



The Temperate Times

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The Trials, Tribulations and Technicalities of Trail Monitoring

There are not many National Parks that it would take you only a few minutes to walk across in one direction, but several months to walk in another direction. The Appalachian National Scenic Trail (A.T.) is one such park and is of course much more well-known for its length and less so for its about 1,000 foot width. Not often thought of as a traditional national park, acre-for-acre the A.T. is by far the largest park within NETN's purview of 13 parks and rivals the acreage of Rocky Mountain National Park at over 250,000 acres in total size (Acadia National Park is a distant second at just over 47,000 acres). This narrow national park traverses through many unique and rare habitats (including some of the last remaining old growth forests in the East) as it wends its way more than 2,100 miles between

Maine and Georgia. A unique park such as this provides unique challenges for a representative natural resource monitoring program. The recently published *Appalachian National Scenic Trail Vital Signs Monitoring Plan* address these issues and serves as the foundation for monitoring activities along the Trail. Publication of the plan represents a significant milestone for NETN's Fred Dieffenbach - the Environmental Monitoring Coordinator for the A.T.

The plan calls for a close collaboration between the Appalachian Trail Park Office (ATPO), the not-for-profit Appalachian Trail Conservancy (ATC) and NETN. Monitoring is a central component of natural resource stewardship in the NPS, and in conjunction with natural

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McAfee's Knob on the Appalachian Trail in Virginia. Carobe photo.

Acadia is all SET

In late June, a total of 12 salt marsh SET (Surface Elevation Table) plots were established in four marshes at or near Acadia National Park.

Bass Harbor Marsh, Thompson Island, a marsh on Schoodic Peninsula, and a marsh owned by Maine Coast Heritage all had a benchmark pipe driven through the marsh peat and into the underlying sediment all the way down to the bedrock. The pipe provides a constant reference elevation through time. Depths to bedrock ranged from 6-ft on Thompson Island to 63-ft at Bass Harbor Marsh.

A SET is a portable mechanical leveling device for measuring the relative elevation change of wetland sediments. (For more information on SET's and NETN Salt Marsh monitoring, see The Salt Marsh Monitoring Field Note on the Education & Outreach/Resource Briefs page of NETN's website). Precise measures of sediment elevation in wetlands are necessary to determine rates of elevation change, particularly relative to sea level rise, and to gain an understanding of the processes responsible for elevation change. The SET provides a nondestructive method for making highly accurate and precise measurements of sediment elevation of intertidal and subtidal wetlands over long periods of time relative to a fixed subsurface datum. This technique overcomes many of the limitations of methods currently used to estimate elevation such as sedimentation pins and precision surveying.

Data gathered at both the previously set-up Boston Harbor Islands' SET plots, and Acadia's new plots will be posted on the respective parks Google Earth modules on NETN's website and other documents when it becomes available. *TT*

Spending Their Summers in the Islands

The 2010 Coastal Breeding Bird Summary was published in June and details monitoring results from last year's field season at Boston Harbor Islands National Park Area. In 2002, the Islands were designated as a Massachusetts Important Bird Area (IBA) because many of them provide habitat for a significant number of colonial-nesting waterbirds, including Least and Common Terns, which are both listed as species of special concern in Massachusetts. American Oystercatchers have expanded their range northward into Massachusetts and now have a substantial breeding population in the Boston Harbor Islands. The North American population of American Oystercatchers is listed as a high priority shorebird species with high conservation concern. In addition, eiders, cormorants, gulls, and several other wading and shorebird species regularly nest on the islands.

Since 2007, a dedicated group of highly skilled volunteers have assisted lead scientist Carol Trocki with waterbird surveys in the Islands. The coastal breeding bird monitoring program has the following objectives:

- Determine annual changes and long-term trends in abundance of high priority coastal breeding bird species such as Least Terns, Common Terns, and American Oystercatchers.
- Conduct an annual surveillance program

within the park to identify future use by threatened or endangered coastal breeding bird species such as Piping Plover or Roseate Tern. If discovered in the park, these species would be a high priority for monitoring.

- Determine long-term trends in species composition and abundance of priority coastal breeding bird species (eiders, cormorants, wading birds, shorebirds, and gulls).

