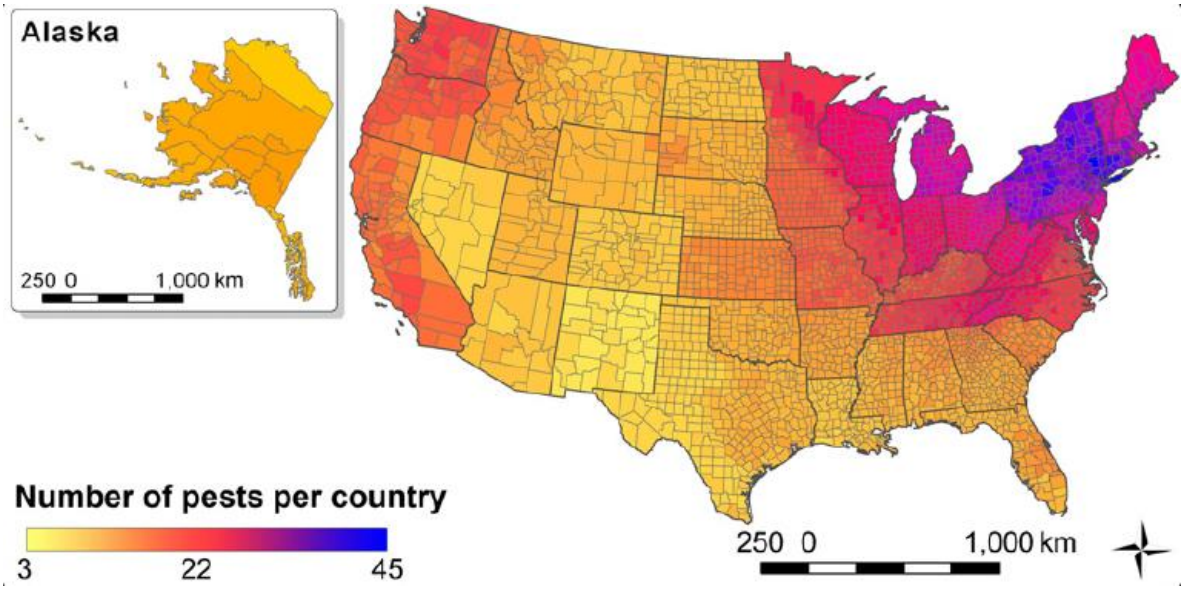
ART + SCIENCE AT HOME

Hara Woltz and Shelly Forster

INVESTIGATING TREE PESTS

Trees are a source of food for many organisms. As a result, they are often under attack from insects, fungi, bacteria, viruses, and larger herbivores. Though trees have some fascinating physical, chemical, and social adaptations to limit herbivory, these adaptations are often less effective when trees are faced with a novel consumer or disease that they haven't co-evolved with. Humans transport goods around the world and this movement sometimes includes other organisms that are able to thrive in a new habitat. Exotic species are sometimes introduced to the United States intentionally, such as nursery plants, or unintentionally, such as insects like the Hemlock Woolly Adelgid that stow away undetected on those nursery plants. When exotic pests arrive, they may become invasive if they do not have any predators or if our trees have insufficient defenses to ward off their establishment. In collaboration with a group of colleagues from numerous institutions, Cary scientist Gary Lovett estimates that approximately 2.5 introduced insect species establish populations in the United States every year.



This map is from a scientific paper called "A highly aggregated geographical distribution of forest pest invasions in the USA", from Liebhold et al, 2013. Whew, that's a mouthful! The map shows the number of invasive forest insects in each county in the US. Take a look at New York. Why do you think we're such a hotspot?

Dr. Lovett studies the impact of imported and invasive insects on Northeast forest health. These impacts are often substantial and can radically shift ecosystem dynamics, landscape aesthetics, and cause tremendous economic damage. In fact, imported forest pests may currently be the greatest threat to forest health in the northeastern United States, and are sometimes capable of eliminating entire species of trees in time frames as short as ten years. Dr. Lovett's research is informing national policies that limit the ways that pests are inadvertently imported, for example by limiting the use of wooden packaging crates and pallets, and limiting the importation of live plants.

