

HOW DO DIFFERENT TYPES OF POLLUTION AFFECT WOOD FROG POPULATIONS?

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Background

- Both nuclear and coal powered energy plants produce by-products that pollute the local and global environments. The common types of pollution associated with nuclear, and coal powered energy are thermal and air respectively (Cleveland, 2004) & (EIA, n.d.).
- The Great Swamp National Wildlife Refuge borders an Asbestos Dump Superfund Site on two sides (Great Swamp National Wildlife Refuge). Exposure to asbestos in both humans and wildlife can lead to carcinogenesis and fibrogenesis (Holt, 1974).
- Because of their biphasic life style and semi-permeable skin, amphibians, particularly frogs, make good indicator species (Waddle 2006).
- In the case of New Jersey, wood frogs are a good species to focus on as they are found all over the state (Gessner, 2001).

Motivations

- While the impacts of power plants and industry on human and atmospheric health are well researched, there is limited research on the impacts to wildlife and wildlife population sizes. This can be significant for endangered and threatened species, as well as conservation initiatives.
- We propose to study the effects of different types of industries on the population size of wood frogs, an indicator species of ecosystem health

Hypothesis

We hypothesize that there is a relationship between wood frog population size and exposure to pollution, as well as pollution type.

Predictions

- We predict that wood frog population size in areas exposed to pollution (i.e. the coal plant, nuclear plant, and industrial superfund site) will be smaller, or decreased, from wood frog populations in conservation areas (Fig. 1).
- Specifically, we predict that coal plants, because of their wide range of pollutants, will have the most detrimental effect on wood frog population sizes, and the ecosystem as a whole.

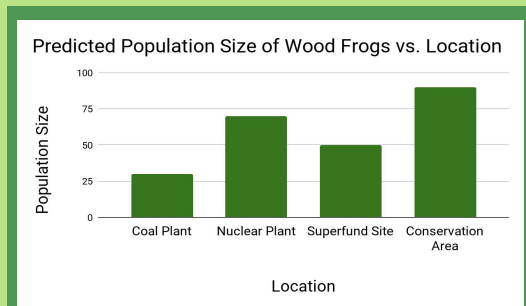


Figure 1. Our predictions of woody frog population sizes as they are exposed to various pollutants.

Study Design

- We will conduct a mark-and-recapture field study at each of our chosen sites (all in New Jersey), which each represent a different type of pollution. The sites are Salem Nuclear Power Plant (nuclear), Carney's Point Cogen Plant (coal), Great Swamp National Wildlife Refuge (located next to a Superfund site), and Warren Grove Conservation Area (control).

Study Design

- We will mark a random sample of frogs in 3 randomly-selected frog habitats at each study site to rule out anomalies, and then return a week later to recapture another random sample of frogs at the same locations. We will repeat this process 2 more times during different times of year to account for seasonal differences.
- We will tag the frogs using a method similar to that photographed below (Fig. 2).



Figure 2. A frog tagged with a small identifying code. We will tag wood frogs for our mark-and-recapture study in a very similar manner. Photo by Brad M. Glorioso (U.S. Geological Survey).

Intended Analysis

- The results of the ANOVA test will help us determine the extent to which wood frog populations respond differently to the three different types of pollution, as well as how drastically the populations differ from the control group. Our inferences will be limited to the study area, the specific polluting centers, and the species of frog.

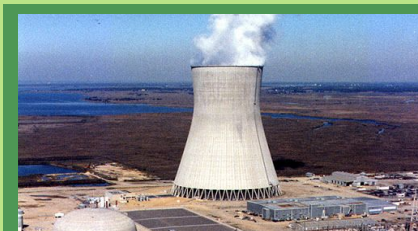


Figure 2. The Salem Nuclear Power Plant in Salem, NJ. The plant is located very close to bodies of water, many of which feed into local wetlands and forests, where wood frogs live. Photo from State of New Jersey, Office of Emergency Management.

Expected Benefits

- Amphibians like frogs are good indicators of environmental health (Amphibians, n.d.). So, it is crucial to understand how frogs react to certain pollutants because these findings can be used to understand broader implications about their ecosystems. For coal and nuclear power, our findings could be evidence supporting/opposing certain types of energy, and it could inform the scientific community on which ecosystems need the most attention in terms of pollution amount and need for conservation.

Intended Analysis

- Because our response variable (wood frog pop.) is continuous and our ind. variable (pollution type: coal, nuclear, Superfund site, and control) is categorical and contains 2+ groups, we will analyze the data collected using an ANOVA statistical test.