. Plants, animals, and insects use the variations in day length, air temperature, precipitation, and other similar environmental cues to regulate their life cycles.

Because of this, seasonal life cycles are sensitive to changes in climate and can be used as indicators of climate change. This is particularly true in ecosystems where the growing season is limited by cold weather, such as at high elevations and in the northern U.S. Plants in these cold-limited ecosystems are likely to be affected rapidly by warming temperatures, showing changes in their flowering patterns and even their survival.

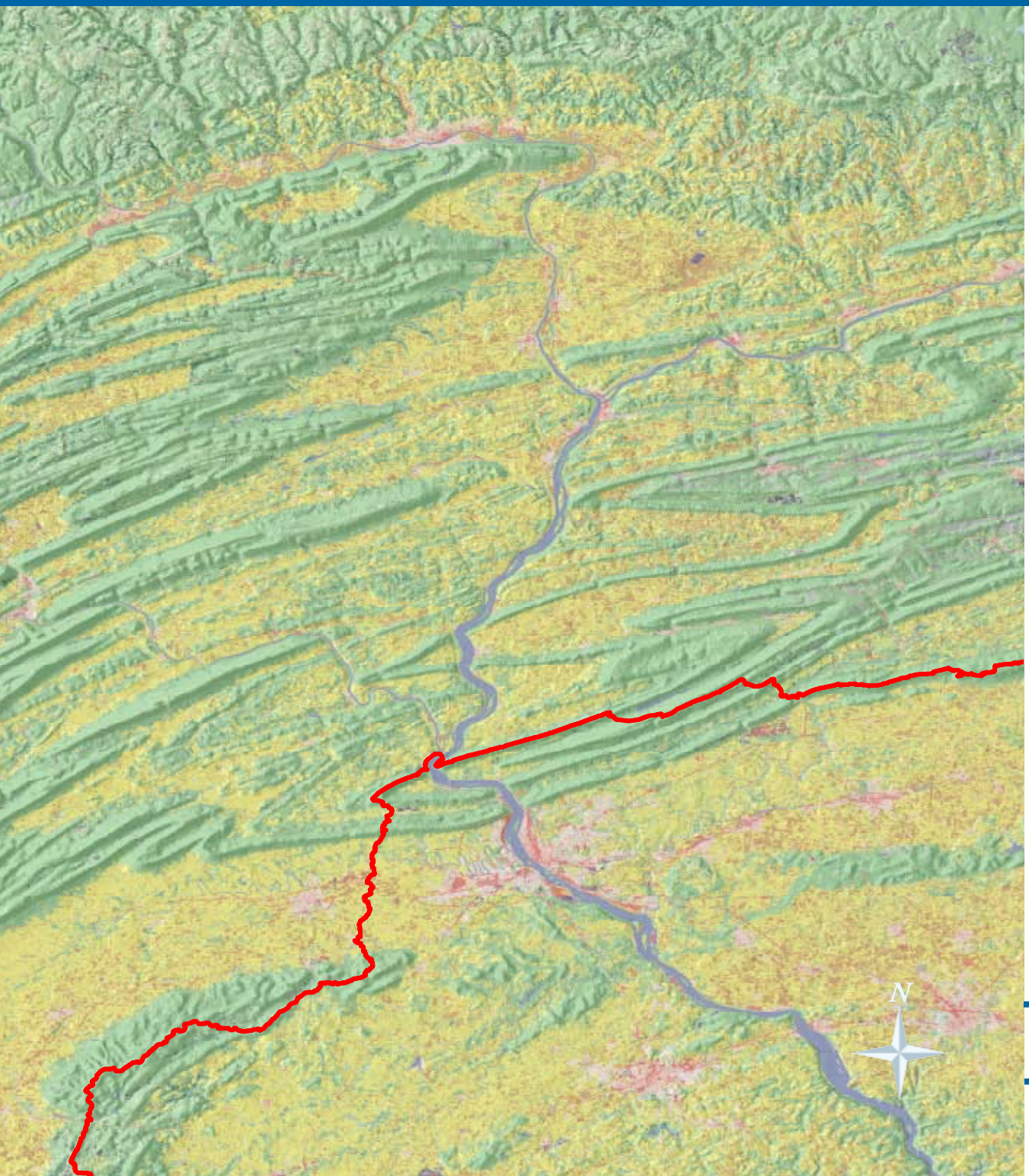
Because the Appalachian Trail crosses much of the East's mid-to high-elevations from Georgia to Maine, it provides a unique opportunity to detect climate-driven changes in the seasonal life cycles of sensitive high elevation species all along the East Coast. Climate change along the Appalachian Trail will likely precede change at lower elevations, and can serve as an early warning.

