IPY/NSTA Symposium: Impact of Polar Climate Change on Living Systems
Thursday, March 29, 2007

8:00 AM – 8:25 AM

Welcome, Introductions, Goals for the Symposium

Al Byers, Assistant Executive Director of Government Partnerships and e-Learning, NSTA
Sharon Locke, Program Director, National Science Foundation
Flavio Mendez, Symposia and Web Seminars Program Manager, NSTA

- About NSTA Symposia
- Agenda/Goals
- Forms/Logistics/Introductions

Dr. Jacqueline Grebmeier, Research Professor, University of Tennessee, Knoxville, TN
Dr. R. Max Holmes, Associate Scientist, Woods Hole Research Center, Massachusetts
Betty Carvellas, Teacher and Science Department Co-chair, Essex High School, Vermont
Amy Clapp, Science Teacher, Salisbury Community School, Vermont

8:25 AM – 8:45 AM

Overview: Climate Change and the Arctic

Dr. R. Max Holmes

Learning Outcomes:

After participating in the presentation,

- Participants will explain the relative importance of fossil fuel use and deforestation as drivers of increasing atmospheric carbon dioxide concentrations.
- Participants will identify two ways climate change is impacting arctic residents.
- Participants will describe at least two feedbacks from the Arctic to the global climate system.

8:45 AM – 9:20 AM

Movement of Organic Carbon from Land to Ocean in the Arctic

Dr. R. Max Holmes

Learning Outcomes:

After participating in the presentation,

- Participants will identify two main routes by which organic carbon moves from land to ocean in the Arctic.
- Participants will give an example of organic carbon sources that are modern, thousands of years old, and millions of years old.
- Participants will explain why the age of the dissolved organic carbon in arctic rivers may change with continued warming.

9:20 AM – 10:15 AM

Activity 1: The Albedo Effect/Melting Ice

Amy Clapp

Learning Outcomes:

After participating in the activity,

- Participants will describe why global warming is amplified in the Arctic.
- Participants will compare how sea level is impacted by melting of sea ice vs. land ice.
- Participants will design an experiment to answer the question "Will warming of the oceans as a result of global warming affect sea level?"

10:15 AM – 10:30 AM
Break

10:30 AM – 11:05 AM
Arctic Marine Food Web Dynamics
Dr. Jackie Grebmeier
Learning Outcomes:
After participating in the presentation,
- Participants will list at least 3 physical factors that are causing biological changes in Arctic marine populations.
- Participants will describe the role of various forms of carbon in the Arctic marine ecosystem.
- Participants will explain at least 3 methods that scientists use to study the Arctic marine ecosystem.

11:05 AM – 12:00 PM
Activity 2: Arctic Marine Food Web
Betty Carvellas
Learning Outcomes:
After participating in the activity,
- Participants will use pictures to create an Arctic marine food web.
- Participants will describe potential changes in 3 Arctic marine populations with environmental change.
- Participants will explain the impact that changes in the populations might have on the food web.

12:00 PM – 12:10 PM
International Polar Year – Get Involved!
Dr. Jackie Grebmeier
Learning Outcome:
After participating in the presentation,
- Participants will describe the role of science educators in overall IPY science goals.
- Participants will list three available resources for obtaining IPY science education information and activities for their classroom use.

12:10 PM – 12:30 PM
Final Words
- Post-assessment form
- Evaluation form/Survey/Credit info
- NSTA Web Seminars
- Raffle of door prizes

National Science Education Standards Addressed:
Content Standards, 5-8

Content Standard A:
Abilities Necessary to do Scientific Inquiry

- Design and conduct a scientific investigation.
- Develop descriptions, explanations, predictions and models using evidence.
- Think critically and logically to make the relationships between evidence and explanations.
- Communicate scientific procedures and explanations.
- Use mathematics in all aspects of scientific inquiry.

Understanding about Scientific Inquiry

- Different kinds of questions suggest different kinds of scientific investigations. Some investigations involve observing and describing objects, organisms, or events; some involve collecting specimens; some involve experiments; some involve seeking more information; some involve discovery of new objects and phenomena; and some involve making models.
- Mathematics is important in all aspects of scientific inquiry.

