NIEHS, USFS, NOAA Symposium:
Teaching About Climate Change—Here and Now
Thursday, March 29, 2012
JW Marriott Indianapolis, Grand Ballroom II
8:00 a.m. – 12:30 p.m.

8:00-8:30 a.m.
Welcome, Introductions, Goals for the Symposium
Flavio Mendez, Senior Director, NSTA Learning Center
Paul Tingler, Director, NSTA Symposia and Web Seminars
• About NSTA Symposia
• Agenda/Goals/Forms/Logistics/Introductions

8:30-9:00 a.m.
Ice Breaker/activity: Trends and Consequences
Peg Steffen, Education Coordinator, NOAA National Ocean Service
Bruce Moravchik, Education Specialist, NOAA National Ocean Service

Learning Outcomes
After participating in the presentation, participants will:
• Identify positive and negative consequences of a health issue related to climate.
• Utilize a simple visual technique (futures wheel) to consider the impacts of a climate trend.
• Describe at least one way to bring decision-making into the classroom.

9:00-9:15 a.m.
Presentation: Weather and Climate
LuAnn Dahlman, Climate Education, NOAA Climate Program Office

Learning Outcomes
After participating in the presentation, participants will:
• Describe difference between weather and climate and recognize examples of each.

9:15-10:00 a.m.
Presentation: Citizen Science Connections: Tree and Bird Atlases
Vicki Arthur, Conservation Education Specialist, USDA Forest Service

Learning Outcomes
After participating in the activity, participants will:
• Understand the relationship between species distribution and suitable habitats.
• Understand the basis of the range of carbon emissions scenarios.
• Understand how computer modeling is used to show the relationship between the range of carbon emissions scenarios and potential changes to species distribution.
• Understand what data the computer models that make up the Bird & Tree Atlas are based on.

10:00-10:15 a.m.
Break

10:15-11:00 a.m.
Presentation/activity: Climate Change: A Human Health Perspective
Bono Sen, Education and Outreach Program Manager, Environmental Health Perspectives, National Institute of Environmental Health Sciences, National Institute of Health

Learning Outcomes
After participating in the presentation, participants will:
• Describe potential impacts of climate change on human health.
• Organize information into a visual to assist with understanding the complexities of the climate change-health effect system.
• Describe the health co-benefits of climate change adaptation.

11:00-11:30 a.m.
Presentation: Importance of Communicating Climate
Ed Maibach, Director, Center for Climate Change Communication, George Mason University

Learning Outcomes
After participating in the presentation, participants will:
• Cite 2 sources of information regarding American adult knowledge and attitudes about climate science and the impacts of global warming.
• Identify criteria of effective communication about climate change and its impacts.

11:30-12:00 a.m.
Discussion panel: Q and A about communication
• What are your biggest challenges to teach climate?
• What is your biggest need for information about climate?

12:00-12:30 p.m.
Wrap Up
• Post-assessment form
• Evaluation form/Survey/Credit Info
• NSTA Web Seminars
• Drawing of door prizes
National Science Education Standards Addressed

Content Standards, 5-8

Content Standard A: Abilities Necessary to do Scientific Inquiry
- Develop descriptions, explanations, predictions and models using evidence.

Understanding about Scientific Inquiry
- Scientific explanations emphasize evidence, have logically consistent arguments, and use scientific principles, models and theories.
- Science advances through legitimate skepticism. Asking questions and querying other scientists’ explanations is part of scientific inquiry. Scientists evaluate the explanations proposed by other scientists by examining evidence, comparing evidence, identifying faulty reasoning, pointing out statements that go beyond the evidence, and suggesting alternative explanations for the same observations.

Content Standard F: Science in Personal and Social Perspectives

Natural Hazards
- Human activities also can induce hazards through resource acquisition, urban growth, land-use decisions, and waste disposal. Such activities can accelerate many natural changes.

Risks and Benefits
- Individuals can use a systematic approach to thinking critically about risks and benefits. Examples include applying probability estimates to risks and comparing them to estimated personal and social benefits.
- Important personal and social decisions are made based on perceptions of benefits and risks.

Content Standard G: History and Nature of Science

Nature of Science
- Scientists formulate and test their explanations of nature using observation, experiments, and theoretical and mathematical models. Although all scientific ideas are tentative and subject to change and improvement, there is much experimental and observational confirmation.
- It is part of scientific inquiry to evaluate the results of scientific investigations, experiments, observations, theoretical models, and the explanations proposed by other scientists.

Content Standards, 9-12

Content Standard A: Science as Inquiry

Understandings About Scientific Inquiry
- Scientific explanations must adhere to criteria such as: proposed explanation must be logically consistent; it must abide by the rules of evidence; it must be open to questions and possible modification; and it must be based on historical and current scientific knowledge.
- The methods and procedures that scientists used to obtain evidence must be clearly reported to enhance opportunities for further investigation.
Content Standard C: Life Science
The Interdependence of Organisms
- Human beings live within the world’s ecosystems. Increasingly, humans modify ecosystems as a result of population growth, technology, and consumption. Human destruction of habitats through direct harvesting, pollution, atmospheric changes, and other factors is threatening current global stability, and if not addressed, ecosystems will be irreversibly affected.

Content Standard F: Science in Personal and Social Perspectives
Environmental Quality
- Natural ecosystems provide an array of basic processes that affect humans. Those processes include maintenance of the quality of the atmosphere, generation of soils, control of the hydrologic cycle, disposal of wastes, and recycling of nutrients. Humans are changing many of these basic processes, and the changes may be detrimental to humans.
- Materials from human societies affect both physical and chemical cycles of the earth.

