

Terrestrial Salamander Monitoring Project at Tremont

A Guide for Teachers and Staff

What is the Terrestrial Salamander Monitoring Project?

This project was established in the summer of 2006 as a long-term study to monitor terrestrial salamanders at Tremont. We used two type of cover boards (or salamander shelters) to attract and survey salamanders: 1' × 1' × 1" pine boards and 3" thick "cookies" cut from dead hardwood logs. We established 4 plots, with 40 boards at each site. The USGS Terrestrial Salamander Monitoring Protocol suggests using the 1' × 1' × 1" boards to attract salamanders, but we **hypothesize** that the "cookies" will attract more salamanders because they should hold moisture better, thereby attracting more salamanders. In the scientific community, cover boards are seen as a non-intrusive way to sample salamanders; however, a major drawback of sampling with cover boards is that many cover boards are needed to achieve an adequate sample size. We hope that our study leads to a more efficient (and less expensive) method to sample salamanders.

The study will also monitor the effect of Eastern Hemlock decline on terrestrial salamanders. Hemlocks are dying because of the **invasive exotic** Hemlock Woolly Adelgid, a type of aphid that feeds on the tree, eventually killing it. Two of our plots are located in hardwood forests with relatively little Eastern Hemlock canopy, while the other two plots are located in forests with >60% hemlock canopy. We hypothesize that the abundance and diversity of salamanders will decline in the short term where the hemlock canopy is denuded, but eventually the abundance and diversity will recover, though the composition of salamanders may change (i.e., salamanders better adapted to hemlock forests will give way to salamanders adapted to hardwood forests).

Why are salamanders important?

Salamanders are important for a number of reasons. They are one of the major predators of terrestrial arthropods, thereby serving as an important vector for energy flow (the salamanders feed on the bugs and, in turn, are fed on by birds, snakes, and small mammals). If you were to weigh all the salamanders in Great Smoky Mountains, they would outweigh all the birds and even outweigh all the mammals found in the park. Because salamanders are cold-blooded, and therefore have a slower metabolism, they can live in relatively high numbers since they don't need to consume as much as warm-blooded birds and mammals. In the Smokies, terrestrial salamanders have small **home ranges** – roughly 1 salamander per square meter of forest. For such small animals, salamanders are relatively long-lived (10 years are more – some high elevation species can live more that 25 years). Because they are long-lived and sensitive to changes in their environment, such as pollution, habitat degradation, and climate change, salamanders serve as important **biological indicators**. If salamanders start to decline, it may indicate that environmental conditions are having negative effects on human health as well. Finally, salamanders are just plain cool – there are 31 species of salamanders that have been found in the Smokies, making the park the salamander capital of the world!

Equipment

- Ruler (scientists use the metric system)
- Zip-lock bags to place salamander for measuring
- Spring scale for weighing salamander
- Data sheet, clipboard, and salamander id key
- Surface Thermometer
- Stopwatch to time soil temperature probe

Directions

- 1) Write the names of the data collectors, school or group name, date, circle the site name, and record the time on the data sheet.
- 2) Once at the site, find the first board (there are 5 columns of 8 boards; the columns are the first number and the board number is the second, so column 3 board 6 would read 3-6). Record the board number.
- 3) Next lift the board so that the board is still between you and what lies underneath (snakes also hide under boards). Catch any salamanders and put them in a bag to be identified, measured, and weighed.
- 4) Take the surface temperature with the laser temperature gauge **in degrees Celsius**.
- 5) Record the soil moisture level (1 = little to no moisture, soil and leaves dry to touch or minimally moist; 2 = moderately moist, though some dry spots; 3 = very moist, soil and litter underneath board wet and glistening).
- 6) Place the board back down and release the salamander next to the board, gently coercing it back under the board. **DO NOT** put the salamander down and then put the board on top of the salamander – you may **mash the salamander!**

Questions to ask students

This Citizen Science project is a good one to talk about hypothesis testing. Ask the students what their hypothesis is regarding the best type of board for sampling salamanders. Ask them if they think that their data collection (one day at 1-2 sites) would be enough to adequately test their hypothesis (A: no – more data is needed to take into account other variables that might be affecting salamander occurrence under the boards).

The students will be taking two types of measurements. When they are taking the soil temperature via the soil temperature probe, they are taking **quantitative** measurements (they are getting an exact number). When they are describing the soil moisture, they are using a **qualitative** measurement (it is still a number, but not a true measurement). What are some drawbacks of a qualitative measurement (A: it is very subjective)? What are some benefits (A: quick and easy)? Ask them how this project could be improved. Also, what other factors would they measure that might affect salamander occurrence under the boards. (A: soil pH, percent canopy cover, percent and composition of herbaceous layer, rainfall in last 24 hrs., ambient air temperature, humidity, number of predators in the area, site history (was the site timbered or once used for farming), amount of leaf litter in the area, distance to nearest natural cover object (downed log or rock)).

This is also a good opportunity to talk about the reality of not catching many salamanders with this project. Boards that harbor no salamanders are just as important as boards that have 10 salamanders under them. It helps us determine what factors (soil moisture, time of year, time of day, temperature under boards) are important for salamanders and helps us determine the best conditions and times to collect salamanders so that researchers can use their time more efficiently. Remember, salamanders spend up to 70% of their time in underground burrows. In hot, dry weather, we may not see salamanders, even under boards where conditions are moister.