The timing of plant flowering and other seasonal biological events also varies from south to north. When plants reach full flower in the South, flower buds are just beginning to emerge farther north. Monitoring the phenology of plant species that can be found along the entire length of the A.T. will help us understand any regional variations in climate change.

A.T. MEGA-Transect partners hope to build on programs like the Appalachian Mountain Club's Mountain Watch program. Currently only in place in the northeastern U.S., Mountain Watch is a volunteer-based program through which citizen scientists can monitor the flowering of common forest and alpine plants while hiking. Lessons learned and procedures from Mountain Watch should be applicable to the entire A.T.

Bloodroot has one of the earliest blooms on the Appalachian Trail. PHOTO: Matt Stevens (ATC)

Tracking and understanding landscape changes along the Trail will be a catalyst for policy-makers and citizens to plan development and resource use that protects the natural resources we all depend on.



Landscapes

A landscape is made of the visible features of an area, from living things and physical elements such as mountains or valleys to human structures, human activities, and frequently-changing conditions such as weather. Landscape dynamics refers to the changes in visible features due to human intervention or natural events.

These changes can be sudden, such as those due to fire, clearing of land for development or agriculture, or severe weather, like floods or hurricanes. The changes can also be gradual as in natural vegetation succession, effects of air pollution, gradual damages by insects and pathogens, or climate change.

One of the most profound effects humans have on landscapes is the alteration of habitats critical to the survival of plants and animals, and to the ecosystem services that sustain our own lives. Changes in land use and management can alter water quality and flow regimes, introduce and facilitate the spread of invasive plants and animals, and reduce blocks of contiguous forest.

We already know from satellite, aerial remote sensing, and field data that the landscapes along the A.T. have changed significantly in past decades due to both natural forces and human activities. Urban development along the A.T. corridor has decreased the recharge of natural water reserves as well as water quality. It has reduced and fragmented forests, decreasing wildlife habitat and biodiversity.

All of these activities have greatly altered the A.T. region, resulting in a mosaic of land types and uses where historically the areas were mostly forested lands supporting high quality water resources. Knowing the processes of landscape change and the effects on surrounding natural resources will help the public, resource managers, and decision-makers make policy and management decisions that will protect those resources and the communities that depend on them.

A.T. MEGA-Transect partners will develop landscape monitoring projects using remote sensing observations and GIS data available from various agencies, universities, states, and other organizations. Volunteers will be involved by helping to identify sensitive segments where landscapes are changing or have changed in recent years, and by testing and evaluating the remotely sensed landscape change data.

This map of central Pennsylvania, shows the A.T. (red) crossing forested areas (green), agricultural areas (yellow), and developed areas (pink). Analyzing changes in land cover and land uses over time can help predict likely trends for the future, and can help redirect development and land use through planning to protect important resources. IMAGE: Casey Reese (NPS)

Monitoring the quality, quantity, and timing of the water flows will help us protect the eastern U.S. watersheds, the plants and animals that depend on them, and the communities downstream.

Water

The Appalachian Trail passes many lakes, ponds, streams, and wetlands which provide drinking water and beautiful scenery for hikers as well as important habitat for wildlife and plants. Because the Trail follows the high grounds of mountains and ridge crests, it is often at the top of important watersheds—areas of land that collect water and drain it into a stream or river. The nearly 1,800 streams, rivers and lakes found along the Trail feed into 64 major watersheds along the eastern seaboard. Further downstream, this water supports public water supplies, fisheries, agriculture, and hydropower generation.

While the quality of the water changes naturally as streams run through watersheds and merge into rivers, human activities cause damaging impacts. These impacts can be categorized as those that affect waters everywhere including the high elevation water bodies along the A.T., and those that mostly impact lower-lying areas downstream.

Air pollution, created by burning fossil fuels like gasoline and coal, is carried by the wind and eventually dropped on the land. These pollutants include nitrogen, sulfur, and mercury, and cause increases in acidity of the water as well as mercury accumulation in wildlife (elevated mercury has resulted in fish consumption advisories in all 14 States the Trail passes through). These pollutants impact waters everywhere, including the high elevations of the A.T.

Human activities that mostly impact downstream areas include soil erosion from development, agricultural fertilizer and pesticide run-off, power plant cooling waters and sewage treatment plant effluents.

By monitoring the headwaters along the A.T., we can assess the quality of the water before it moves down through the watershed. This high-elevation assessment will create a clearer picture of the impacts of air pollution on our water resources than data collected lower in the watersheds would show. This is important both for protecting the natural conditions along the Trail and for protecting the water for its downstream uses.

