PROTOCOL
Branch Beating Insect Collection-Protocol
Teacher Instructions

Many arthropods, such as spiders live on the branches of trees in our forests. Students can assess the relative abundance of mobile tree-dwelling arthropods in a study site near the school and compare it to at least on other site (preferably native).

Objectives

1. Collect, identify, and count all specimens obtained.
2. Calculate statistical significance of specimens collected at different sites.
3. Note findings and write up a scientific style report of findings.
4. Conduct additional experiments or obtain additional data if needed.

Student group size- students in groups of 3 or 4.

Estimated time-Approximately 15 (fifteen) days, 50-55 minute class periods. Time varies dependent on what material has already been covered, age group, etc.

Day 1 - 2

1. Discussion about arboreal arthropods and discuss ecological models.
2. The teacher or teacher/student groups may first want to visit the collection site, but this is optional. (1-2 periods)
3. Map site, design research technique. (1-2 periods)
4. Construct beating sheets. Visit the protocol for assistance.

Day 2 - 3

1. Set up study plot. (Mark and map trees used) (1-2 periods)
2. Instruct on proper use of beating stick, catch basin, and pooters. (1/2 period, can be done in field)

Day 3- 5

1. 1.Beat branches, collect and preserve specimens. (1-2 periods)

Day 4 - 8

1. Identify, sort samples and specimens. (3-4 periods)
2. Enter data, analyze. (2-3 periods)

Day 6 – 15

1. Write up and present findings (conclusion). (1 period)
2. Discuss implications for further research. (1/2-1 period)
3. Revise models of ecosystems, finalize. (1/2 period)

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Student Instructions

Discussion about Ecological concepts: Why study arboreal arthropods?

Arthropods are joint-legged animals with segmented bodies and an exoskeleton. This diverse group is comprised of the insects, arachnids (spiders, mites, and scorpions), crustaceans (shrimp, lobster, crab, etc), millipedes, and centipedes. There are far more species of arthropods than all the other higher order animals put together. Arthropods currently make up 62% of the total known species of all organisms with new species of arthropods continually being discovered.

Whether measured by species numbers, numbers of individuals, or mass of living tissue, arthropods make up the largest, most diverse, and least understood component of most terrestrial ecosystems. Their extreme variety and small size have enabled them to fill virtually every niche available in these ecosystems. Traditionally, forest entomologists have viewed arthropods in terms of their negative impacts on timber production. Less attention has been given to the critical roles they play in the functioning of these ecosystems. Although arthropods live and feed on virtually every part of the plants in terrestrial ecosystems, these same plants also depend on arthropods for their own survival. Aside from serving as agents of pollination and seed dispersal for a large percentage of plants, arthropods are the major force that decomposes dead materials into nutrient rich topsoil needed for plants to grow. Arthropods also serve as the largest prey base for small predators, sustaining other arthropods, amphibians, reptiles, birds, and small mammals, which, in turn, sustain the larger predators. Without arthropods, most terrestrial ecosystems would surely collapse.

So why should science classes study arthropods? For one thing, despite their critical roles in ecosystem functioning and nutrient cycling, a general lack of information about arthropods persists. Student investigations of arthropods could help to fill the gaps in scientific knowledge about invertebrates and the ecosystems they inhabit.

Monitoring the presence or absence of arthropod species with well-known ecologies can also be a useful tool to understanding an ecosystem as a whole. When a species is identified as being closely tied with particular ecosystem characteristics it can be considered an indicator species. There is currently a movement to use arthropod indicator species in public land management practices. However, in order for this practice to be scientifically viable, clearly links between particular arthropod species and certain ecosystem characteristics must be established through the gathering of baseline data. Collecting this baseline information is a time consuming process requiring repeated arthropod surveys in a wide variety of habitats. Students of science can fulfill a genuine need for baseline data by surveying arthropods using the field protocols developed by ecologists and placing their results on the web.

As discussed previously, arthropods have been able to fill virtually every niche available in the ecosystems they inhabit. Different sampling protocols are required to survey arthropods in different niches. We will be using branch beating to assess mobile arboreal arthropods.

Materials

assembled beating sheet (sheet and frame)
pooter(s)
extra vials
water bottle
marking pen
plastic drinking straws
forceps
hand lens or dissecting scope
identification aids
beating sticks

I. Preparation

1. Read branch-beating protocol through as a class and discuss any safety issues.
2. Students form groups of 3 or 4.
3. Create a map of the study sites using either GIS or aerial photos
4. Discuss your sampling scheme apply to map. Check each team's branch beating style to ensure uniformity of technique.
5. Teams are assigned to or choose specific areas and trees for sampling.

II. Setting up the field study

1. Student groups pick up equipment to travel out to the field site.
2. Conduct branch beating and collection. Place beating sheet under branch(es), beat each branch three times in the same manner.
3. Estimate branch percentage coverage by examining how much of the branch covers the beating sheet.
4. Use pooter to aspirate all insects and spiders. Add 10 drops of water to vial before aspirating (water prevents spiders from spinning lots of silk and making the specimens hard to disentangle later on).
5. Label vial with the sample number and species of tree.
6. Important! Repeat the above steps 2-5 for each species of woody plants you are sampling at least 3-5 separate branches.

III. Sorting and Identification

1. Transfer the specimens from the collection vials to the Petri dishes.
2. Sort and identify all arboreal arthropods. It is not necessary to ID a specimen, instead, sort it into its "morpho species", such as "large green spider" and assign it a number.
3. Record all invertebrates in data sheets with appropriate names and numbers.
4. If you want to preserve some specimens for insect collections, you could do this now as well. Refer to the protocol on the website for further instructions on preservation.
5. To determine actual species names, check this site http://ippcweb.science.oregonstate.edu/ent3/bugbytes/ or use other insect ID keys.

IV. Analyzing the data collected

1. Calculate variance using ANOVA worksheet
2. Have teams pool finalized numbers into class results and discuss.

V. Write up of results and presentations

1. Each team should write up a research report according to the teacher's instructions and discuss results as a class.

Sample Data Sheet for Branch Beating

Sample Data Table

Sample #	Tree Species	Large green Spider 1	Small brown Spider 2	Aphid	Shiny large Beetle 1	
Sample 1	Doug Fir 1					
Sample 2	Doug Fir 1					
Sample 3	Doug Fir 1					
Sample 4	Doug Fir 2					
Sample 5	Doug fir 2					