Waterbird monitoring data can also be compared with other data on park management actions, rocky intertidal communities, water quality, climate, and other available data to assist park managers in their efforts to protect and, in some cases, encourage the recovery of coastal breeding birds in the park.

The following is a brief summary for some of the species surveyed last year. For the complete report, visit NETN's Monitoring/Coastal Birds webpage.

Common Eiders

The number of eider chicks observed in 2010 reached a peak of 341 in mid-June, and remained high all season. This was high compared to the previous year, in which a high count of 196 was obtained in early June, and about a month later only 34 chicks remained.

In general, Common Eider experience

Setting up the SET monitoring plots at Schoodic in Acadia National Park. Jim Lynch photo.

high annual adult survival rates (over 80% in several studies), but experience a highly variable degree of reproductive success in any given year with years of ‘near disaster’ not uncommon. In a stable population, low survival of young are compensated for by their comparatively long average life span (5 to 6 years). The consistently high number of chicks observed in 2010 would seem to suggest that this was an unusually successful season for nesting eider.

American Oystercatchers and Willets

Boat-bound and binocular-bearing volunteers were successful in detecting territorial pairs of American Oystercatchers and Willets in 2010. Many nest locations appear to be used repeatedly, which should increase search efficiency for known nesting locations in the future. Statewide efforts to track banded American Oystercatchers have also been extended to the Boston Harbor Islands and will hopefully allow for improved management of this species. Currently, the islands support a significant portion of the state’s nesting oystercatchers, an estimated 11% in 2010, based on preliminary data from the State of Massachusetts Natural Heritage staff shared at the annual Massachusetts waterbird meeting in August of 2010.

Willetts were once again observed defending territory on Snake Island in 2010, but have not been observed on any of the other islands in the park. Regular surveillance of all islands will be undertaken on a 3-year rotation and should be sufficient to detect new Willet territories elsewhere in the park.

Least Terns

Thirty-five Least Terns were observed nesting on Lovells Island in 2010, after being absent from the park since a predation event on Lovells Island in 2007. Since 2008, Least Terns have been nesting on nearby Winthrop Beach, outside the park boundary. It is presumed that the terns that appeared on Lovells Island midway through this season were pursuing a re-nesting effort following a predation event on Winthrop Beach. Researchers hope that the Terns will return to Lovells next year for their breeding grounds. *TT*



American Oyster Catchers have increased their population at Boston Harbor Islands in recent years. Thomas Stomberg photo.

NETN Welcomes Two New Faces

NETN is very pleased and privileged to have brought on board two new team members to the Network this summer. A seasonal Data Technician and a full-time Hydrologic Technician were welcomed to the team in June and July.

Brian Schuetz is the new Hydrologic Technician and will be responsible for water quality monitoring at most NETN parks. He has bachelor’s degrees in history and biology from Loyola University and is currently working on a master’s degree in aquatic entomology through the University of Minnesota.



NETN’s new Hydro Tech - Brian Schuetz

Brian’s graduate school research involves exploring the pollution responses of benthic macroinvertebrates (essentially aquatic animals without backbones that are larger than ½ millimeter in size) in streams flowing through urban and agricultural settings.

Brian brings several years of technician and research experience to NETN, and is looking forward to exploring the Network’s parks with a special attention to their water resources. He is stationed in Troy, NY, at the USGS New York Water Science Center.

Jonathan DeDell, a 17 year-old student who will be entering his senior year at Woodstock Union High School in Woodstock, VT in the fall, was brought on in June as a seasonal Data Technician. He is helping to fulfill a vital role in the Network by making digital copies of data, reports, plans and other documents from NETN parks, and then uploading them to the national NR Info/IRMA database so that they become



Data Tech Jonathan DeDell doing his best ‘data-dork’ impression.

accessible to researchers, parks, and the general public. He will also be helping to gather phenological data at Marsh-Billings-Rockefeller NHP over the course of the summer. Other activities he is involved with include the local Legion Summer Baseball league and the Boy Scouts. *TT*

Several Parks Get Second Check-up from Forest Monitoring Crew

The 2010 field season marked the first year NETN resurveyed forest monitoring plots in Acadia National Park, Marsh-Billings-Rockefeller NHP, Minute Man NHP, Saint-Gaudens NHS, and Saratoga NHP. Below is a summary of the results published in the 2010 Forest Health Monitoring Report.