SOME OF THE INSECTS OF CONCERN FOR NORTHEAST FORESTS:

Female Gypsy Moths (Hara Woltz)

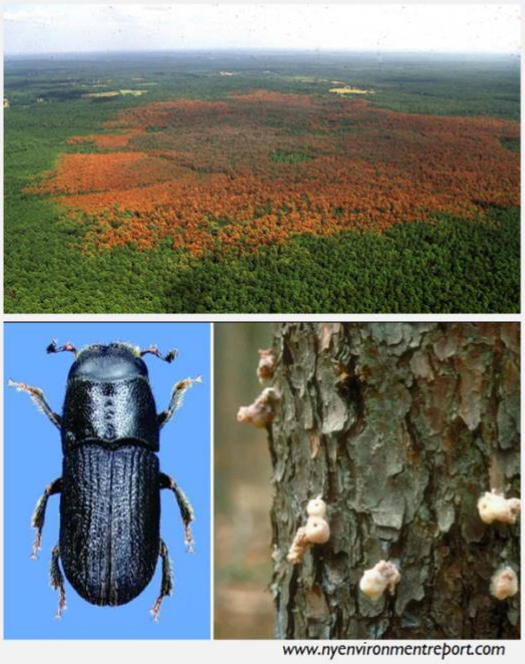
Southern Pine Beetle (USDA)

Emerald Ash Borer (Wikicommons)

Hemlock Woolly Adelgid (Wikicommons)

Asian Longhorned Beetle (Nature Serve)

EXAMPLE OF INSECT DAMAGE (SOUTHERN PINE BEETLE)



www.nyenvironmentreport.com

ENTOMOLOGY, Univ. of Florida

STEP ONE: Gather your supplies and head outside.

- Find an area where you can observe some trees.

STEP TWO: Observe the Weather

- You know the drill! Make some notes about the weather.

STEP THREE: Using this guide, evaluate the overall health of your tree.

- Write down any questions and observations that you have.

STEP FOUR: Look for examples of herbivory.

- How do the leaves on your tree look?
- Do you see any places where it looks like another organism has eaten leaves or bark? At the end of this PDF you'll find a field guide from the Cary Institute *Eco-Inquiry* book that can help you identify who's been munching on your tree.
- Keep in mind that any signs of herbivory that you find are **not** necessarily from an invasive pest, but if you're interested you might try to look for one of the invasive species we mentioned.
- If you have oak (Gypsy Moth), ash (Emerald Ash Borer) or hemlock (Hemlock Woolly Adelgid) trees in your area you may be able to spot signs of the forest pests on the previous page. The Emerald Ash Borer is now particularly common in urban and suburban areas in the Northeast.

STEP FIVE: Draw the story.

- You can either stay outside, or head back inside to a comfortable place for working.
- Storytelling is an evocative way to communicate about science.
- Pick one of the following plant/pest interactions and draw your version of this story. On one page of your fieldbook make some notes and diagrams about this interaction. What particularly interests you?
- On the next page or two, make a drawing that tells this story. Get creative and try to fill in the whole page with your drawing. What parts of the story are most important? How will you emphasize those visually?

Asian Long Horned beetle
Emerald Ash Borer
Gypsy Moth
Hemlock Woolly Adelgid
Southern Pine Beetle
Chestnut Blight
Dutch Elm Disease

arts Mid-Hudson
together we create

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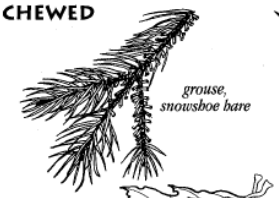
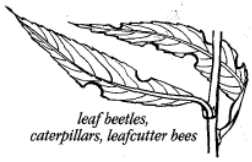
SIGNS OF ANIMALS EATING PLANTS

LEAVES

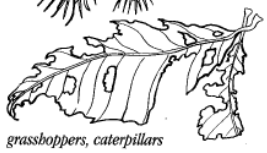
CHEWED



grouse, snowshoe hare



leaf beetles, caterpillars, leafcutter bees

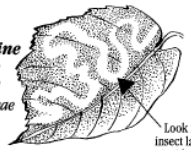


grasshoppers, caterpillars

caterpillars, beetle larvae

MINED

serpentine mine
fly and moth larvae

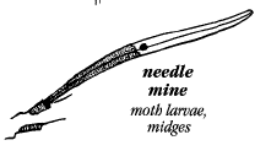


Look for insect larvae inside the mines.

