ART + SCIENCE AT HOME

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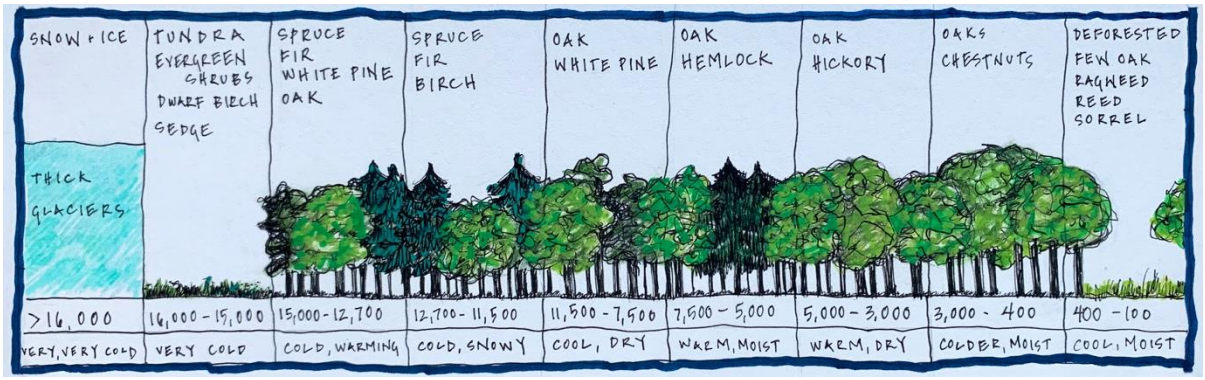
ECOLOGICAL COMMUNITIES + DATA VISUALIZATION

Have you ever noticed that you see different types of trees when you visit different habitats? You might not know the names of the trees, but perhaps you've noticed that the trees you've seen by the beach are very short, scraggly and windblown while the trees that grow in the deciduous forest are tall with layered canopies that fill in all the light gaps between you and the sun. Maybe you've noticed that your town or city streets seem to have very different tree species than a forest does. And you've most likely noticed a pattern in the types of plants and animals that you find alongside these various tree groupings.

If so, you've uncovered the concept of ecological communities, perhaps without even realizing it! An ecological community is a group of interacting plant and animal populations that live in the same environment and tend to be found together. Ecological communities are shaped by factors like the climate, topography, soils, and a history of events like glaciation, floods, and agriculture. New York State alone has 179 natural ecological communities! If you like to geek out on classification you might be interested in this online database on the ecological communities of NYS.

The New York Natural Heritage Program classifies terrestrial (land) communities by their dominant vegetation or by the way humans use the land. For example, the Cary Institute campus, which is largely forested, has patches of Appalachian oak-hickory forest on the tops of the hills and patches of Hemlock-northern hardwood forest in the steep valleys by the Wappinger Creek. It also includes human-dominated communities like "Mowed lawn with trees" and "Paved road/path". Yes, those *are* ecological communities because they have plant and animal species that tend to be found there! However, as you might imagine, ecological communities like "Mowed lawn with trees" have much less predictable groupings of trees and plants because humans play a heavy hand in choosing which species make the cut.

One of the most interesting things about ecological communities is that they change in response to disturbance and environmental shifts. For example, prior to 16,000 years ago New York had no forests, because it was covered in glaciers over 1000 feet thick. We know from ancient pollen records that as the glaciers melted, New York sprouted a tundra mix of shrubs and dwarf trees. As the climate warmed over the next few thousand years the Hudson Valley grew a mix of birch, spruce and other evergreen trees that's a lot like what we see in the Northern Adirondacks today. The glaciers continued to retreat northward, allowing the Hudson Valley to keep warming up, and by 11,500 years ago oaks and other deciduous trees began to creep in. By the time European settlers arrived in the Hudson Valley in the early 1600s the climate had changed so much that most of the dominant trees were oak and chestnut. Here's a graphic of change up to 100 years ago.



European settlers brought a new level of disturbance that rapidly changed ecological communities in New York as they imported invasive species, planted crops, introduced livestock, and harvested trees for timber and other uses. This chart (included in this morning's email) shows specific changes in forest composition from 1700 to present day. Logging and agriculture were so intense in the mid-Hudson Valley that only 15% of the pre-colonial forest cover remained by 1900! Thomas Cole and other painters of the Hudson River School documented some of this deforestation in the first half of the 19th century. Hiking the Hudson River Art Trail is a great way to see how forests have changed. Here's a current photo of Catskill Creek juxtaposed with one of Cole's paintings.

