

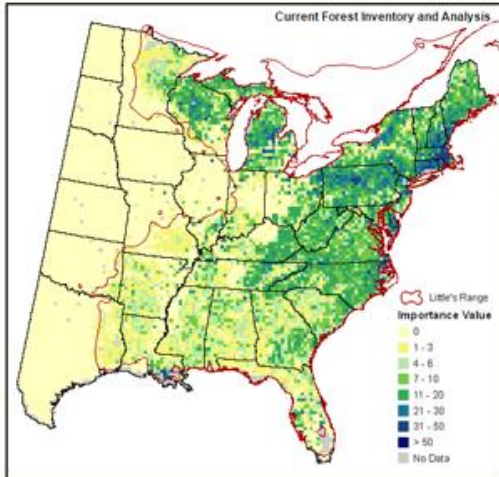
Supplement E-1: Tree Identification Chart

Will be provided at the lesson. It is very easy to follow with many pictures.

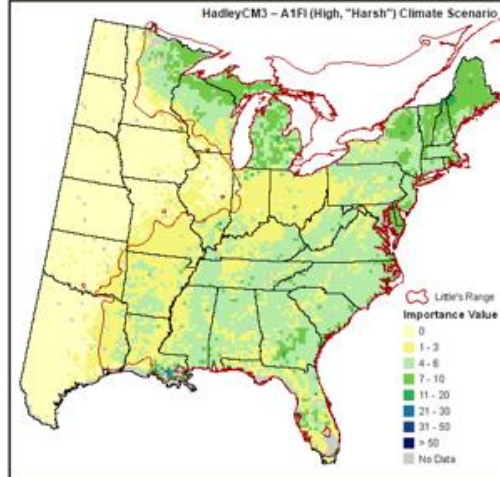
E-2: Tree Distribution Maps

Red Maple

Current Locations of Trees

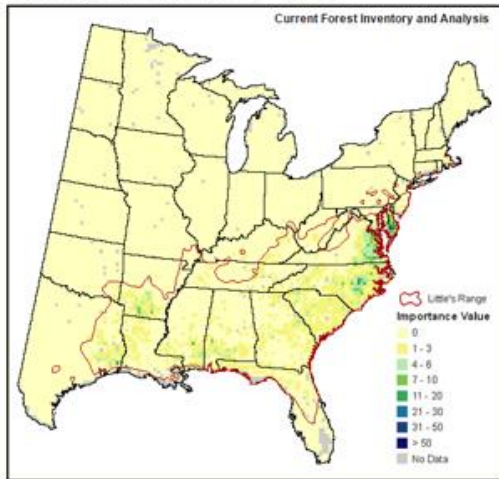


Predicted Locations in 2100

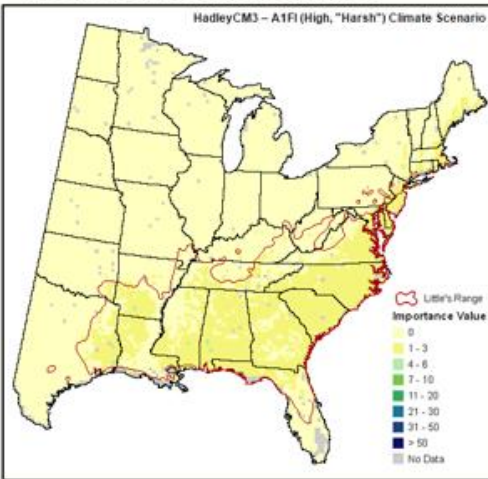


American Holly

Current Locations of Trees

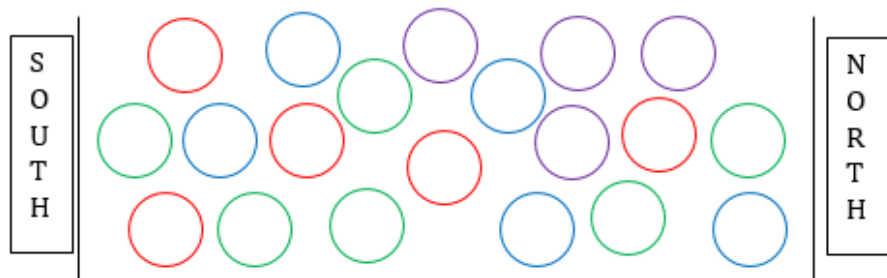


Predicted Locations in 2100



These maps show the changes in tree population from current population inventories, completed in 2016, and how those populations will change in 2100. The darker the area, the bigger the population. Due to climate change, it is predicted that by 2100 Red Maple populations will start to decrease in the U.S. and move towards Canada. Based on science, there are no barriers that would stop the Red Maple from adapting, but from studies conducted in the U.S. they are not adapting to climate change. Due to climate change, American Holly trees are predicted to move west and populations in Maryland will severely decrease by 2100. These are prediction models created by the USDA. They have predictions for almost all the trees in the United States collected into a Tree Atlas. If you are interested, here is the link to the Tree Atlas: <https://www.fs.fed.us/nrs/atlas/models/#lverson1>

Supplement F: Bird Migration Game









Please lead the kids to the game you set up with the Arlington Echo staff member during training.