Acadia National Park

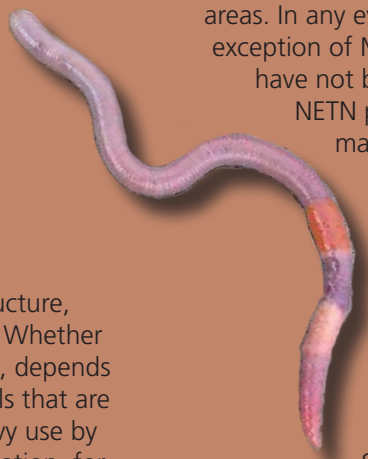
Acadia's forests appear to be approaching mature stages of forest succession, but late-successional structure, such as medium to large snags (standing dead trees), is still lacking. The park continues to be the least affected by invasive species in the Network, including exotic plants and exotic earthworms (see inset for more on earthworms). All management units have little anthropogenic land use near forest plots. As long as impacts from stressors such as invasive species, forest pests and deer densities are kept in check by management or natural barriers, forest structure should improve with time.

Marsh-Billings-Rockefeller National Historical Park

Preliminary data, particularly the high abundance of ferns, suggest that deer browse pressure and exotic earthworms may be impacting forest understories in the park. Quantifying deer densities and characterizing the spring ephemeral component of the understory are both important next steps to determine if deer are impacting forests here and if deer management is necessary.

Worming Their Way into Our Woods

Research over the past decade or so suggests that a recent (geologically speaking) European migrant, the common earthworm (*Lumbricus terrestris*), could be causing the decline of many native plants and other species in our northern forests. How is it possible that something that seems to be such a part of New England folklore, gardening/agricultural history, and the childhoods of so many kids be an invasive stranger that is causing harm to our forest ecosystems? Aren't earthworms good for our soils? Well, like the answer to so many questions, this one begins with: it depends. Earthworms create a soil of a certain consistency and cause basic changes in its structure, biology, and chemistry. Whether that is beneficial or not, depends on the location. For soils that are compacted due to heavy use by agriculture and urbanization, for example, earthworm tunnels can create "macro-pores" to aid the movement of water through the soil. They also help incorporate organic matter into the mineral soil to make more nutrients available to plants. In the relatively undisturbed northern hardwood forest that cover much of the northeast however, earthworms can cause much more harm than good, which is why these slimy soil dwellers are of such concern to NETN scientists. Before getting into the how



and why of it, a little background about earthworms is in order. There are over 100 species of native North American earthworms in areas such as the southeastern U.S. and the Pacific Northwest. However, few if any native earthworms hail from the northeast or northern-most reaches of the continental United States and Canada. If they did exist they were either destroyed by the advance of ice sheets (which scraped away the soils down to bedrock in many parts of the northeast) over many glaciations or forced south into non iced-over areas. In any event, with the possible exception of Morristown NHP, there have not been earthworms in NETN parks since the last major ice sheet retreated about 10,000 years ago. There weren't, that is, until European settlers either unknowingly or purposely brought them over a few hundred years ago. Ships traveling to

North America used rocks and soil as ballast which they dumped on shore as they adjusted the weight of the ship. During the late 1800's and early 1900's many European settlers imported European plants that likely had earthworms or earthworm cocoons (egg cases) in their mud-packed root balls. More recently, the widespread use of earthworms as fishing bait has spread them to even remote areas of northern states and

Worms, cont. page 6.

and open fields may negatively impact the landscape dynamics in this park.

Minute Man National Historical Park

Coarse woody debris and snag abundance continue to be low. Soil chemistry data indicate potential impacts of atmospheric deposition, including soil acidification and excess soil nitrogen. Native species diversity and abundance are higher in the Minute Man forest understories than in all NETN parks except Saratoga. However, invasive exotic species are also abundant, and exotic shrub thickets are likely impacting forest structure and composition. Minute Man also has the highest percent of anthropogenic land use surrounding forest plots in the Network, and the forests in general are highly fragmented. The degrees of fragmentation and intensive land use in and around the park have likely

contributed to the park's invasive exotic species problem.

