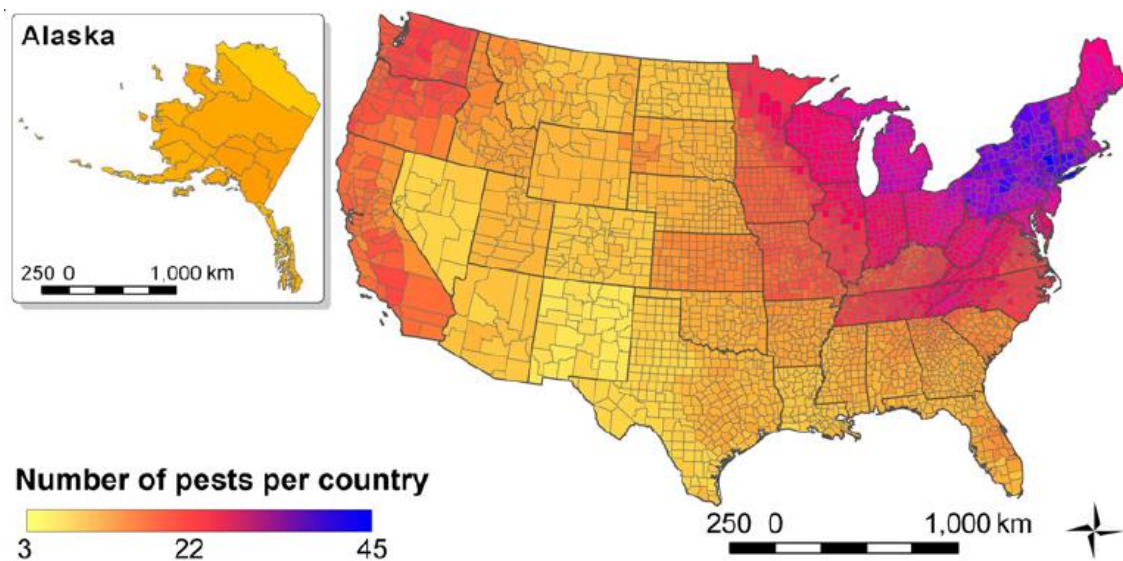


ART + SCIENCE AT HOME

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 25 introduced insect species establish populations in the United States every decade.



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 devastate species that depend on tree species, wipe out neighborhood street trees, 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 effectively eliminating entire species of trees in time frames as short as a few decades. 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*)

*Note: The Southern Pine Beetle is native to the Southern United States, NOT invasive. However, climate change is allowing it to expand its range northward into areas that used to be too cold for it to survive.



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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](#)

SIGNS OF ANIMALS EATING PLANTS

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Appendix A

LEAVES		SEEDS, NUTS, AND FRUITS	
CHEWED grouse, snowshoe hares leaf beetles, caterpillars, leafcutter bees grasshoppers, caterpillars	GALLED mites gall midges, aphids, mites	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
MINED serpentine mine: fly and moth larvae blotch mine: fly and moth larvae patch mine: beetles, moth and beetle larvae needle mine: moth larvae, midges Look for insect larvae inside the mines.	 gall midges Look for insect larvae inside the galls. oak gall wasps	 white-footed mice, deer mice, fox, deer, opossum, woodchucks	
SKELETONIZED caterpillars, leaf beetles, earwigs	ROLLED moths, butterflies, beetles		

SIGNS OF ANIMALS EATING PLANTS continued

STEMS AND TWIGS		TRUNKS, LIMBS, AND LOGS	
CLIPPED cottontail rabbits	CHEWED deer	BARK STRIPPED woodchucks, squirrels porcupines	 rabbits, bears
PRUNED porcupines, red squirrels, beetles	GNAWED mice, voles	 rabbits, bears	 deer
GALLED Look for insect larvae inside the gall. midges, flies, gall wasps goldenrod gall flies		BORED sapsuckers bark beetles	
FROTHED spittlebugs	GIRDLED twig pruner beetles	CHEWED cottontail rabbits cottontails, jackrabbits, ground squirrels, tortoises, woodrats, pocket mice	

Who Eats What guide

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