Human Accelerated Environmental Change- Version 1 (lower level)

Time Period: One 90-minute session
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, 4, 5, 6, 7

Objective: Students will know some of the major changes that have taken place in the Hudson River watershed and be able to determine what has caused these changes.

Lesson Outline:

1. Students view a powerpoint of different human impacts on a global scale, taking notes and discussing questions when necessary.
2. Using the jigsaw technique, students examine one type of change more closely and then explain this to their classmates.
3. Students answer questions based on a short reading assignment.

Note: There are two different versions of this lesson, one for lower level students, and one for upper level students. Version 1 is the lower version.

Materials:

- Power Point presentation
- Copies of HAEC Notes-one for each student
- Copies of HAEC questions-one packet for each student
- Copies of HAEC group handout-one copy for the class; can be laminated and used again (color printing is best)
- Copies of HAEC Summary Graphs-one per student
- Copies of HAEC reading-one for each student

Engage: Ask the students to brainstorm the major changes that they think have taken place over the last 20, 50, 100 years. Make a chart on the board, and add to the chart as the class progresses.
Explore: Students use the handout to take notes during a powerpoint presentation that explores the major global changes that have taken place as a result of humans. Encourage students to answer questions such as: Is the world overpopulated? What does overpopulated mean? How do the different environmental changes interact globally? Locally? The presentation has notes at the bottom which can help you discuss the topics involved.

Now that students have spent some time thinking about global changes, they will spend some time in groups learning about different changes in the Hudson Valley.

Divide the class into jigsaw groups, asking them to think about the major questions at the top of the handout that will frame the activity. When conducting a jigsaw activity, you first begin with the jigsaw groups. Ideally, these groups will each have four students. Then, students number off within the jigsaw groups to form expert groups. Ultimately, they return to their jigsaw groups to explain what they learned with their expert groups. If you do not have a class with multiples of four, you can have some groups that have more than four students, or determine another arrangement that works best for you.

Once students have answered the first questions, they should move into their expert groups. Hand out the graphs for each expert group (they are labeled with numbers 1-4). Allow students about 10 minutes to learn about their topic and answer the questions on the handout. Make sure to explain to students that they will be the 'expert' when they meet with their jigsaw group, and so everyone needs to be able to explain the information. Once students have answered all the questions, they will move back to their jigsaw group and learn about the other changes. Draw students' attention to the chart that asks them to identify which changes are responsible for the case studies discussed in the jigsaw groups, and then have them think about whether these changes are temporary or permanent.

Explain: Change is a constant theme within ecosystems, and adapting to that change is how organisms have evolved over time. However, humans have managed to create change on a dramatic, global scale by altering the landscape, polluting water, air, and land, encouraging and allowing the invasion of exotics, and decreasing biodiversity through exploitation and overuse. Compounding these factors is climate change, which promises to accelerate many of these issues, and ozone depletion as a result of pollution. The growing human population is accelerating these impacts, increasing the damage around the world and affecting ecosystems in many ways.

Scientists are just beginning to understand the ways that some of these changes are interrelated. Examples include the worldwide decline in amphibians, as well as the loss of corals. Without a clearer understanding of these interactions, it is difficult to advocate for solutions because anything that does not address the other causes will be ineffective. Policy makers also need to be made aware of these changes so that policy can account for synergistic causes.

In the Hudson Valley watershed, the major changes that have taken place are related to land use change, the introduction of exotic species, climate change, and the resulting loss of biodiversity. Lyme disease increases with decreases forest size, indicating that the forest fragmentation that has taken place within the Northeast has played a role in the increase of this disease. There is also data that demonstrates that connection between increased diversity and Lyme disease; that is, the more diverse a forest ecosystem, the lower the incidence of infected nymphs.

Exotic species have created myriad problems, from affecting the food web (in the case of the zebra mussel) to reducing biodiversity (common reed). Students will learn more about each of these invaders during the Invasive Species module, but this will give them a good overview of the changes.

Although the amount of sulfur oxides in the atmosphere has decreased since the Clean Air Act amendments, the amount of nitrous oxides has remained the same and thus the acid rain problem has not been "solved". The data shows students how a community of fish changed in a stream at Hubbard Brook, and then gives them pieces of data that demonstrates how the abiotic conditions of the northeast changed during that period as a result of air pollution

Finally, new research that indicates a warming Hudson River could be related to the decrease in certain fish species, including the Atlantic Tomcod and Rainbow Smelt. Both species are temperature dependent and used to have ranges that extended further south along the Atlantic coast, but are now found only further north.

Extend: Students could research other types of change in the Hudson Valley watershed and create a report for the class.

Evaluate: Students should submit their notes and the answers to the jigsaw activity.

Comments:

References:

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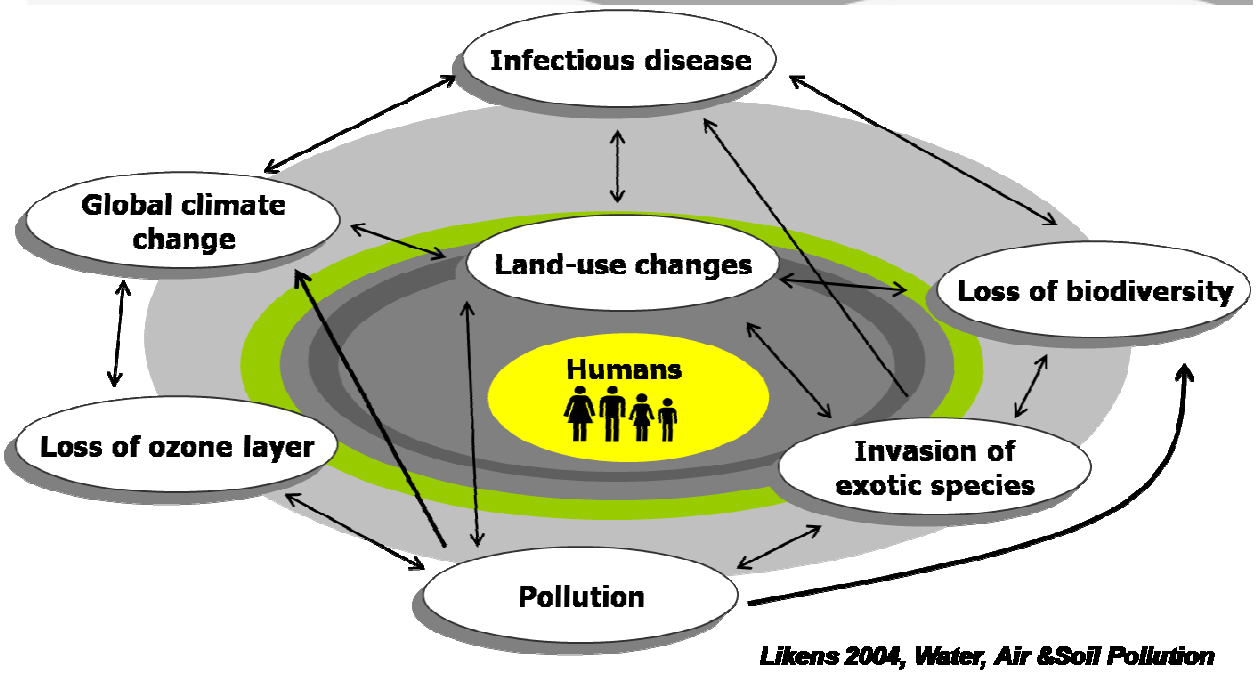

Likens 2004, Water, Air &Soil Pollution