Water quality is a measure of the chemistry of the water, and monitoring programs often include parameters like oxygen concentration, nutrient levels, pH (acidity), clarity, temperature, and contaminants such as mercury.

Water quality monitoring has been undertaken in many waterways along the A.T. Here, members of the Bankhead Boys Association from Atlanta, Georgia analyze a water sample to determine pH. PHOTO: Marianne Skeen

Global changes in climate will likely affect the quantity and timing of the water flows along the Trail. Changes in the quantity of water in the streams and lakes will affect the plants and animals that depend on them and could impact communities downstream who use the water for residential uses or power generation. Monitoring water sources on the A.T. will also enable us to see changes in quantity and timing of water flows without interference from other sources of variables farther downstream, and may provide early warnings of climate change impacts on our water resources.

Right: The A.T. (red line) and its associated natural areas protect the headwaters of watersheds (light blue) that extend all the way to the Atlantic Ocean and provide water for some of the major metropolitan areas (pink) of the eastern United Sates. IMAGE: Casey Reese (NPS)

Below: Where the A.T. (red line) crosses the Susquehanna River in central Pennsylvania, streams flowing off the ridge (green lines) contribute relatively clean water to the river. IMAGE: Casey Reese (NPS)


Bangor, ME
Burlington, VT
Concord, NH
Albany, NY
Hartford, CT
New York, NY
Baltimore, MD
Washington, DC
Charleston, WV
Richmond, VA
Knoxville, TN
Charlotte, NC
Atlanta, GA
N

Monitoring the air quality along the Trail will help us protect the health of hikers and all eastern U.S. residents, as well as our water resources, forests, and wildlife.

Air Quality

Air quality describes the level of pollutants in the air. Good air quality exists when ozone, dust, and other pollutants are near natural levels. The most immediate impact of poor air quality is that it interferes with a hiker's ability to see the Trail's famous vistas. Visibility is influenced by the amount of dust, fossil fuel emissions, and other pollutants in the air, so it is a good indicator of these pollutants.

More importantly, high ozone levels, greenhouse gas emissions, and other pollutants have consequences for both ecosystem and human health. The air-borne pollutants associated with poor air quality are damaging trees and plants, acidifying streams and lakes, and leaching nutrients out of the soil. Air pollution can also cause or worsen respiratory problems. Hikers experience the short term effects of ozone in the form of coughing, shortness of breath, pain when breathing deeply, and aggravated asthma. The effect of ozone on lung tissues is akin to sunburn and scientists are concerned that repeated short-term damage from ozone exposure may permanently injure human lungs.

Little of the air pollution experienced by hikers along the A.T. is generated in the immediate proximity of the Trail. Concentrated industrial and electric power generation facilities, pollution from large cities and along major highways, and relatively high humidity levels all contribute to air pollution problems experienced on the Trail and by people who live in the eastern United States. Air pollutants are blown throughout the region and conditions along the A.T. can be considered an indicator of air quality in much of the East.

The National Park Service, in conjunction with the Environmental Protection Agency and States, has been monitoring air quality in Shenandoah National Park and Great Smoky Mountains National Park since the early 1980s. Data show slowly improving air quality that is not yet comparable to natural clean air conditions. A.T. thru-hikers are currently exposed to high levels of ozone 24 hours per day for weeks at a time, and backcountry rangers in Great Smoky Mountains National Park are not allowed to go in the field on high ozone days.

By continuing and expanding air quality monitoring along the Appalachian Trail, A.T. MEGA-Transect partners will be providing the American public and policy-makers with information necessary to protect human health, reach the goals of existing clean air legislation, and preserve our natural resources.

Views of the Great Smoky Mountains from Look Rock Air Quality Monitoring Station, Tennessee. Top: good visibility of about 150 miles. Bottom: same view under hazy conditions caused primarily by tiny sulfate particles that lower visibility to about 10 miles. PHOTOS: Jim Renfro (NPS)

Tracking the number of visitors to the Trail and the resulting impacts to the environment and facilities will help us protect this natural and cultural legacy for today's American citizens and future generations.

PHOTO: John Fletcher (ATC), Glen Brook Lean-to, Massachusetts

Visitor Impacts

An estimated three to four million people visit the Appalachian National Scenic Trail every year. Most are out for one day to hike several miles, some are on the Trail for longer periods of time—weekends, weeks, or months—and a few will thru-hike the entire 2,175-mile Trail in one trip.

The A.T. represents one of the last great wild and natural outdoor places in the eastern United States, and many seek it out to experience a sense of wilderness and isolation. Retaining that character and allowing all visitors to enjoy the Trail without adversely affecting natural resources is important to the health and well-being of today's population and of future generations.

