DLiA Discover Life in America

Schoolyard ATBI

Photos by Charles Wilder

SMOKIES ATBI
TAXA TALLY

Species New to Science =
900

Species New to the Park =
6,417

Objectives: Students will attempt to determine the comparative taxa diversity of several different types of habitat while learning about inventory methodology and design, use of scientific field equipment, and the diversity of life forms that live around them.

Study site: An area with multiple habitat types, such as old field (native or non-native plants), second growth forest, mature forest (softwood, cove hardwood, mixed oak/pine, etc.), lawn, stream bank, rocky outcrop, old building, etc. For most groups it would be easiest to designate two habitat types that are obviously different, such as a forest and a field. If done at a school, a weedy area and an area with trees could be compared, or a trip to a nearby park, if there is one, could be made.

Equipment:

1. string and stakes or something to use as markers for plot
2. aspirators
3. tweezers and jars
4. beating sheets
5. leaf-litter shakers
6. sweep nets
7. paper and pencils
8. clipboards or something else to write upon
9. flip chart or something else to tally up observations upon
10. [optional: simple keys to insect orders, etc.]
11. [optional aquatic dip nets, pans, seines, etc.]

Introduction: Introduce the All Taxa Biodiversity Inventory (or wait until conclusion): what do the words mean? who's involved with it and why it's being done? They will be conducting an ATBI on a small scale at the study site.

Discuss different habitats around the study site (what's a habitat? have them come up with distinct habitat types found around them). Get students to develop list of what sorts of animal/plant/fungus life they expect to find in each (keep it on the level of orders, or let them be free-form). After lists are made, have them rank the habitats as to which would have the most species of plants/animals/fungi (or subdivide into highest plant diversity/highest animal diversity). Additionally, have them predict total numbers of species living in that habitat.

- How would we go about testing our prediction(s)?
  - Answer should be something about taking an inventory of the habitat.

- How could we test it in the next couple hours? Answer should include...
  - Limiting the area searched to a unit of ground the same size for each habitat (if the different habitat types cover significantly different areas, the larger area could be expected to hold more species; using study plots of the same size allows us to ask if the different habitats would have different numbers of species regardless of their acreage).
  - Sample a few ways the same for each habitat (can't do this if comparing aquatic and terrestrial habitats). We're limited by time, time of day, and available equipment.

- How do we identify what we find? For field work, the rule is roughly: one hour in the
  - field requires 4-10 hours of sorting, processing, identifying, and cataloguing. We may not have the equipment to identify (or even see) bacteria and other microscopic organisms. It might take too long or be beyond our skill level to identify everything to species. We may be able to use a simple key to identify something as a "beetle", but there are hundreds of thousands of beetle species in North America.
  - What would a scientist do if they found a new species? They would give it a name and describe it in such a way that anyone else who found it could identify it with that description or identify it as something new. Describe color, shape, pattern, behavior, and draw a picture if you think it will help:
    - "yellow and black striped beetle with long antennae"
    - "star-shaped leaf; see attached drawing"

Activity: have the students break into two groups, and assign each group to a habitat (one to a forest, one to a field). If working with an especially large group, have them divide farther and do two study plots in each habitat or add more habitats.

Decide on a hypothesis (or hypotheses). Before they start their research, scientists usually write down what it is they are trying to find out, often in the form of a prediction. A scientist would make a prediction that doesn't imply a bias, something like "each habitat will have the same number of species in it", then do the work to see in which direction their prediction was off. Students are welcome to predict the outcome. Hypotheses may include: "Habitat A has more species than Habitat B" or "Birds will be the most diverse group".

Demonstrate the use of the equipment available.

First Study Plots: Have them pick a part of their habitat to be their study plot and mark off a roughly square or rectangular plot with stakes in the corners and string running around the outside to show the boundary. I recommend 10-15 feet to a side. Pacing will work fine for this activity if measuring equipment is not available, but have the pacers compare their paces first so that each group's plot ends up as close to the same size as possible. Scientists might take pains to insure that the plot is precisely square using a compass, but staking out the plot will probably be the most time-consuming and "boring" part of this exercise and should not be dwelt upon anymore than is necessary to insure they learn that a lot of science is set-up.

Tell them what you want is a list of all of the "species" of plant, animal, and fungi found in their study plots, with unfamiliar "species" named and described. Set them to work doing the inventory. Don't give them any farther directions unless they ask for them. Give them about 30-45 minutes.

You may or may not want to build up the competition aspect of this exercise (who can find more species) depending on what motivates the group, but the most important thing is to conduct a thorough and complete inventory of everything they can find. We're testing the hypothesis that the group came up with during the introduction.

At the end of the time allotted, bring them back together. What did each group find? Which group found more species? Tally what each group found onto a big piece of paper (flip chart) and figure out which species were found in both habitats, which species only in one or another. Which species were most common in each habitat? Which taxa was most common? What does the data say about their hypotheses?

- After analyzing the data, analyze the methods. What worked and what didn't? Have them set up a protocol (methods; "rules") for how to do this study, then put the different steps in order, what should they do first? Some of the ideas they come up with include:
    - choose a leader;
    - look over the habitat first to find a good site;
    - select specialists (or give everyone a job);
    - don't trample the plot before staking it out;
    - use some of the tools and not others, etc.

- Why do scientists use protocols?
    - To make the work go better based on knowledge from experts or past experience;
    - To make it possible to duplicate the study;
    - To make it possible to compare different sites because they were both studied the same way with the same protocols.

This first effort was a "pilot study", a quick and messy attempt to collect data, generate a protocol, and improve the hypotheses. Scientists often do a pilot study, especially before spending several years on a research project. It helps reduce the chance that they have to start the whole study over again much later.

Second Study Plots: Have the groups switch habitats and, using the protocols they designed, inventory a new plot in each habitat.

Conclusion: Do the results come out the same? Were any new species found? Were the hypotheses supported or contradicted? How far off were they? What groups (taxa) were most common in their study plot? Which groups least common? What parts of their plots (microhabitats) had the most species and which the fewest? Discuss habitat differences and come up with ideas for why their results were what they were. Where could they look for species they missed (in the tree tops, in the soils, different seasons, at night, etc.)?

Did the study work better now that they have the protocol and some experience? Which methods worked for them and which not? How would they redesign this experiment if they could?

The ATBI is scheduled to be completed in 10 years. How realistic do they think this time frame to be?

For more advanced groups: Rank the ten most abundant species, based on their seat-of-the-pants guesses. Note which species they found only one of. Why do they think some of these species were very abundant and some represented by only one. This can lead a discussion of species abundance curves, species/area relationships, rareness, extinction, reserve design, etc. How could they design this experiment so they could make a graph of species ranked by their abundance?

Post Visit Activity: The students can conduct a more complete inventory of the species found in their school yard or a local park, using the protocol they developed and adding some of their other ideas about how to find species they missed. They can try to identify species using field guides and/or trips to museums.

***This activity is based on a university lab activity written up in "The educational value of an All Taxa Biodiversity Inventory." J. Mark Dangerfield and Anthony J. Pik. 1998? Journal of Biological Education