Natural and Human-Induced Hazards
- Human activities can enhance potential for hazards. Acquisition of resources, urban growth, and waste disposal can accelerate rates of natural change.
- Natural and human-induced hazards present the need for humans to assess potential danger and risk. Many changes in the environment designed by humans bring benefits to society, as well as cause risks. Students should understand the costs and trade-offs of various hazards—ranging from those with minor risk to a few people to major catastrophes with major risk to many people. The scale of events and the accuracy with which scientists and engineers can (and cannot) predict events are important considerations.

Science and Technology in Local, National, And Global Challenges
- Humans have a major effect on other species. For example, the influence of humans on other organisms occurs through land use—which decreases space available to other species—and pollution—which changes the chemical composition of air, soil, and water.

Content Standard G: History and Nature of Science
Nature of Scientific Knowledge
- Science distinguishes itself from other ways of knowing and from other bodies of knowledge through the use of empirical standards, logical arguments, and skepticism, as scientists strive for the best possible explanations about the natural world.
- Scientific explanations must meet certain criteria. They must be consistent with experimental and observational evidence about nature, and must make accurate predictions about systems being studied. They should also be logical, respect the rules of evidence, be open to criticism, report methods and procedures, and make knowledge public.
- All scientific knowledge is, in principle, subject to change as new evidence becomes available.
Climate Literacy Essential Principles

Guiding Principles for informed climate decision:
A. Climate information can be used to reduce vulnerabilities or enhance the resilience of communities and ecosystems affected by climate change.
B. Reducing human vulnerability to the impacts of climate change depends not only upon our ability to understand climate science, but also upon our ability to integrate that knowledge into human society.
G. Actions taken by individuals, communities, states, and countries all influence climate.

2. Climate is regulated by complex interactions among components of the earth system.
A. Earth’s climate is influenced by interactions involving the Sun, ocean, atmosphere, clouds, ice, land, and life. Climate varies by region as a result of local differences in these interactions.

3. Life on Earth depends on, is shaped by, and affects climate.
A. Individual organisms survive within specific ranges of temperature, precipitation, humidity, and sunlight. Organisms exposed to climate conditions outside their normal range must adapt or migrate, or they will perish.
C. Changes in climate conditions can affect the health and function of ecosystems and the survival of entire species. The distribution patterns of fossils show evidence of gradual as well as abrupt extinctions related to climate change in the past.

4. Climate varies over space and time through both natural and man-made processes.
A. Climate is determined by the long-term pattern of temperature and precipitation averages and extremes at a location.
B. Climate is not the same thing as weather. Weather is the minute-by-minute variable condition of the atmosphere on a local scale. Climate is the conceptual description of an area’s average weather conditions and the extent to which those conditions vary over long time intervals.

5. Our understanding of the climate system is improved through observations, theoretical studies, and modeling.
B. Environmental observations are the foundation for understanding the climate system. From the bottom of the ocean to the surface of the Sun, instruments on weather stations, buoys, satellites, and other platforms collect climate data. To learn about past climates, scientists use natural records, such as tree rings, ice cores, and sedimentary layers. Historical observations, such as native knowledge and personal journals, also document past climate change.
C. Observations, experiments, and theory are used to construct and refine computer models that represent the climate system and make predictions about its future behavior. Results from these models lead to better understanding of the linkages between the atmosphere-ocean system and climate conditions and inspire more observations and experiments. Over time, this iterative process will result in more reliable projections of future climate conditions.
6. Human activities are impacting the climate system.
   A. The overwhelming consensus of scientific studies on climate indicates that most of the observed increase in global average temperatures since the latter part of the 20th century is very likely due to human activities, primarily from increases in greenhouse gas concentrations resulting from the burning of fossil fuels.
   C. Human activities have affected the land, oceans, and atmosphere, and these changes have altered global climate patterns. Burning fossil fuels, releasing chemicals into the atmosphere, reducing the amount of forest cover, and rapid expansion of farming, development, and industrial activities are releasing carbon dioxide into the atmosphere and changing the balance of the climate system.
   D. Growing evidence shows that changes in many physical and biological systems are linked to human-caused global warming. Some changes resulting from human activities have decreased the capacity of the environment to support various species and have substantially reduced ecosystem biodiversity and ecological resilience.
   E. Scientists and economists predict that there will be both positive and negative impacts from global climate change. If warming exceeds 2 to 3°C (3.6 to 5.4°F) over the next century, the consequences of the negative impacts are likely to be much greater than the consequences of the positive impacts.

7. Climate change will have consequences for the Earth system and human lives.
   B. Climate plays an important role in the global distribution of freshwater resources. Changing precipitation patterns and temperature conditions will alter the distribution and availability of freshwater resources, reducing reliable access to water for many people and their crops. Winter snowpack and mountain glaciers that provide water for human use are declining as a result of global warming.
   E. Ecosystems on land and in the ocean have been and will continue to be disturbed by climate change. Animals, plants, bacteria, and viruses will migrate to new areas with favorable climate conditions. Infectious diseases and certain species will be able to invade areas that they did not previously inhabit.
   F. Human health and mortality rates will be affected to different degrees in specific regions of the world as a result of climate change. Although cold-related deaths are predicted to decrease, other risks are predicted to rise. The incidence and geographical range of climate-sensitive infectious diseases—such as malaria, dengue fever, and tick-borne diseases—will increase.