(www.hudsonriverschool.org)

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As agriculture shifted toward the Midwest, forests crept back into abandoned farm fields. Now, forests cover 60% of the mid-Hudson Valley. Cary forest ecologist Dr. Charlie Canham is an expert on land use changes in the Hudson Valley and recently published a book called *Forests Adrift: Currents Shaping the Future of Northeastern Trees*. Here's a taste of his take on History, Current Status, and Future of Northeastern Forests. Charlie is one of our favorite visitors to the Art+Science class and has taught us how to read the history of the forest landscape by examining the species that grow there today. For instance, when you encounter a cedar hedgerow (a line of closely planted wild trees and shrubs) in a forest, that is often an indication that a fence line once stood there, even when the fence is long gone. Why? Because birds like to sit on fences. And while birds sit there, they often poop out seeds. Those seeds germinate and grow in a line along the fence. The fence may be long gone, but the trees remain.

Today we are going to gather data on an ecological community of trees and make it visual through collage!

STEP ONE: Gather your materials and head outside

STEP TWO: Find an area to explore that has at least ten to fifteen trees.

STEP THREE: Observe the Weather. This is easy as pie by now, right?

STEP FOUR: Identify your trees.

The following resources are helpful for tree identification:

- Digital guides:
  - iNaturalist, Arbor Day Foundation,
- Printed field guides*:
  - Tree Finder: A Manual for the Identification of Trees by Their Leaves by May Theilgaard Watts (Bonus feature: it's pocket sized!)
  - National Audubon Societies Field Guide to Trees: Eastern Region by Elbert L. Little
  - The incredible printable photo guides and folding charts from the Northern Forest Atlas

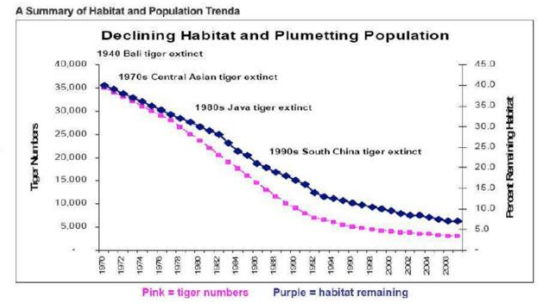
*Hudson Valley students: At the time we wrote this PDF all of these print guides were available in-store and online from our friends at Oblong Books & Music in Rhinebeck and Millerton.

If you have trouble identifying a tree precisely, that's okay. You can make up a name for that tree that will help you remember and recognize it (ex: "Scruffy Branch"). Scientists do this too! This process of grouping similar-looking individuals even if you don't know their species name is called morphotyping. Describe the tree morphotype in your field book and note how many you saw of each morphotype.

STEP FIVE: Map your path.
Draw a line that shows your movement through the landscape and notes the trees that you visit along it. Note whether you are finding more than one tree of the same species. This is your way of investigating the ecological community (remember page 1?) When you have recorded and identified ten to fifteen tree species or morphotypes (or more if you like), head back inside.

STEP SIX: Visualizing your data.
Head back inside and gather some materials for creating a collage in your fieldbook. In the Art+Science class we've used magazines, old books, field guide brochures, feathers, leaves, flowers, mud, berries, and more. Use whatever you have handy that sparks your imagination. Use tape or a glue stick to adhere your materials to the pages of your fieldbook.

There are many ways to visualize data, including graphs, charts, drawings, video, etc. Humans are visual creatures and seeing science can be an impactful way to help us understand it better. Here are examples of visualizations of tiger species data. On the left, a graph of declining tiger populations from a Wildlife Conservation Society paper by C. Vongkhamheng and A. Johnson. In the center, artist Jill Pelto depicts the decline of forest habitat from 1970 to 2010. She has chosen to highlight the separation of tiger from habitat as a way of addressing tigers being pushed out. On the right, designer Mikami Yoshiyuki worked with World Wildlife Foundation to illustrate the declining population of Bengal tigers.



Trend in population status of tigers and habitat throughout its range (Source: Damania et al. 2008, www.wds.worldbank.org)


Jill Pelto, Habitat Degradation: Deforestation

1 pixel for every Bengal Tiger that remains.

STEP SEVEN: Imagine a storm blowing through the area that you surveyed. If two leaves from each tree blew into the pile, what would it look like? Come up with a symbol for each type of tree leaf. If you noted three trees of the same species, you would have six leaves in the pile, etc. When you are finished, your pile will be a map of the species distribution in the area.

BONUS STEP: Imagine a disturbance comes through your area (ex: climate change, a mighty tornado, Godzilla) and knocks down all but the mightiest trees. What would your collage representing the survivors look like?

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This project is made possible with funds from the Decentralization Program, a regrant program of the New York State Council on the Arts with the support of Governor Andrew M. Cuomo and the New York State Legislature and administered by Arts Mid-Hudson.