



ALLEGHENY PORTAGE RAILROAD NHS • BLUESTONE NSR • DELAWARE WATER GAP NRA •
FORT NECESSITY NB • FRIENDSHIP HILL NHS • GAULEY RIVER NRA • JOHNSTOWN FLOOD NMEM •
NEW RIVER GORGE NR • UPPER DELAWARE SRR

Monitoring in the Context of Climate Change

The Eastern Rivers and Mountains Network is composed of nine parks in Pennsylvania, West Virginia, New York, and New Jersey. The parks range in size from approximately 66 to 30,000 hectares and consist of a mosaic of forested hillsides and floodplains, streams and rivers, talus slopes and cliffs, vernal pools and wetlands, open fields, and agriculture. Together, these parks encompass roughly 60,000 hectares of land area, more than 636 miles of streams and rivers, and host roughly 7 million visitors each year. The parks that were formed around rivers contain some of the most significant water resources and water-based recreational activities in the National Park system.

Relevant Monitoring

Under all modeled climate change scenarios, we expect to see a variety of change across all Eastern Rivers and Mountains Network parks. Though not established specifically to monitor ecosystem responses to climate change, vital signs monitoring will look for patterns consistent with predicted climate change effects on park ecosystems, including alterations in weather and climate patterns, changes in water quality and quantity, and long-term effects on a variety of plant and animal communities.

WEATHER AND CLIMATE

Weather and climate are dominant factors that drive physical and ecological processes. Climate change in the Northeast and Mid-Atlantic is predicted to result in increased summer temperatures, milder winters, variations in quantity and timing of rainfall, and increased frequency and severity of weather related disturbances such as drought. The Eastern Rivers and Mountains Network is monitoring weather and climate for all network parks. Because most parks do not have weather stations on-site, data are drawn from a wealth of cooperative weather stations surrounding each park.

WATER QUALITY AND QUANTITY

Water resources in the Eastern Rivers and Mountains Network range from a multitude of small, cold, headwater streams to some of the largest and oldest rivers in the United States. These systems support diverse flora and fauna that are uniquely adapted to specific habitats. Temporary water bodies such as vernal ponds and intermittent streams provide critical breeding and nursery habitat for numerous amphibian and invertebrate species. Unfortunately, many water bodies throughout the network are already negatively impacted by local, historical and ongoing human activities.



New River Gorge National River: the New River is one of four American Heritage Rivers in the country. Photo Credit: Stephanie Perles

Climate change is expected to raise average annual water temperature of water bodies and increase the incidence of extreme events (e.g., drought and floods). These changes are expected to exacerbate negative effects of current stresses on aquatic systems. Network monitoring includes:

- Core water quality data (temperature, pH, dissolved oxygen, specific conductance) that affect environmental and human health at 80 sites throughout the network.
- Collaboration with park staff and other agencies (e.g., Delaware River Basin Commission) as part of an ongoing, long-term water quality monitoring program at 46 sites on the Delaware River and its tributaries.

TERRESTRIAL VEGETATION AND FAUNA

If the predicted changes in climate occur, we may see a modification in the range and distribution of plant and animal species and communities. Altered disturbance regimes may also increase the spread of invasive exotic plants, pests, and pathogens. Network monitoring includes:

- Forest health metrics including tree growth, mortality, and regeneration; understory species presence and abundance; and standing and coarse woody debris.
- Early detection of invasive exotic plant and animal species that will affect the ecological integrity of forest systems.
- Rare riparian plant communities to detect changes in known occurrences.
- Tracking the presence and distribution of Louisiana waterthrush and other bird species that occur along streams in the network parks.



Forest vegetation monitoring at Delaware Water Gap NRA. Photo Credit: Stephanie Perles



Streamside bird monitoring at New River Gorge NR. Photo Credit: Brady Mattsson.

AQUATIC FAUNA

Predicted increases in water temperatures are expected to further limit the distribution and abundance of cold-water adapted organisms such as brook trout. Moreover, extreme hydrologic events that are expected to result from climate change will favor the establishment and spread of non-native and invasive aquatic species.

Benthic macroinvertebrates (BMI) are being monitored at 80 sites throughout the network. BMI communities are the most commonly used biological assemblage to assess and monitor the condition of the nation's fresh water ecosystems. Because of their relatively brief life cycles, BMI communities respond more quickly and predictably to environmental perturbations (e.g., increased water temperature) than vertebrates such as fishes and amphibians.

Network Collaboration

Addressing climate change within the Eastern Rivers and Mountains Network will depend on effective enhancement of scientific understanding and collaboration with other networks and agencies such as the U.S. Fish and Wildlife Service's Landscape Conservation Cooperatives (LCCs).



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