The physical impacts of visitors are most apparent at overnight sites, around very popular areas, or along fragile sections of the Trail. Evidence of overnight site impacts include large areas of bare and compacted soil, exposed tree roots, trash and human waste left on-site, habituated wildlife, and contaminated water sources.

Impacts on the Trail include soil erosion, excessive root exposure, widening of the Trail footpath, standing water, and creation of multiple treadways and "bootleg" side trails.

These adverse impacts to soils, water, and vegetation degrade the environment and alter the natural character of the Trail which affects visitors' enjoyment of the Trail environment.

In addition to environmental impacts, an individual's experience of the Trail can be compromised by the sheer number of other visitors, or by others' actions and behavior, including crowding, conflict and noise.

A.T. MEGA-Transect partners are considering adapting the Trail facilities assessment process that ATC and the Trail clubs are already using to gather and incorporate information about visitor-created side trails and campsites.

In addition, the USFS Southern Research Station at the University of Georgia led a visitor count pilot project in 2007 that was successfully administered by both staff and volunteers. A.T. MEGA-Transect partners are exploring avenues to expand this project to the entire Trail, and incorporate new questions on quality of experience and crowding.

With the results of these studies, managers will implement new measures that protect the Trail, its resources, and the associated experience of its visitors.

Future Directions & Challenges

Establishing and sustaining an environmental monitoring program along the entire Appalachian Trail is a collaborative endeavor as ambitious as the initial creation and ongoing maintenance of the Trail. This initiative—the Appalachian Trail MEGA-Transect—will require a network of new partnerships bridging geography and scientific disciplines across the eastern United States.

Research institutions and government agencies will lend scientific and technical capacity to the program, while environmental and community organizations can help reach volunteer citizen scientists and the American public both to participate and hear the results of this ambitious project. Because of its decades-old expertise in coordinating public and private entities and large numbers of volunteers, the Appalachian Trail Conservancy is ideally suited to coordinate and sustain these partnerships.

The proposed monitoring themes in this report are by no means exhaustive. A.T. MEGA-Transect partners recognize that other environmental resources may provide useful indicators and may be added to the program. For example, the Appalachian Trail Conservancy has partnered with the Smithsonian Institute Conservation and Research Center to pilot a wildlife survey project using motion-triggered infrared cameras on the Trail (photo left). The survey will help build an inventory of wildlife along the Trail and contribute to our understanding of landscape change impacts on wildlife populations. The indicators in this report were selected as a starting point for the A.T. MEGA-Transect Program because they had already been researched and selected by the NPS Inventory and Monitoring Program and the Appalachian Trail Conservancy, but both of these partners recognize the potential value of other monitoring themes.

Universities and other academic research centers, agencies and organizations, and hundreds to thousands of volunteers and citizen scientists will contribute data as partners in this effort. Analyzing and understanding the data gathered by numerous individuals and agencies, across time, species, and geographical regions, will require an advanced, innovative system for data management. A sound structure and set of protocols will ensure data quality, security, and availability.

The Appalachian Trail Conservancy and its partners are committed to making the A.T. MEGA-Transect a reality for A.T. land managers, decision-makers and the American citizens of the eastern United States. We invite like-minded organizations and individuals to join and support this effort to protect this premier national asset and the surrounding natural resources for this and future generations.

Further Reading

Partnership Charter

In preparation of the 2006 Symposium that marked the launch of the A.T. MEGA-Transect program, interested parties developed a charter to establish the mission and goals of the A.T. MEGA-Transect partnership, as well as its core values, benefits and responsibilities.

Symposium Proceedings

Following the 2006 Symposium, the results were gathered and summarized for distribution to interested parties. The Proceedings also includes background and a brief history of the events that inspired and led to the launch of the MEGA-Transect program.

Appalachian Trail Vital Signs

In 2005, the National Park Service's Inventory and Monitoring Program published the "Appalachian Trail Vital Signs" Technical Report (NPS/NER/NRTR--2006/026). This report identifies eleven important indicators of the overall health and condition of park resources. Park staff and collaborators explain the importance of each indicator and, where possible, describe the current conditions of this indicator. Some of these vital signs are also included in this report because they are well-suited to a volunteer monitoring program.

These documents are available from the Appalachian Trail Conservancy's web site: www.appalachiantrail.org/MEGA

For more information contact the Appalachian Trail Conservancy:

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MEGA-Transect Partners & Sponsors

The MEGA-Transect is a collaborative program building off the strengths of A.T. managing partners, federal agencies, educational and scientific institutions as well as community-based environmental organizations.

Membership in the program is open: any organization that wishes to participate or support the program should contact megatransect@appalachiantrail.org

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