Saint-Gaudens National Historic Site

While coarse woody debris volume and snag abundance are higher here than in most Network parks, these levels are still

Forest, cont. page 5.

A.T. monitoring, from page 1.

resource inventories and research, it provides the information needed for effective, science-based decision-making and resource management.

Like most parks, the A.T. is an open system, with threats such as air and water pollution, climate change, and invasive species originating beyond park boundaries and out of the control of park managers. Because of these challenges, a multi-agency, ecosystem based approach will be used to manage the A.T.'s natural resources.

However, developing from scratch a program that relies on "new" data specific to the A.T. region would be extremely costly, not to mention unrealistic given the trail's configuration and the limited resources park managers have for monitoring. Rather than re-inventing the wheel, the A.T. plan intends to take advantage of the work already being done by numerous federal and state agencies, universities, and other organizations.

The ATPO manages the A.T. in close coordination with the ATC, the U.S. Forest Service (USFS) and nearly 100 other federal, state and local agencies and non-profit organizations. Their collective objective is to preserve and promote the enjoyment of the varied scenic, historic, natural and cultural qualities of the A.T. as it passes through 14 states, six National Parks, seven ecoregions, eight National Forests, six other Inventory and Monitoring Program networks and numerous state parks and forests. In its role as the lead network for A.T. monitoring, NETN has committed to work with and engage the other networks, parks, and agencies to accomplish the Trail's monitoring goals.

A.T. as a Mega-Transect

In 2000, a small group of scientists, policy makers, and land managers met to discuss using the A.T. as a scientific "mega-transect" for monitoring the environmental health of the eastern United States.

The concept was revisited several times in subsequent years and in 2006 NETN, the ATPO, and the ATC co-hosted a symposium to discuss using the A.T. as a natural resource monitoring laboratory.

In broad terms, the goals of the mega-transect are:

- **Monitor** – Collect and synthesize existing and new data on key indicators of environmental health from agencies, organizations, researchers, and citizen scientists
- **Understand** – Transform status and trend data into knowledge through analysis, synthesis, and modeling
- **Inform** – Provide early warning of undesirable conditions or trends, such as climate change, as a means of better protecting the resources and reducing costs of management
- **Engage** – Share knowledge by engaging, educating, and involving decision makers, stakeholder organizations, and citizens

To learn more about the A.T.'s vital sign monitoring program and its use as a mega-transect, download a copy of the report from NETN's Reports and Publications webpage. *TT*



Exotic species, such as bush honeysuckle, are unwelcome residents of many NETN parks. NPS photo.

Forest, from page 4.

lower than expected for late-successional hardwood stands. Invasive exotic species are present, but do not appear to be greatly impacting understory diversity or forest structure. Large buffers of intact forest surround most of the park boundary, and there is only minor anthropogenic land use near forest plots. Soil chemistry data indicate potential impacts of atmospheric deposition, including soil acidification and excess soil nitrogen. As long as park management efforts continue to control invasive exotic plants, and exotic pests (especially hemlock woolly adelgid) do not invade here, forest health should continue to improve with time.

Saratoga National Historical Park

Despite supporting the most diverse understory in the network, preliminary data suggest that invasive exotic species and possibly elevated deer densities and exotic earthworms are impacting forest condition. Exotic shrubs, particularly bush honeysuckle, have invaded large areas of the park, and are suppressing forest succession of old-field habitats. Emerald ash borer poses a considerable threat to these early successional habitats, as white ash is one of the only tree species with seedlings capable of penetrating the thicket and forming a canopy. Forest habitat is considerably fragmented by fields and roads inside the park boundary, and agricultural lands dominate the area outside of the park boundary. Habitat fragmentation may have contributed to the spread of invasive exotic species in the park, and it appears that exotic shrub thickets are maintaining habitat fragmentation by inhibiting forest succession.

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Appalachian views. Kristen Du Bruyne photo.

Worms, from page 4.

Canada. All common bait worms are non-native species, including those sold as “night crawlers,” “Canadian crawlers,” “leaf worms,” or “angle worms.” Invasive earthworm species can also be spread through composting kits used by gardeners.

