



# Monitoring in the Context of Climate Change

## Status and Trends

The Northeast Temperate Network (NETN) has many ongoing and expanding monitoring, data management, and other projects with well established metrics important for tracking the current and future effects of climate change. NETN is working with the Northeast Coastal and Barrier Network and the National Capital Region Network to develop a work plan for enhanced coastal monitoring in NETN park units that are also part of the North Atlantic Landscape Conservation Cooperative (Acadia NP, Boston Harbor Islands NRA, and Saugus Ironworks NHS). The plan is on-track to be finished by late fiscal year 2010.

## Highlights and Accomplishments

### WATER QUALITY AND QUANTITY MONITORING

Fresh and saltwater habitats are diverse and productive ecosystems providing habitat for aquatic plant, invertebrate, and vertebrate species. Water resources in the temperate northeast are projected to be profoundly influenced by climate change. Long-term projections for water temperatures indicate a substantial range reduction for some cold-water fish species due to increasing water temperatures, and projected sea-level rise will greatly alter intertidal, salt marsh,



Rocky intertidal monitoring in Acadia. NPS photo

and estuarine habitat. Water resource related monitoring parameters in NETN parks include:

- Timing and quantity of flows at continuous stream / river gauging stations in Acadia NP and Saugus Ironworks NHS.
- Rocky intertidal monitoring with sea-temperature loggers and vertical transects to document shifts in zonation in Acadia NP and Boston Harbor Islands NRA.
- Developing a freshwater wetland monitoring program that includes temperature and water-level loggers (Parks TBD).
- Developing a salt marsh monitoring program that will document shifts in marsh area with sea-level rise in Acadia NP, Boston Harbor Islands NRA, and Saugus Ironworks NHS.

### FAUNA AND FLORA MONITORING

As changes in temperature continue to affect distribution and quality of plant and wildlife habitat in both the interior and coastal regions of the northeast, careful and accurate monitoring of key species will



Monitoring rare plant species, like the Gray's Lily which grows along some southern portions of the Appalachian Trail, will help park scientists track changes in climate. Photo: Jim Dollar

provide vital data on the ways ecosystems are being affected by climate change. Monitoring projects include:

- Tracking presence and relative abundance of forest (most parks), grassland (Saratoga NHP), mountain (Appalachian NST), and coastal (Boston Harbor Islands NRA) breeding bird species.
- Developing protocols to monitor freshwater wetland vegetation (Acadia NP) and amphibians in vernal pools (Marsh-Billings-Rockefeller NHP).
- Forest health metrics including tree growth, mortality, regeneration, and understory species presence/abundance. In addition, rare plant species and community monitoring along the Appalachian Trail will detect changes in known occurrences.

### PHENOLOGY MONITORING

Phenology is the study of periodic plant and animal life cycle events and how they are influenced by seasonal and inter-annual variations in climate, and is a key indicator of the pace of climate change. NETN has partnered with the USA National Phenology Network, Appalachian Mountain Club, University of Vermont, Harvard University, and others to develop methods for monitoring phenology that could be used in areas beyond NETN parks. Other phenology related projects and events in the network include:

- Pilot phenology monitoring began in 2009 at Acadia, Appalachian NST, and Boston Harbor Islands NRA, and will be expanded to other parks in 2010. Volunteers observed phenophases of target species of plants and animals.
- NETN and partners are developing a multi-method phenology monitoring protocol. The protocol will feature observational, acoustic, and photographic data, often collected by citizen scientists with appropriate levels of quality control. The protocol



*Shifts in climate will have dramatic impacts on migratory animals, such as the ruby-throated hummingbird. Photo: Ed Sharron*

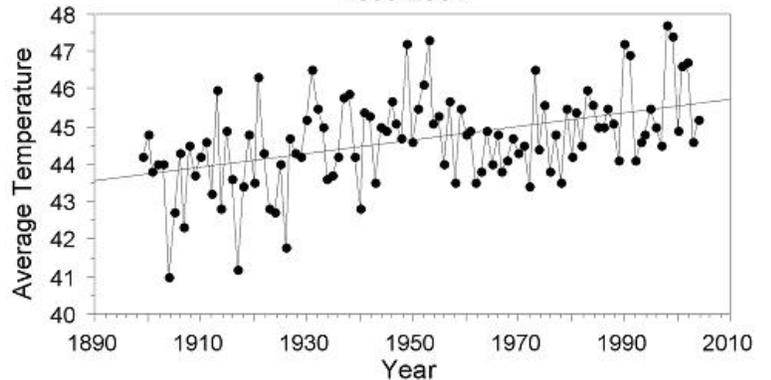
should be suitable for implementation nation-wide, and this work will be accelerated thanks to USGS Status and Trends funding starting in 2010.

- NETN staff will moderate an oral session on phenology monitoring at the Ecological Society of America meeting in 2010. Several of the presentations will be related to NETN climate change monitoring activities.
- NETN and Marsh-Billings-Rockefeller NHP are collaborating with local teachers to produce a middle school and high school curriculum about phenology.

### APPALACHIAN TRAIL MONITORING

The NASA-funded Appalachian Trail Decision Support System will integrate remote sensing of phenology with on-the-ground forest monitoring plots within a framework that supports structured decision making. The ground-based plots, in up to 10 mid-to-high elevation watersheds, will be established in 2010 and 2011. If long-term monitoring funds can be secured, the plot system will function in concert with the remotely sensed data to document shifts in species phenology and elevational distributions along the entire east coast of the United States.

### New England Annual Average Temperature 1899-2004



*New England's average temperature has continued to rise steadily over the past century (source: New England Climate Change report).*

### More Information

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#### Links & Resources

Northeast Temperate Network: [www.science.nature.nps.gov/im/units/netn/](http://www.science.nature.nps.gov/im/units/netn/)



#### Northeast Temperate Network

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