

Land Use Change since 1609

Time: 1-2 class periods

National Benchmarks: Benchmarks 5A: Diversity of Life; 5D Interdependence of Life; 5E: Flow of Matter and Energy; 9B:Symbolic Relationships; 9D:Uncertainty; 12B:Computation and Estimation; 12D:Communication Skills; 12E:Critical-Response Skills.

National Science Content Standards: *Science as Inquiry: A; Life Science: C:* Biological Evolution; The Interdependence of Organisms; Matter, Energy, and Organization in Living Systems; *Science and Technology: E:* Abilities of Technological Design; Understandings about Science and Technology; *Science in Personal and Social Perspectives: F:* Population Growth; Natural Resources: Environmental Quality; Natural and Human-induced Hazards; Science and Technology in Local, National, and Global Challenges

New York State Standards: 1, 2, 3, 4, 5, 6, 7

Objective: Students will know how the climate of the Hudson Valley has changed since the last 400 years and be able to explain these changes.

Lesson Outline:

1. Students brainstorm about ecosystems in the past
2. Using prepared soil 'samples' with fossilized 'pollen', students determine the changes in vegetation since European arrival
3. As a class, students reconstruct the history of the Hudson Valley since the arrival of Henry Hudson

Materials: 6 bags of soil with 14 different types of confetti organized in the manner described below, student worksheets, tweezers, paper plates, sample sediment 'core': can be made out of different kinds of soil in a tennis ball container, graduated cylinder, soda bottle, etc. These layers can represent the exact layers from the activity, or it can be used only as a visual to get students thinking about the concept.

Preparation: In order to make this lab effective, you need to prepare six bags of soils with the below mentioned types of confetti. The ratios are approximate. Feel free to use whatever colors you have on hand. Once you have prepared the zip-loc bags with the soil and confetti, disperse the bags to your groups of students. If you can't make six groups, it would be advisable to give one group two layers (probably the simpler layers, ie combine layer 3 with another layer). Once students have identified the 'pollen' based on the charts they have, they will be able to reconstruct the land use changes in the Hudson Valley over the last 400 years. You can keep the zip-loc bags with the materials for future use.

Color and Shape	Plant Species	Climate Characteristics
Pink Hearts	Oak	Found in warm, temperate sites with dry, warm summers
Red Hearts	maple	Native tree
Silver Circles	charcoal	Result of wide-scale burning

Clear stars	White pine	Usually grows at higher altitudes, but can tolerate seasons and variability
Silver stars	Chestnut	Prefers moist and colder temperatures
Blue stars	Hickory	Warm and dry, well-drained soils
Black stars	Birch	Enjoys cold, sub-alpine conditions
Gold hearts	Hemlock	Requires moist soil, temperate conditions
Green stars	Salt meadow cordgrass	Native marsh grass
Orange stars	Common reed	Can tolerate seasonal fluctuation, colonizes wet areas easily, invasive
Purple stars	Purple loosestrife	Invasive meadow species

Layer	Date	Vegetation	Confetti set-up	
1	1920-present	Common reed, maple, some hemlock, purple loosestrife, some oak, yellow birch, white pine	10-orange stars 10-purple stars 10-red hearts 5-gold hearts	5- pink hearts 10-black stars 5- clear stars
2	1850-1920	maple, yellow birch, charcoal, fewer salt meadow cordgrass, some chestnut	10-red hearts 10-black stars 10-orange stars 5- silver circles	3-silver stars
3	1800-1850	maple, yellow birch, salt meadow cordgrass	10-red hearts 10-black stars	10-silver circles
4	1750-1800	Fewer hemlock, maple, yellow birch, chestnut, salt meadow cordgrass	5-gold hearts 10-red hearts 10-black stars	10-silver stars 10-silver circles
5	1700-1750	Hemlock, maple, yellow birch, fewer oak, chestnut, fewer hickory, salt meadow cordgrass	10-gold hearts 10- black stars 5-pink hearts 10-silver stars	5-blue stars 10-silver circles
6	1000--1700	Hemlock, maple, yellow birch, white pine, oak, chestnut, hickory, salt meadow cordgrass	10-gold hearts 10-black stars 10-red hearts 10- clear stars	10-pink hearts 10-silver stars 10-blue stars 10-silver circles

Engagement: Show students the sediment core and ask what they could discover about the history of a place using the sediment layers. Ask: How far in the past could we go using sediment cores? Students will probably think about fossils or the Grand Canyon. Explain that within the sediment cores are tiny, fossilized pollen grains. Show them the short powerpoint that illustrates some of the different types of pollen found in sediment. Ask: how can scientists tell what kind of pollen is in a sediment core? Explain that they will become ‘scientists’ to discover the paleoclimate of the Hudson Valley.

Explore: Distribute the materials-one layer (bag with ‘pollen’), pair of tweezers, and paper plate to each group of students. Students should sift through their sediment layers

and separate out each of the different pollen types. Allow enough time to discover what layer they have and what type of climate may have existed during this period, using the information on their student guide. Once all groups have completed their work, they should compare their results and complete the class chart. This should allow a discussion of the history of climate change in the Valley.

Explain: Since each type of pollen has a distinct shape, scientists can find out what plant produced the pollen. By discovering what types of plants lived during each time period, scientists can infer what the climate was like during that time, and even how many of each type of plant lived during that period. They can also draw conclusions about how long it took for different changes to take place—for instance, how long did it take from the last ice age until the appearance of marsh plants? The speed that plant communities migrate into an area can help scientists understand how plants are currently migrating around the world, and what might happen when the temperatures increase in the future. More recent sediment layers tell scientists about changes such as the incidence of fire, invasive species, the disappearance of native species due to possible human interference, and even human events such as the testing of nuclear weapons. Scientists from Lamont-Doherty have collected pollen samples throughout the Hudson River area, and are continuing to collect samples to create a more complete picture. To read more about this effort, visit: http://www.ldeo.columbia.edu/news/2005/05_19_05.htm

Extend: Students can investigate other regions of the world to determine the paleoclimate data. Information can be found at: http://www.windows.ucar.edu/tour/link=/earth/climate/cli_paleo.html.

Evaluate: Students should be able to complete the activity and answer the questions appropriately.

Comments:

Modified from University Corporation for Atmospheric Research, www.windows.ucar.edu