

## CORE LESSON: Critter Survey

**Objectives and Summary:** Students use the “beat sheet” method to sample the insect/invertebrate communities found on the Waskowitz campus. The sample collection method involves placing a white pillowcase beneath a plant/shrub and shaking it vigorously or “beating” it with a small (approximately the length and width of a yard stick) “stick”. The agitation of the plant will cause a surprising number of “critters” to fall off the plant and onto the “sheet”. The previously largely unseen invertebrates become highly visible once landing on the sheet, and are easily collected for identification and analysis. Ideally, this sampling serves as a basis for comparison between different sites or different “host” plant species.

**Note:** This activity can be extended to offer a complete tour of the “Scientific Process” by guiding students beyond the data collection process and onto critical reflection and even presentation.

**Background:** Invertebrates are animals that lack spines, aka backbones. This is an incredibly diverse group that includes everything from fruit flies, to snails, to jellyfish. Despite their often insignificant size and humble appearance, invertebrates make up as much as 95% of the animal kingdom. Insects, a subgroup of invertebrates, number an estimated 1 million + species! Given the omnipresence and diversity of invertebrates in most environments, they make for excellent if often unappreciated subjects for scientific investigation. Furthermore, as primary level consumers, invertebrates serve as vital food sources for most of the rest of the food web, including many of the more well-known vertebrates.

“Beat sheet” sampling is an established and frequently used technique by researchers all over the globe. It should be done in a way to minimize harm to the plants and invertebrates sampled.

**Note:** The invertebrates studied here are members of the same group of organisms investigated in the Waskowitz H2O ecology lesson, the benthic (bottom dwelling) macroinvertebrates. You may wish to highlight this connection or draw a comparison.

### Standards:

### Materials

- Pillow cases. Approximately 5 total, or one per HS leader.
- Collection/viewing boxes. 1-3 per HS leader.
- 1 stick/yard stick/PVC pipe per HS leader. 3-4’ x 1 – 1.5”
- Magnifiers. 1-2 per HS leader. (optional)
- Journals and pens/pencils.
- Critter ID sheet. 1-2 per HS leader.

**Location and Duration:** Approximately 60min for the first round, perhaps less for repeat sampling. This activity can be done anywhere with lots of plants that are knee high or taller, and ideally is repeated between 2 or more sites.

**HS Leader Role:** Lead small groups in collection. Aid in ID and classification of specimens, and data recording.



## Procedure

**Introduction:** Ask students to define invertebrate, and lead the group to an appreciation of the distinction between invertebrates (animals without boney spines) and vertebrates (animals with back bones). Ask students why researches might wish to study invertebrates, or why they think invertebrates might be important: *Invertebrates play vital roles in most ecosystems. As primary/low level consumers they provide food for many other animals in the ecosystem. Many invertebrates such as worms and carrion beetles also play vital roles as decomposers of dead material that would otherwise accumulate in the environment. Other invertebrates may be used for our own benefit in surprising ways; the larva of silk moths give us silk, bees give us honey, and spiders help control pest populations.*

Tell students that we are now going to collect data, in the same way that professional researchers do, to see what/how many different kinds of invertebrates we can find living on the plants of this forest. **Note:** Advanced groups may be ready to carry out this investigation as an extension of the Plant ID lesson by assigning different small groups different target species of plants to “beat”. If so, introduce this idea now. Alternatively, you could simple state that this data collection will be carried out in 2 or more different habitats/sites as a basis for comparison, while disregarding the particular plant species. Or, you simply may wish to focus on the process of data collection and specimen ID, without setting up the data collection as a comparison between the invertebrate populations found in different sites or on different plant species.

### Lesson/Activity:

- 1) Demonstrate the collection method for the group. The sheet is placed on the ground beneath the target plant (assign, or have student choose plants knee high or larger). In some cases, it may be helpful to slide two sticks inside the pillow case to serve as handles; use the sticks to slide the “sheet” under the plant, and apply tension. Leave them there to aid in retraction after finishing your “beat”. Beat the plant with the “stick”, in the region directly overhead of the sheet. Choose a consistent method. For instance, choose either a moderate # of hits (approximate 20), at medium force, or choose a number of seconds, (approximately 20) at medium force and consistent rate, at waist height. Some plant may simply be shaken by firmly grasping the main stem. For advanced groups, you can discuss the need to establish these methods to *control variables and isolate independent variables*. **Discuss safety concerns: This is not done in a way that harms the plant. Think of it as equivalent to a very strong wind. The “beater” needs to have a safety bubble around her, where other students will not enter, thus avoiding be accidentally hit. Task HS leaders with enforcing safety.** Next, remove the sheet and collect the specimens in viewing boxes/collection bins as quickly as possible (before they crawl away!). Use hands and twigs as needed.
- 2) Divide into small groups. Each group should have a leader, a pillow case or “sheet”, a beating “stick”, Critter ID sheet, and collection/ viewing boxes. See materials above. Assign each group to a small area adjacent to the trail; spread them out with at least 30ft between groups. If desired, assign groups specific plant species. See **Note**, above. Leaders can assign different jobs: beater, sheet placer, collectors, time keepers, Critter ID card holders, data recorders, etc.



- 3) Carry out collection. Based on the results and available time, repeat the process. You may wish to continue until students have at least several different types of critters to record, or high numbers of a certain type.
- 4) After collection, have groups pause. Give them 2-3 mins. In small groups to look over their collections, and then reconvene. Ask for some ideas as to how to go about classifying their findings. Use the Critter ID cards provided, or create your own system based on the groups interests (Spiders, insects, beetles, etc).
- 5) Have small groups record their data using the Critter ID cards provided (or other system), counting each animal as a certain type. Feel free to include an "unknown" field! The optional magnifiers may help this process. *Provide data recording and analysis directions based on the group's ability. Some groups may be directed to record the plant species beaten/ and or location in addition to the numbers of different types of critters.*
- 6) Data can now be analyzed in as much detail as appropriate; students can be directed to graph each different type of critter. Groups can share data to generate a total graph between all groups, or can compare different plant species or even sites. If the small groups repeated the collection process more than once, data could be averaged between trials, or simply added together.

**Conclusion:** Discuss the results and help students come to some conclusions, either about the different species/types of critters found on different plants or sites, or about the diversity of critters sampled, or about the need for consistent sampling methods, etc. If repeating the process elsewhere, discuss ways to improve the sampling techniques for increased reliability or consistency. If you began this investigation by having students phrase a question, "Which plant species hosts greater invertebrate diversity?" or "Do different habitats host different invertebrate species?" e.g., you could now direct students to write a claims, evidence, and reasoning piece in their blank journal pages or elsewhere.

**Extension:** This activity could be as involved as you like. If time and interest permit, the sampling could be targeted to specific plants, habitats, and or locations. A discussion and refinement of methods could be extensive, as could data analysis, and presentation. For instance, each group could be charged with conveying their data in large graph format, and with discussing their methods with the rest of the group. Sophisticated groups may be able to discuss sources of error, and or present ideas for future study.

And/or:

Students could use magnifiers to generate a detailed sketch of a certain type of critter, using a blank journal page. Sketches can be extensively noted with written observations and details.

**Notes:**



*Waskowitz Outdoor School is a magical journey of discovery exploring the diversity of people and nature, while providing a safe, high quality, affordable residential experience for the students of the greater Puget Sound area.*