Northern hardwood forests developed in the absence of earthworms. Relative to agricultural and urban/suburban soils, earthworm-free hardwood forests have a naturally loose soil with a thick “duff” layer. Without worms, fallen leaves decompose slowly, creating this spongy layer of organic matter. The duff layer not only helps prevent soil erosion but is the natural growing environment for many native woodland wildflowers, hardwood forest tree seedlings, and ferns. *Lumbricus terrestris* is an “anecic” worm - that is, it forms and resides in temporary deep burrows coming to the surface only to feed on the duff layer, as opposed to burrowing through the soil for its food as most other earthworm species do. While earthworms do an excellent job of recycling nutrients in more urban environments, in forest settings they can completely eat away the duff layer and native plant seeds that germinate there and depend upon it for nutrients and protection from harsh winters, like trillium, mayflowers and wood anemone, may disappear. Big trees survive, but many young seedlings perish. In areas heavily infested by earthworms, soil erosion and leaching of nutrients may reduce the productivity of forests and ultimately degrade fish habitat. Earthworms also increase the compaction of hardwood forest soils by turning the spongy humus into denser, mineral soil. Compaction decreases water infiltration which combined with the removal of the duff and fallen tree leaves results in increased surface runoff and erosion. Other creatures that live in the duff and forest litter like salamanders and ground-nesting birds can be affected as well. Within a decade or two, invasive worms are capable of changing the soil profile into something like the black mineral-rich soils that are found in many European forests.

According to a recent article in *Conservation Biology*, earthworm invasion could also be a driving factor behind the spread of invasive plants in northeastern forests. The study was conducted in woodlands that had areas with little-to-no invasive plants as well as areas with invasives such as garlic mustard, Japanese barberry, and Japanese Stilt Grass. Research showed that earthworm biomass was less in the areas with native plant cover and greater in the areas with non-native plant cover. If this result can be expanded to other plant invaders of northeastern forests, it implies that controlling exotic earthworms not only helps native plants directly but could help prevent future invasions of exotic plants. It may also imply that controlling invasive

plants without controlling earthworms may accomplish little in the long run.

So how do we help contain the spread of these wily worms? Invasive worms, like most invasive pests and many of the world’s most widespread species—such as pigeons, rats and cockroaches— have humans to thank for their spread and proliferation. You may have noticed worms are not the speediest of creatures, and without people moving them around, they spread only about a half mile over a 100 year period. If humans stop introducing them, earthworm-free areas can stay that way for a long time. Currently there are many other nonnative earthworm species available for sale that could have even more harmful effects on our forests. Even in areas with earthworms already present, introducing any of these other species would be a bad idea. The increasingly popular non-native “red wiggler” earthworms that are sold and shipped all over the country for home compost piles and vermicomposting (worm composting) operations have difficulty surviving most northern winters. However, if they or other species are able to survive winter and escape from compost piles they could further harm native forests. If you have a compost pile in a forested area, do not introduce additional non-native earthworms. The following are more steps you can take to prevent the further spread of earthworms in our forest:

- Don’t dump your worms in the woods.
- Dispose of unwanted bait in the trash.
- Tell others about invasive earthworms.
- If you practice vermicomposting, before using the compost, freeze it solid for at least 1 week (a month is better). This kills the earthworms as well as their egg cases (cocoons) which are often more tolerant of drying and freezing than the earthworms themselves.
- Do not transport leaves, mulch, compost or soil from one place to another. *TT*



Forest, from page 5.

Forested systems in most NETN parks are relatively young, and are likely to fall short of desired levels of CWD and snags for some time. As long as forests are left to mature these important forest features are expected to improve with time. Results also suggest that forest conditions in most NETN parks could benefit from management actions such as reduction of white-tailed deer populations, and eradication and/or control of invasive species – especially exotic shrub species. Early

detection of exotic forest pests and plants combined with rapid response control measures are important to maintaining forest condition. In addition, forest health in these parks may be negatively affected by soil chemistry problems stemming from atmospheric deposition. To get much more detailed information for each park, visit NETN’s website and go to the Monitoring/ Forest Health page to download the report in its entirety. *TT*



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