## HOTELS, RESTAURANTS AND NURSERIES

### Objectives

- To investigate interactions between plants and animals
- To develop an appreciation for the interdependent systems of living things in a habitat
- To refine observational skills in the field
- To practice drawing educated conclusions from observations of natural phenomena and consider how to ascertain their accuracy

### Materials

- An outdoor space with a varied habitat – edges are most important
  A large variety of plants means a large variety of animals
- People to share this cool stuff with

### Background

There are many ways animals and plants interact. Many scientists believe the immense variety of plants that exist in the world arose in response to being attacked by the wide variety of insects and other herbivores in the world. It is as if these two major groups of living organisms are engaged in an arms race of counter-strategies. This process is referred to as 'co-evolution.'

Sometimes the interactions are mutually beneficial. Pollination is a plant-animal interaction that generally benefits both organisms. To plants pollination is a means of reproduction. To the pollinating animal it can be a source of food, nutrients and water. However, there are cases where, for example, a male wasp is lured to a flower because it looks (and often smells) like a female of the same wasp species. By the time the courting wasp learns of the deception, he has already been coated with pollen from faux female. Not one to learn from his mistakes he gets fooled again and transfers the pollen to the next imposter.

When pollination isn't the objective, plants and animals often interact in a less 'cooperative' way. This often appears to take the form of animals attacking plants but the plants get their licks in, too! They use thorns, toxins, bad smells, life cycle timing and other methods to outwit herbivorous enemies. Plants even change chemicals in their leaves when being attacked by caterpillars and load them with gummy proteins to frustrate the insects' feeding.

These sorts of chemical interactions are difficult to observe without a biochemistry lab and a good experimental design. But there are many ways plants and animals live together that are equally as intriguing and enlightening, and are much easier to see. This field experience focuses on the evidence left behind by animals as they employ plants as hotels (places to live), restaurants (places to eat), and nurseries (places to raise offspring). An exhaustive listing of such phenomena is impossible, but this activity presents some obvious and common examples that are likely to be encountered in the northeastern and central United States. Very similar interactions can be found in most habitats around the world.

**Procedure**
Go for a walk. (Guidelines on leading groups of children outdoors will be covered during the workshop and in other writings.) You may see many insects active and even some interacting with plants. Nearly every plant you encounter will have evidence of insect interactions. Three basic categories can be established to help organize the amazing variety of these signs.

Draw at least one example of these interactions and note whether the animal is still there or speculate what animal produced it. Then try to support this speculation using the images below, on the Internet, or at the library.

**HOTELS**

When animals use plants as homes
Sometimes they eat there, too

There are many different types of these interactions. The examples below involve various arthropods (insects and spiders), but many animals use plants as homes. Woodpeckers dig out holes to make their nests which may then be taken over by raccoons or mice. A squirrel makes 'nest' of leaves called a 'drey.' Birds make a variety of nests from plant material – often in plants.

**Examples**

- Galls – see sheet on galls
  - Eggs of wasps, moths, or flies laid just under surface of leaf or stem
  - Chemical secretions from eggs, larvae, or mother change cellular growth of plant
  - "Captures" larva in isolated section of plant
  - Larva feeds inside gall
  - Sometimes pupates in gall, though many species fall to the ground to pupate
- Webs or "tents"
  - **Eastern Tent Caterpillar** - *Malacosoma americanum*
    - Female moth lays eggs in spring
      - Looks like a shiny, black Styrofoam collar around a small branch near the outer part of tree (usually cherry tree)
    - Larvae migrate to nearest branching point of larger stems
    - Larvae make nest with silk from their spinnerets
    - Caterpillars add to nest as they grow
    - Larvae leave nest at night to feed
    - Leave silk 'trails' on branches to help them hold on and find their way back to nest
    - They live through the winter in cocoons, usually off of the host plant
      - In early summer you often see Eastern Tent Caterpillars wandering around looking for a place to pupate
      - If you see one off of its tree it is an ok time to collect it and put it in a container with twigs and leaves. It will probably make a cocoon and soon become a moth
    - Could be considered a nursery, too

