



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.

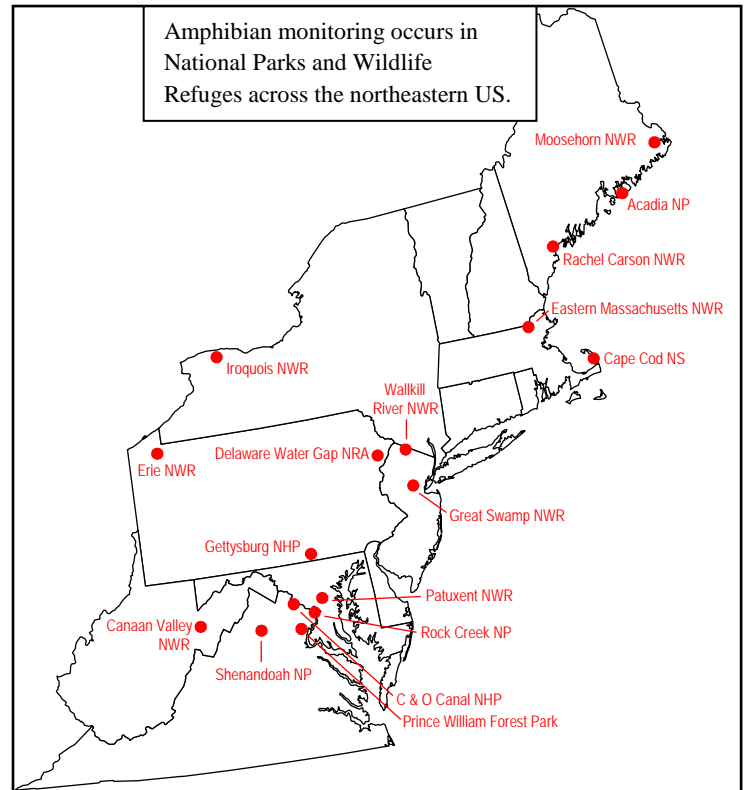
Monitoring studies at a moderate number of parks or refuges across the region where amphibian habitats are sampled and inferences drawn about the occurrences of select species within the area. The state variable of interest is the probability of occupancy.

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.



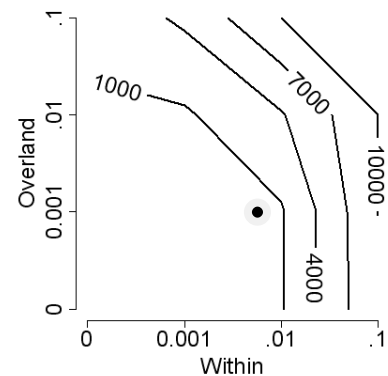
Wood frogs (*Lithobates sylvatica*), Southern leopard frogs (*L. sphenocéphala*), and spotted salamanders (*Ambystoma maculatum*) are wetland-breeding amphibians which are part of the northeast ARMI monitoring program. Long-term studies on occupancy, abundance, and dispersal of the stream-associated 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.

Dispersal in complex networks

Stream ecosystems have been dramatically influenced by land-use change and habitat loss that has resulted in the loss of entire tributaries or the fragmentation of stream reaches within a watershed. In stream networks in Shenandoah National Park, VA, we followed marked salamanders to describe the dispersal between different streams. We found that the observed dispersal may be a mechanism for persistence of stream salamander populations. These discoveries fill a critical gap in our understanding of the population dynamics of amphibians, helping to explain why one group of amphibians may be persisting when so many species are declining worldwide.



Managing Habitat for Amphibians

Monitoring programs worldwide focus on estimation of trends in populations, often with an implicit expectation that identification of a trend will result in smart decisions as to how to respond (via management). In three ongoing projects (funded by the USGS Amphibian Research and Monitoring Initiative, the National Park Monitoring Program, and the National Park Service), we are linking amphibian monitoring data directly to management by following a structured approach to decision making. These projects involve working closely with biologists from USGS and academic institutions, resource managers from FWS and the NPS, and other stakeholders, including The Nature Conservancy. Notably, these collaborations will result in better-informed management, elucidate the links between local and regional stressors and amphibian population response, and provide more robust inference for amphibian population change throughout the northeastern United States.

Using data on marked individuals, northeast ARMI researchers were able to understand how the observed movements (within a stream and overland between streams, black point in below graph) can increase the number of years a population can avoid local extinction.



Under projections for climate change in the northeastern United States, vernal pools are at particular risk for early drying. These habitats may need active management to maintain populations of amphibians which rely on vernal pools for breeding.

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