



## Road De-icing Salt and Amphibians: Assessing Impacts on Demography and Ecological Genetics

### Environmental Issue

- De-icing agents are applied to roads in 26 states annually

-average annual rates range from 0.3 in Idaho to 19.4 tons/lane-mile in Massachusetts

-sodium chloride is the principal agent, due to its low cost

-runoff from road salt has been shown to reduce abundance of invertebrates in streams and lakes, decrease biomass of wetland plants, and contaminate public drinking water supplies

- Amphibians may be useful indicators of ecosystem health

-amphibian populations are declining globally, and causes include habitat loss, introduced species, pet trade, disease, climate change, and chemical contaminants

-little previous research has examined the impacts of road salt on vertebrate species

-due to their physiological constraints and presence in many environments, amphibians may be useful indicators of ecosystem health and, thus, good models with which to investigate the effects of road salt on the environment



### Scientific Approach

- Hypothesis: Road salt affects the distribution, growth, and survival of native amphibians



- Research Plan:

Determine the distance that road salt travels from roads as runoff

-monthly salinity measurements will be taken over 2 years in 50 ponds located at different distances from a major highway

Quantify the size of amphibian populations breeding in roadside and forest ponds

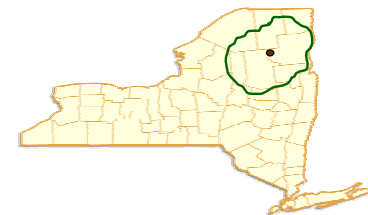
-surveys will be conducted during each breeding season  
-reproduction will be compared between pond types

Assess the impacts of road salt on growth and survival of amphibians

-amphibian eggs and tadpoles will be subjected to saline water in field and laboratory experiments  
-growth, survival, and incidence of deformities will be recorded

Determine if adaptation is occurring

-eggs will be transplanted between roadside and forest pools to assess different species' capacities to adapt to road salt



Adirondack Park (outlined in green) in New York is the largest publicly protected land in the contiguous US. The study area (indicated by brown dot) is located in the central Adirondack region.

### Impact

- Preliminary data (2004)

-pilot research indicated that road salt: (1) traveled at least 550 ft (170 m) from roads and into wetlands; (2) significantly reduced survival of wood frogs and spotted salamanders, but not green frogs; and (3) caused deformities in all three species

Spotted salamanders exposed to road salt developed curvature of the spine



- Implications for Environmental Health

-roads and highways influence ecological processes on 20% of the land area of the US, including wetlands  
-based on the findings of this research, efforts may need to be made to reduce use of road salt near sensitive wetlands  
-reduced road salt use in these areas may help to maintain the native biota, reduce the spread of invasive plants, and improve the quality of drinking water