

Environmental Literacy and Inquiry: Investigating Climate Change and Energy Issues

Alec Bodzin, Lehigh University
amb4@lehigh.edu

Session presented at the 2013 PAEE Conference in Bushkill, PA. March 15-16

Abstract:

To promote environmental literacy and inquiry, Lehigh University developed two curriculum units: Energy (40 day instructional sequence), and Climate Change (21 days). Freely available at <http://www.ei.lehigh.edu/eli/>, participants engage in learning activities that promote essential climate and energy literacy principles with an emphasis on sustainable and non-renewable energy resources, environmental issues, how human activities influence climate change, and energy efficiency and conservation practices. The units include embedded supports designed to assist development of pedagogical content knowledge for effective curriculum enactment, and provide teachers with a novel energy and climate change curriculum that promotes geospatial thinking skills important for investigating a range of environmental issues in our society.

The curriculum is freely available at:

<http://www.ei.lehigh.edu/eli>

To access the assessments, use login: **eliteacher**; password: **87dja92**.

Below is a brief description of the learning curriculum learning activities featured in this session. The Web address listed above contains additional information about each learning activity including teacher guides, student guides, assessments, and teacher support materials.

Climate Change

Investigating Weather and Climate with Google Earth

<http://www.ei.lehigh.edu/eli/cc/sequence/day2.html>

The curriculum begins with an investigation using Google Earth to explore global temperature changes during a recent 50 - 58 year period. Students explore, analyze, and interpret climate patterns of 13 different cities, and analyze differences between weather and climate patterns. At the completion of this activity, students understand that changes in climate are variable based on location and that the magnitude of observable climate change temperature is quite small.

Instructional Sequence Days 3-14

<http://www.ei.lehigh.edu/eli/cc/sequence>

Next, students are introduced to the four main Earth spheres (atmosphere, lithosphere, hydrosphere, and biosphere) and explore the structure and composition of the atmosphere with an emphasis on greenhouse gases and the role that ozone plays in the troposphere and stratosphere. Students explore and investigate concepts pertaining to Earth system energy balance including albedo, and surface and atmospheric absorption and reflection. In the next learning activity (Day 9), students use Google Earth to determine how latitude, elevation, proximity to bodies of water, and mountain ranges affect a location's climate.

Next, student learning activities focus on the carbon cycle and the importance of greenhouse gases in our atmosphere. Students also learn about proxies and complete a paleoclimate reconstruction lab in which they reconstruct past climates using lake varves as a proxy to interpret long-term climate patterns and understand annual sediment deposition and how it relates to weather and climate patterns.

Interactive Geologic Timeline Activity

<http://www.ei.lehigh.edu/eli/cc/sequence/day15.html>

Students use a Web-based geologic timeline to examine temperature, CO₂ concentration, and ice cover data to investigate how climate has changed during the last 715 million years. At the completion of these activities, they understand that long-term climate patterns provide evidence for fluctuating CO₂ concentrations.

Carbon Calculator Activity

<http://www.ei.lehigh.edu/eli/cc/sequence/day16.html>

Students use a Web-based carbon calculator to determine their carbon footprint and examine their personal and household habits and choices in relation to their carbon footprint. The calculator generates graphical data displays for students to compare their personal carbon footprint to the average U.S. and global citizen.

Investigating Earth's Climate Hot Spots

<http://www.ei.lehigh.edu/eli/cc/sequence/day17.html>

Students use Google Earth to investigate geographical areas and populations affected by recent changes in climate patterns. Spatial data includes changes in habitat ranges and analysis of time-sequenced photography of glaciated areas.

Investigating Future Worlds with Google Earth (Parts 1 and 2)

<http://www.ei.lehigh.edu/eli/cc/sequence/day18.html>

<http://www.ei.lehigh.edu/eli/cc/sequence/day19.html>

In the culminating two-day investigation, students use Google Earth to explore evidence of climate change during 1980 – 2010 including changes in Arctic Sea ice extent and changes in the distribution of coral reefs in the Caribbean Sea. Students begin to understand that there have been some rapid changes in the environment in recent history. During the second day of the activity, students are presented with the IPCC's worst-case scenario of a 2-meter rise in sea level. They then use Google Earth to explore future world scenarios by examining the effects of a 2-meter rise in sea level on the existing landscape (using the Google Earth elevation profile tool) through low-lying locations that could be affected by sea level rise. They then observe 1-meter and 2-meter sea level rise IPCC scenarios in the Chesapeake Bay watershed with embedded GIS data in Google Earth.

Carbon Reduction Strategies - <http://www.ei.lehigh.edu/eli/cc/sequence/day20.html>

In the final learning activity, students explore strategies at personal and societal levels to help reduce atmospheric carbon emissions levels.

Energy

This unit begins with an introduction to energy and energy units. Students then calculate their personal and household energy audit. They analyze their energy consumption patterns and ways they can reduce their energy use. Students are then introduced to different sources of energy including solar, wind, tidal, hydroelectric, nuclear, geothermal, biomass/biofuels, coal, oil, and natural gas. Students use Google Earth to explore locations of different power plants. They use GIS to investigate the best places to locate new power plants and to analyze data. Students also examine images and videos of how different power plants work.

Students examine USA's energy sources and uses. Students then recalculate their personal and household energy audit to see if there is any change in their consumption patterns. In the culminating activity, students develop an energy policy for Navitas Isle given the island's energy resources and population. Students use GIS to analyze the island's energy resources and develop an energy policy that will have minimal impact to the environment. They develop a presentation and communicate their energy policy.

Exploring Solar Power Plants with Google Earth

<http://www.ei.lehigh.edu/eli/energy/sequence/day6.html>

Students use Google Earth to view solar power plants around the world. They take a Google Earth tour of 5 large solar power plant and use the Google Earth measurement tool to determine perimeters of each solar plant and analyze land use of the surrounding area.

Where is the Best Place to Locate a New Wind Farm?

<http://www.ei.lehigh.edu/eli/energy/sequence/day11.html>

Students use Web GIS to examine wind speed and land use patterns in Pennsylvania to determine the best place to locate a new wind farm in the Lehigh Valley and in Pennsylvania.

The Isle of Navitas

<http://www.ei.lehigh.edu/eli/energy/sequence/navitas.html>

Students explore energy resources for one of three provinces on the Isle of Navitas. They analyze the benefits, costs, and environmental impacts of each energy source. Students then analyze energy resources for the island and develop an energy policy statement. The policy will recommend an efficient combination of energy sources to provide sufficient power to the province while minimizing environment impacts. Students will apply and use GIS and knowledge from past learning activities to make decisions for the placement of power plants in their province.