Partially frozen Pogue Pond at Marsh-Billings-Rockefeller NHP. Ed Sharron photo.

Weather & Climate Monitoring

Northeast Temperate Network

Program Brief

Climate impacts related to human activities are being felt across the planet, and the Northeast is no exception. Since 1970 the annual average temperature in the Northeast has increased by 2°F, with winter temperatures rising twice as much. This warming has resulted in many other climate-related changes, including more summer days with temperatures above 90°F, more winter precipitation falling as rain, earlier snow melt resulting in earlier peak river flows, and rising sea surface temperatures and sea level in coastal states.

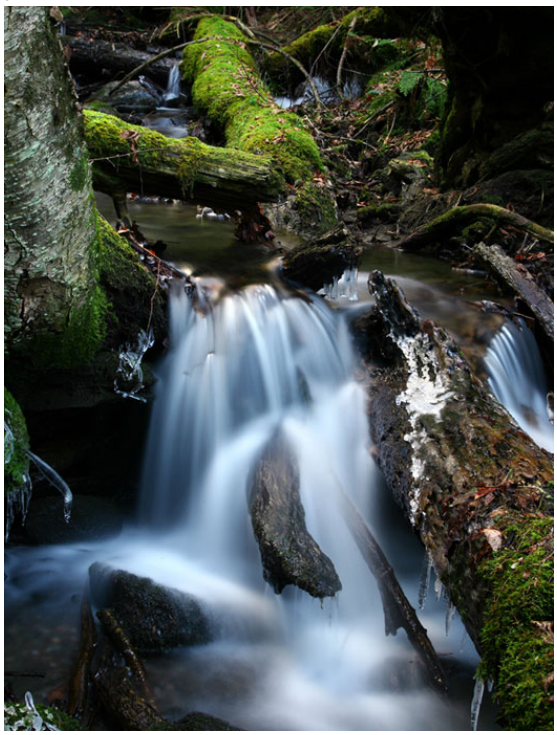
Right: Winters are becoming shorter, warmer, and wetter in the Northeast. NPS photo.

Why monitor the weather and climate?

Climate drives all aspects of Earth's weather/hydrologic systems, such as precipitation, snow, ice, and permafrost, which in turn affects plant and animal life and natural processes such as fire, phenological cycles, and the severity of weather events.

A warm atmosphere holds significantly more moisture than a cool one. Depending on weather conditions, much of this moisture eventually makes its way to the earth in the form of rain or snow. Heavy downpours have increased in frequency and intensity in the Northeast, where a 71% increase in the amount of precipitation falling in very heavy events (defined as the heaviest 1% of all daily events) has been documented over the period spanning 1958 to 2012.

Below: Hydrologic communities, such as Marsh-Billings-Rockefeller NHP's Pogue Brook, are expected to be influenced by changing summer and winter temperatures. Ed Sharron photo.



How is the monitoring done?

NETN has many ongoing and expanding monitoring, data management, and other well-established projects that are important for tracking the current and future effects of climate change.

Historic & Current Weather Data

NETN compiles decades of climatic data for network parks. Data for all units show that temperatures have increased in the Northeast, and often the amount of precipitation has changed.

Freshwater Monitoring

Freshwater habitats are diverse and productive ecosystems providing homes 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 indicate a substantial range reduction for some cold-water fish species due to increasing water temperatures. The network's ongoing water quality and quantity monitoring will continue to provide valuable data on hydrological changes in network parks. Current and developing projects include adding continuous stream / river gauging stations in Acadia NP and Saugus Ironworks NHS, installation of continuous water level, temperature and conductivity sensors at many pond and stream sites, and freshwater wetland monitoring at Acadia NP in collaboration with the EPA.