blotch mine
fly and moth larvae

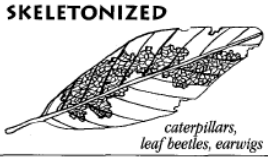
patch mine

beetles, moth and beetle larvae



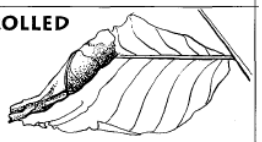
needle mine
moth larvae, midges

SKELETONIZED



caterpillars, leaf beetles, earwigs

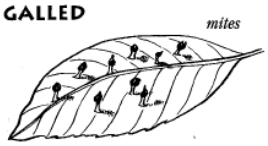
ROLLED

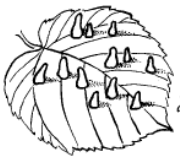


moths, butterflies, beetles

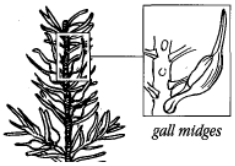
GALLED

mites

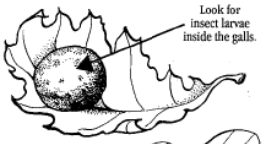




gall midges, aphids, mites



gall midges

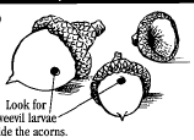


Look for insect larvae inside the galls.

oak gall wasps

SEEDS, NUTS, AND FRUITS

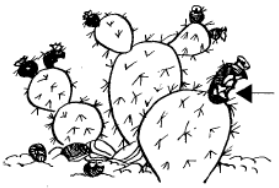
BORED



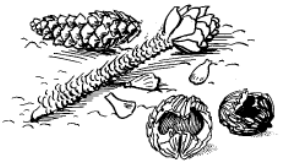
weevils

Look for weevil larvae inside the acorns.

CHEWED



kangaroo rats, orioles, coyotes



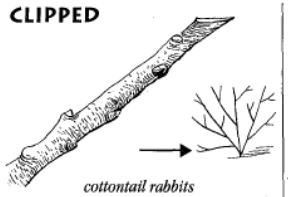
red and gray squirrels, chipmunks, jumping mice, white-footed mice, deer mice

white-footed mice, deer mice, fox, deer, opossum, woodchucks

SIGNS OF ANIMALS EATING PLANTS *continued*

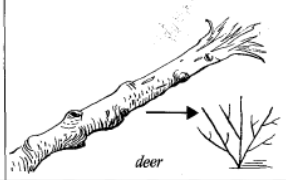
STEMS AND TWIGS

CLIPPED



cottontail rabbits

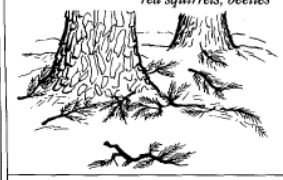
CHEWED



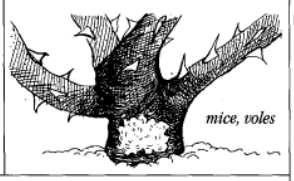
deer

PRUNED

porcupines, red squirrels, beetles



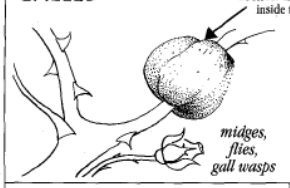
GNAWED



mice, voles

GALLED

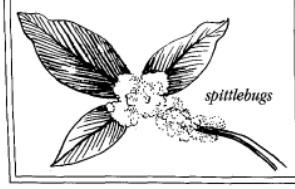
Look for insect larvae inside the gall.



midges, flies, gall wasps

goldenrod gall flies

FROTHED



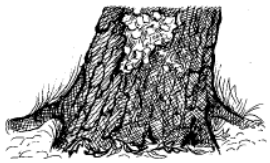
spittlebugs

GIRDLED

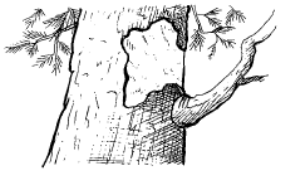
twig pruner beetles

TRUNKS, LIMBS, AND LOGS

BARK STRIPPED

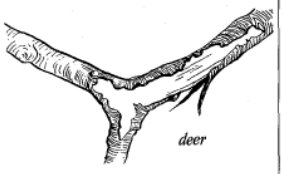


woodchucks, squirrels



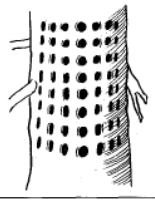
porcupines

rabbits, hares

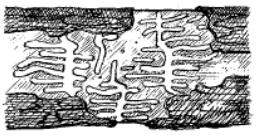


deer

BORED

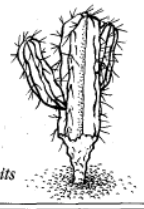


sapsuckers



bark beetles

CHEWED



cottontail rabbits

cottontails, jackrabbits, ground squirrels, tortoises, woodrats, pocket mice