- **Fall Webworm** - *Hyphantria cunea*
  - Pretty much the same as Eastern Tent Caterpillar except they make their webs on the outer branches of the tree, enclosing a bunch of leaves and feeding while still inside the web
  - Both Eastern Tent Caterpillar and Fall Webworm are moth larvae that develop into rather unremarkable moths.
- **Spiders**
  - A wide variety of spider species use plants as their anchor or foundation for their webs.
- **Black and Yellow Argiope** (Our-guy-ō-pee) - *Argiope aurantia*
  - One of the large Orb-Weaver spiders in this area
  - Make huge (sometimes 2 feet wide) webs between tall grasses in fields or in bushes near gardens
  - Black and yellow pattern can be warning (aposematic), or help it blend into field habitats (crypsis), especially where there is tall Goldenrod
- **Grass spiders** – *Agelenopsis sp.*
  - many species with different behaviors
  - Some make a wide, mostly flat web with an escape tunnel in the back (*see photo below*)
  - Plain, brown spider sits on web waiting for landing or falling prey
  - "Disappears" down tunnel when alarmed – *very* fast

- Leaf folders, rollers, and wrappers
  - Many caterpillars and spiders, some beetles and even ants enclose themselves in leaves using silk and/or by chewing the leaves at the base and causing them to fold over
    - Some are ambush predators from within their hotel
    - Others eat the plant they are rolled in, often at night when predators are less likely to see them and they won't bake in the Sun
    - Some only pupate this way usually wrapping the base of the leaf with lots of silk so it won't fall off over the winter
      - This can be an easy way of finding the cocoon in winter
      - If a leaf is still hanging on a plant with few others, take a closer look!
    - This also keeps them from drying out in the Sun
      - Water retention is a big problem for small animals
  - Many leaf rollers are considered to be pests – but some are beneficial because they eat weed plants
  - Often the only way to reveal the animal inside is to unroll the leaf
    - This can cause stress or death to the animal
    - Unless you see a bunch of them (like more than 10) it is probably best to leave it be
- Leaf miners
  - Some moth, fly and wasp larvae live *between* the top and bottom of a leaf
    - A leaf is more like a sandwich than a piece of paper

- The adult female lays her eggs just under the surface of the leaf
- The larva feeds on the cells between the leaf surfaces
- As it feeds, it makes a tunnel that can be seen as a squiggly, white line on the leaf

**RESTAURANTS**

When animals eat plants but don't live there. There are many parts of plants that are edible. We eat leaves, flowers, roots, seeds and nuts, sap and buds. Other animals eat the same parts in addition to nectar and pollen.

**Chewing**

Often chewing animals leave evidence that looks like the leaf was chewed. Caterpillars just start at an edge and work their way through it. Their chewing patterns might take the shape of an arc because they feed from the same spot and just eat as much as they can reach.

Some species of bees and ants chew out small discs from the edge or center of a leaf to take back to their nests and make other food out of it, or use it to build their nests somewhere else.

It is not always easy to tell who made chewing marks in plants. The only way to be certain is to actually catch them in the act. Sometimes, chew marks can be accompanied by other clues such as *frass* (insect poop – it's easy to recognize caterpillar frass)

**Skeletonizing**

Some caterpillars and more beetles and their larvae don't eat all the way through a leaf. Instead they chew away the meaty parts and leave the network of hard to digest veins behind. The leaf looks like a skeleton.

**Sucking**

Many bugs – especially 'true bugs' which are a certain group of insects – feed on the sap of the plants. This is the sweet food they have made in their leaves that is transported around the plant in the *phloem*. In order to get at this food source, true bugs have 'piercing-sucking' mouthparts. This consists of a long beak that they jab into the stem or leaf and use to inject enzymes that break down the cell walls so they can ingest the cell contents.

Unfortunately, you usually cannot see the feeding damage because the holes they pierce are too small. But because they spit enzymes into the plant, they can also spit disease organisms they get from other plants they have fed upon. Most plant viruses are spread this way. Some evidence of this can be spotted, discolored or wrinkled leaves, or abnormal growth.

**NURSERIES**

When animals lay eggs in or on plants
Sometimes the plant becomes a hotel and/or restaurant for the baby

As usual when dealing with natural phenomena there are lots of grey areas and exceptions!