

Environmental Literacy and Inquiry: A Geospatial Curriculum to Support Middle School Teachers and Students

Alec Bodzin¹, Dork Sahagian², David Anastasio²,
Denise Bressler¹, Violet Kulo¹, Tamara Pepper¹,
Christopher Dempsey², and Lori Cirucci³

(1) Education and Human Services, Lehigh University

(2) Earth and Environmental Sciences, