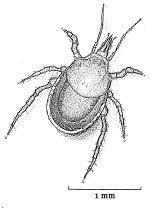
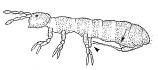
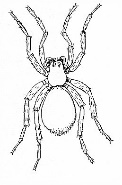
**Leaf litter and soil invertebrates**

**Instructor notes**

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**Summary:**

The diversity of invertebrates occupying the leaf litter and organic layer of soil can be quantified to examine abiotic and biotic questions. This lab can be used as a starting point for a long-term study or short-term activity to examine invertebrates and how they may influence red-back salamander populations.

**Background:**

Terrestrial salamanders have top-down effects on forest floor ecosystems (Best and Welsh 2014; Hocking and Babbitt 2014). They consume invertebrates, which in turn are responsible for regulating the rate of leaf litter decay. Invertebrates affect many ecosystem functions and are highly responsive to climate change (Prather et al. 2013). Increased temperatures may benefit some litter invertebrates by allowing them to expand their ranges and increase their reproduction rates (Rodenhouse et al. 2009; Ladanyi and Horvath 2010). Alternatively, a reduced snowpack layer could increase mortality rates because of its role as an insulator from freezing temperatures at ground level where these invertebrates overwinter (Bale 1991).

**Supporting documents:** Instructor notes, Excel datasheet, Identification guides (4 documents)

**Suggestions for analysis and assessment:**

1. Based on the results of your data analysis, which soil invertebrates occur in greater abundance? Make predictions about the diet of terrestrial salamanders based on the availability of different soil invertebrate groups. Do you predict that they would consume more invertebrates in the classes that are more abundant? Why or why not? Why might they consume invertebrates disproportionately to what is available in the soil?
2. Which plots or treatments have the highest diversity? What might a greater diversity of soil invertebrates indicate regarding the health of the forest ecosystem, soil conditions/characteristics and predator abundance/diversity?
3. Why might there be a high abundance of soil invertebrates in some samples but low diversity? What might this suggest about the ecosystem/plots/treatments?
4. Is there a significant difference in the abundance or diversity of soil invertebrates between control and treatments? What could this simulation indicate about the survivorship/success of soil invertebrates if soil temperatures rise? Are there invertebrate groups that might be more successful than others? What characteristics allow these invertebrate groups to succeed?
5. Is invertebrate diversity a good measure to quantify your biotic/abiotic question(s)? Why or why not? Could you think of another time- and cost-effective study design to address these questions?
6. Are there any plots or invertebrate groups that are outliers? If so, what may be the reason for this?
7. If you were to do the lab again, what would you change to improve the methods?
8. What questions would you be interested in studying next?

# **Suggestions for alterations to methods**

1. If soil is composed primarily of clay or rocks, an alternative sampling method is to collect leaf litter and the top layer of soil within a 20 x 20 cm area, rather than with use of the pvc/metal pipe device.
2. If time does not permit identification of all the invertebrates in the resulting sample, the observers can identify invertebrates in subsamples instead. Gently, but thoroughly mix the sample, then extract a given amount (suggested 10 ml) to identify. Complete at least 4 subsamples per sample to represent the larger sample.
3. Low-cost Berlese funnel set-up: use 2 liter soda bottles, with the bottoms cut off, placed upside down to create a funnel
4. Add collection of temperature data as another aspect of your study. Put I-buttons or Hobo loggers in your plots to examine how temperature may impact invertebrate populations.