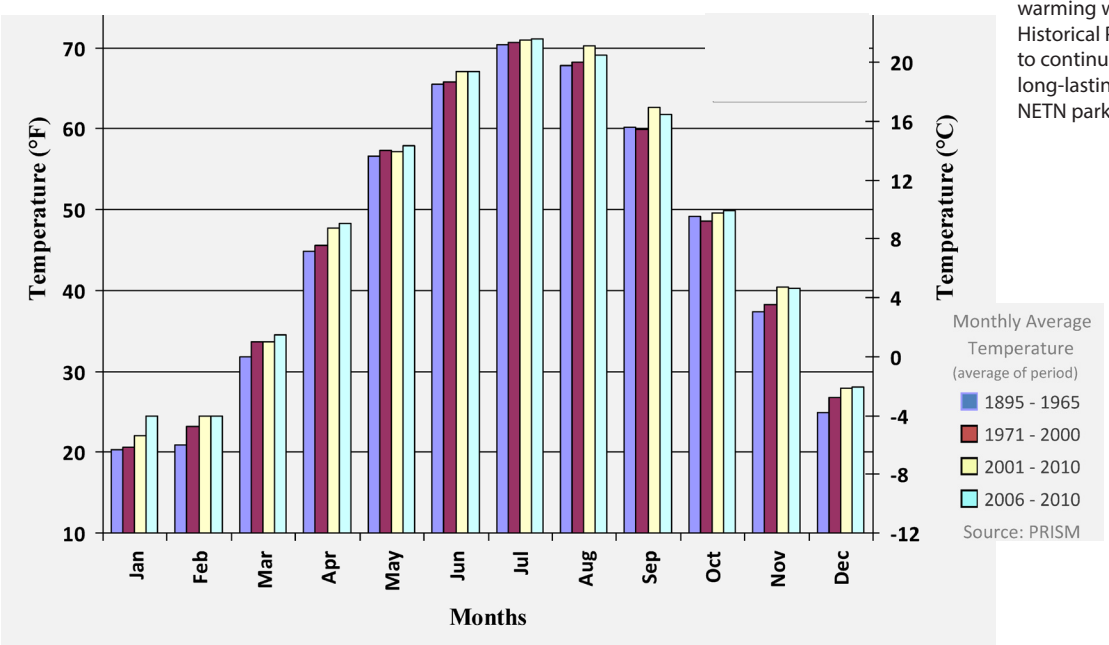
Coastal & Saltwater Resources

With a warming climate comes sea level rise, creating the potential for the submergence of salt marshes and the loss of coastal habitat. There is increasing evidence in the northeastern U.S. that some marsh sites may already be at the early stages of wetland submergence and projected sea-level rise will greatly alter intertidal and estuarine habitat.

Coastal monitoring strategies being implemented by NETN include:

- In collaboration with Northeast Coastal and Barrier I&M Network (NCBN), USGS,

Saratoga NHP temperature Trends. 1895 - 2010



Left: This temperature graph shows a clear trend of warming winter temperatures for Saratoga National Historical Park over the last century. This trend is expected to continue into the foreseeable future and with have long-lasting impacts on all ecosystem in this and all other NETN parks.

NOAA, and the Southeast Coast I&M Network, Surface Elevation Table (SET) and Marker Horizon Method monitoring programs were initiated at Boston Harbor Islands NRA and Acadia NP in 2009 and 2010.

- The rocky intertidal monitoring program at Boston Harbor Islands NRA and Acadia NP includes sea-temperature loggers, vertical transects for documenting shifts of cover species, zone-specific photo plots for monitoring cover vegetation and snail species abundance, annually scraped plots for tracking barnacle recruitment, and tidepool transects for documenting sea star and sea urchin abundance.
- Salt marsh vegetation monitoring based on NCBN's draft protocol began in brackish marshes at Acadia and Boston Harbor Islands in 2010.

Fauna & Flora Monitoring

Heat stress and decreased soil moisture related to a warming climate will likely negatively affect the productivity of several tree types in the Northeast. Common northeastern stalwarts such as maple, birch, and beech as well as spruce and fir trees could experience a significant northward shift in their growing region. Careful and accurate monitoring of key species will provide vital data on the ways ecosystems are being affected by climate change. Monitoring projects include:

- Since 2006, tracking presence and relative abundance of breeding bird species in forest (most parks), grassland (Saratoga NHP), coastal (Boston Harbor Islands NRA), and mountain (Appalachian NST) habitat.
- Since 2011, monitoring Acadia NP freshwater wetland condition at 10 intensive index sites (in collaboration with EPA) and 40 randomly located rapid assessment sites.
- Since 2006, monitoring forest health in network parks. Data gathered includes 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.
- Since the late 1990's, the U.S. Forest Service (USFS) Forest Inventory and Analysis program has installed nearly 4,100 sampling plots near the Appalachian Trail. This collection of plots is part of a national network that the USFS uses to report on things such as tree health, growth, and mortality.

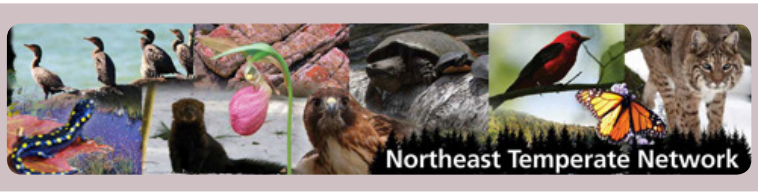
Phenology Monitoring

Phenology is the study of periodic plant and animal lifecycle 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 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. The monitoring protocol was completed in 2013, and current phenology-related projects and events in the network include:

- Staff or volunteers can visit known plant individuals or locations regularly to record current phenophases of target species.
- Time lapse cameras or webcams can be used to photograph plants or forest stands and the resulting photos analyzed to determine phenophases of target species.
- Audio recorders collect data on vocal phenology of breeding birds and amphibians.
- In 2010, NETN and Marsh-Billings-Rockefeller NHP collaborated with local teachers to produce a middle school and high school curriculum about phenology.

More information:

For access to climate-based resource briefs and other monitoring efforts - visit NETN's website and click on the Monitoring / Weather and Climate links. You can also "like" NETN on Facebook where you can view pictures and time lapse videos of monitoring crews in the field and stay abreast of all NETN monitoring activities.

Northeast Temperate Network
54 Elm Street
Woodstock, Vermont 05091
802-457-3368
http://go.nps.gov/netn

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