



# Amphibian Research and Monitoring Initiative

## Understanding Amphibian Populations in the Northeastern United States

Currently, 90 amphibian species are recognized in the Northeast, including 59 species in the Order Caudata (salamanders) and 31 species in the Order Anura (frogs and toads). Almost half of the amphibians in the Northeast are salamanders within the family Plethodontidae. Amphibians are found in all physiographic regions of the Northeast, from sea level to the heights of the Appalachian, Adirondack, and White Mountains. The endangered Shenandoah salamander (*Plethodon shenandoah*; inset) is a focal species in the central Appalachians.

**Worldwide recognition of declining amphibian species and populations** has led the Department of the Interior (DOI) to establish the Amphibian Research and Monitoring Initiative (ARMI). This program of amphibian monitoring, research and conservation began in 2000. The U.S. Geological Survey (USGS), the science and research bureau for DOI, was given lead responsibility for planning and organizing the program in cooperation with the National Park Service, Fish and Wildlife Service, and Bureau of Land Management.

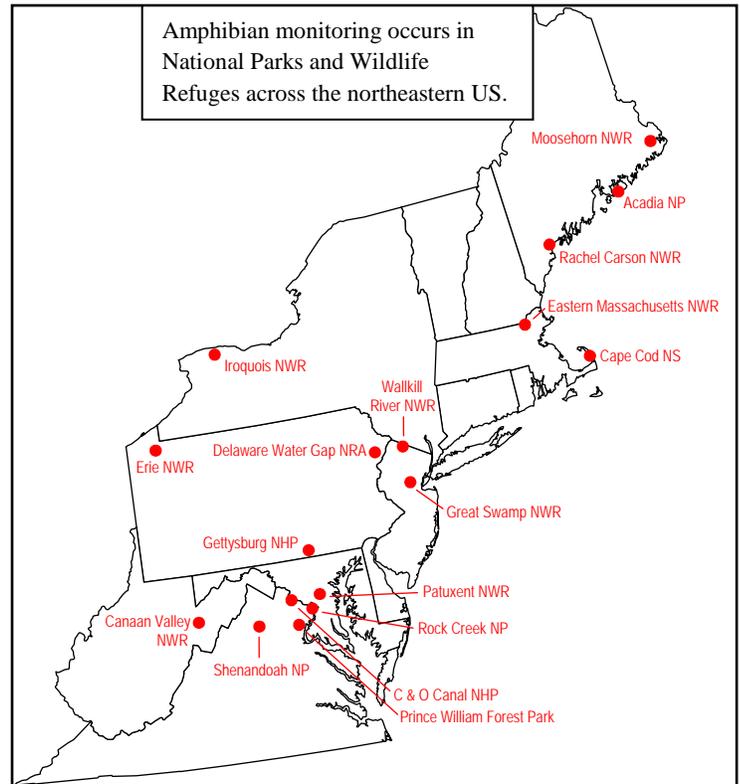
**Monitoring** studies at a moderate number of parks or refuges across the region where amphibian habitats are sampled and inferences drawn about the occurrences of select species within the area. The state variable of interest is the probability of occupancy.

### Mapping and monitoring amphibian breeding habitats

The loss of small, seasonal wetlands is a major concern for state, local, and federal organizations in the northeastern US. Identifying and estimating the number of vernal pools within a given region is critical to developing long-term conservation and management strategies for these unique habitats and their faunal communities. Ideally, any program whose goals are to conserve, monitor, and protect vernal pool habitat would utilize a sampling method that: 1) identifies and locates a subset of vernal pools (i.e., a sample) from which an unbiased estimate of the total amount of vernal pool habitat can be obtained, and 2) serves as a representative sample from which inference can be made about the status of vernal pool-breeding species.

### Developing a monitoring program for amphibians in The National Capital Region (NCR) Network

Amphibians are a priority taxonomic group for the National Parks Service Inventory and Monitoring program. The goals of this program are to determine whether the integrity and status of amphibian populations are changing over time. Amphibian monitoring was initiated in 2005, and is currently concentrated in Chesapeake and Ohio Canal National Historic Park and Rock Creek Park, with stream sampling also occurring in Prince William Forest Park.



**PARTNERSHIPS:** Research and monitoring is often in collaboration with other scientists, including colleagues from other USGS science centers, professors and students (Towson University, University of Maryland, University of Montana), resource managers at federal agencies (Park Service, Fish and Wildlife Service).

Wood frogs (*Lithobates sylvatica*), Southern leopard frogs (*L. sphenoccephala*), and spotted salamanders (*Ambystoma maculatum*) are wetland-breeding amphibians which are part of the northeast ARMI monitoring program. Long-term studies on occupancy, abundance, and dispersal of the stream-associated northern dusky salamander (*Desmognathus fuscus*) will help understand the impacts of climate and landscape change on stream amphibian populations.



**Research** projects are detailed investigations of specific factors which may affect the distribution or abundance of amphibians, and are conducted in National Parks or National Wildlife Refuges. Two areas of research interest are in understanding how animals move within stream networks, and how to identify the best management alternatives for amphibian populations and habitats.

### Headwater Stream Management across Multiple Agencies

Headwater stream ecosystems are especially vulnerable to changing climate and land use, but their conservation is challenged by the need to address the threats at a landscape scale, often through coordination with multiple management agencies and landowners. Climate change is expected to reduce precipitation (shifting habitat to lower elevations) and increase temperatures (shifting appropriate habitat to higher elevations), creating a habitat squeeze for headwater stream species such as brook trout and stream salamanders. This project seeks to be an example of cooperative landscape-scale decision-making to address the conservation of headwater stream ecosystems in the face of climate change. USGS biologists will work closely with stakeholders and resource managers from USFWS, NPS, and USFS to facilitate the decision process among agencies and develop decision support tools (like predictive models of headwater habitat and species responses). Agencies can then use these tools to design long-term management strategies for headwater ecosystems, taking account of climate change and its uncertainty.

### Morphological variation of *Plethodon shenandoah* and *Plethodon cinereus* in Shenandoah National Park

In order for resource managers at Shenandoah National Park to implement long-term monitoring for the federally-endangered Shenandoah salamander, *Plethodon shenandoah*, absolute certain identification of the species in the field is critical. Researchers have observed wide variation in color morphology of a similar species, *Plethodon cinereus*, in the park, particularly when comparing high elevation areas with other, lower elevation sites. The possibility of misidentification presents a major concern for research and monitoring efforts. We will incorporate genetic verification with field-based species determination based on a suite of morphological characters, allowing us to estimate the probability of misidentification in previously collected data, as well as develop methods to account for and reduce the probability of these errors in future research and monitoring efforts.



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