- Have the kids stand on the south and explain that we are birds who will be migrating north for the summer and back to the south for the winter. You can only take 5 steps to get from one side to the other. You can hop, walk, and make longer strides but **NO RUNNING OR LARGE JUMPING THAT MAY lead to injury.**
 - Round 1: students make it across in 5 steps from south to north. Ask students “Was this round hard?” Probably not, because there were no barriers.
 - However, climate change is affecting these wetlands so what is one climate change that may affect these birds? Rising Sea Level is causing wetlands to disappear. Take away 5 hula hoops
 - Round 2: students make it across in 5 steps from north to south. Ask students “Was this round hard?” A little harder but still doable.
 - Can you think of another effect from climate change? The salt coming into the marshes are killing a lot of our native plants so there will be less food and plants for animals to eat or hide in. Take away 5 more hula hoops.
 - Round 3: students make it across in 5 steps from south to north. Ask students “Was this round hard?” A little harder. If some did not make it across then they died.
 - Can you think of another affect from climate change? Climate change brings abnormal weather patterns like hurricanes and thunderstorms that can destroy the wetlands.
 - Round 4: students make it across in 5 steps from north to south one more time. Ask students “Was this round hard?” Probably really hard. “If you were a bird, would you want to migrate? Or try to adapt and stay put?”

Assessment questions after the game:

- Can you think of any migratory birds that you see year round?
 - *Canada Geese*
- There are two types of geese, resident geese and migratory geese. However, some of the migratory geese are staying as resident geese, why do you think that is?
 - *Climate change! Geese migrate for open water sources. Due to rising temperatures, our waters do not freeze as often through the winter season so they do not have to migrate. When it does get a little cooler, their down feathers on their bellies keep them warm.*
<http://www.geesepeace.com/whygeesedonotmigrate.html>
- How will the lack of wetlands affect geese?
 - *They need freshwater sources. With sea level rise, wetlands and other freshwater sources will be mixed with salt water making wetlands saltier and there will be less hiding space in those wetlands to protect their young. Remember, a wetland is a nurse for young plants and animals.*

Supplement G: Examples of Hibernation Homes and Climate Change affects

Animal	Picture of home	How will climate change affect them
Squirrel		Squirrels build nests in trees that help to keep them warm during hibernation. They are made of leaves, sticks, and any other things they can find. Squirrels collect acorns and bury them to provide food in the following spring (as well as plant oak trees.) If it is not cold, they will not feel the need to bury acorns and the oak tree population may decrease.
Groundhog		Groundhogs, also known as marmots, burrow into the ground for winter and make sure to store up extra fat for their long hibernation. They survive better in cooler seasonal areas without long periods of hot temperatures and drought. If climate change continues, they are at risk of extinction. https://blogs.scientificamerican.com/extinction-countdown/climate-change-versus-groundhogs/
Eastern Box Turtle		The Eastern Box Turtle digs a hole and covers the opening with its shell. Eastern box turtles have adapted to hibernating so they must move further north to cooler climates to survive. They have trouble adapting to climate change. https://www.sciencedaily.com/releases/2013/10/131008182339.htm
Skunk		Skunks live in empty logs and old homes made by other animals. They hibernate all of winter and emerge in the spring. Climate change is shortening their hibernation. This is leading them to contract diseases that they were not exposed to during hibernation. https://medicalxpress.com/news/2016-07-climate-landscape-rabid-skunks.html
Black Bear		Black bears hibernate in dens (like cave), piles of lots of branches, or many fallen trees after they have filled up on a lot of food to gain and store fats for the winter. Black bears have become affected by climate change due to drought pushing bears to travel into towns for water. This presents a problem for humans and bears alike. http://www.nwf.org/news-and-magazines/media-center/reports/archive/2014/03-11-14-mascot-madness.aspx
Chipmunk		Chipmunks hibernate underground in dug out dens. They gather leaves for a bed and tons of nuts to store for food. In order to hibernate, chipmunks require colder weather. As temperatures rise, they may not need to hibernate. http://www.livescience.com/51139-chipmunks.html

Supplement H: Vocabulary

Climate- the pattern of seasonal weather that happens year after year.

Climate Change- any major change in the measures of climate that last for over a period of 30 years generally 10 years or more. These include temperature, precipitation, wind patterns, and other effects.

Wetland – a transition area between the land and the water with spongy, muddy soil such as a marsh, swamp, or bog

Adaptation- a change or the process of change by which an organism or species becomes better suited to its environment.

Temperate Region- lies between polar and tropical regions and experiences four seasons: Summer, Fall, Winter, Spring.

Migration- seasonal movement of animals from one region to another.

Biological Interactions- the effects that the organisms in a community have on one another.

Hibernation- When an animal or plant becomes inactive, or dormant, during the winter season.

Habitat – the natural home or environment of a particular species.