Content Standard B:
Physical Science
As a result of their activities in grades 5-8, all students should develop understanding of

- Transfer of Energy
  - Light interacts with matter by transmission (including refraction), absorption, or scattering (including reflection). To see an object, light from that object–emitted by or scattered from it–must enter the eye.
  - The Sun is a major source of energy for changes on the earth's surface. The sun loses energy by emitting light. A tiny fraction of that light reaches the earth, transferring energy from the sun to the earth. The sun's energy arrives as light with a range of wavelengths, consisting of visible light, infrared, and ultraviolet radiation.

Content Standard C:
Life Science
As a result of their activities in grades 5-8, all students should develop understanding of

- Populations and Ecosystems
  - A population consists of all individual of a species that occur together at a given place and time. All populations living together and the physical factors with which they interact comprise an ecosystem.
  - Populations of organisms can be categorized by the function they serve in an ecosystem. Plants and some microscopic organisms are producers – they make their own food. All animals, including humans, are consumers, which obtain food by eating other organisms. Decomposers, primarily bacteria and fungi, are consumers that use waste materials and dead organisms for food. Food webs identify the relationships among producers, consumers, and decomposers in the ecosystem.
  - For ecosystems, the major source of energy is sunlight. Energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis. That energy then passes from organism to organisms in food webs.
  - The number of organisms an ecosystem can support depends on the resources available and abiotic factors such as quantity of light and water, range of temperatures, and sediment composition. Given adequate biotic and abiotic resources and no disease or

predators, populations (including humans) increase at rapid rates. Lack of resources and other factors, such as predation and climate, limit the growth of populations in specific niches in the ecosystem.

Content Standard D:
Earth and Space Science
As a result of their activities in grades 5-8, all students should develop understanding of

- Structure of the Earth System
  - Soil consists of weathered rocks and decomposed organic materials from dead plants, animals and bacteria. Soils are often found in layers, with each having a different chemical composition and texture.
  - Water is a solvent. As it passes through the water cycle it dissolves minerals and gases and carries them to the oceans.
  - Living organisms have played many roles in the earth system, including affecting the composition of the atmosphere, producing some types of rocks, and contributing to the weathering of rocks.

Content Standard F:
Science in Personal and Social Perspectives
As a result of their activities in grades 5-8, all students should develop understanding of

- Populations, Resources, and Environments
  - Causes of environmental degradation and resource depletion vary from region to region and from country to country.
- Natural Hazards
  - Internal and external processes of the earth system cause natural hazards, events that change or destroy human and wildlife habitats, damage property, and harm or kill humans. Natural hazards include earthquakes, landslides, wildfires, volcanic eruptions, floods, storms, and even possible impacts of asteroids.
  - Human activities also can induce hazards through resource acquisition, urban growth, land-use decisions, and waste disposal. Such activities can accelerate many natural changes.
  - Natural hazards can present personal and societal challenges because misidentifying the change or incorrectly estimating the rate and scale of change may result in either too little attention and significant human costs or too much cost for unneeded preventive measures.
- Risks and Benefits
  - Risk analysis considers the type of hazard and estimates the number of people that might be exposed and the number likely to suffer consequences. The results are used to determine the options for reducing or eliminating risks.
  - Students should understand the risks associated with natural hazards (fires, floods, tornadoes, hurricanes, earthquakes, and volcanic eruptions), with chemical hazards (pollutants in air, water, soil, and food), with biological hazards (pollen, viruses, bacterial, and parasites), social hazards (occupational safety and transportation), and with personal hazards (smoking, dieting, and drinking).
  - Important personal and social decisions are made based on perceptions of benefits and risks.

Content Standard G:
History and Nature of Science
As a result of their activities in grades 5-8, all students should develop understanding of

- Science as a Human Endeavor
  - Science requires different abilities, depending on such factors as the field of study and type of inquiry. Science is very a human endeavor, and the work of science relies on basic human qualities, such as reasoning, insight, energy, skill and creativity—as well as on scientific habits of mind, such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas.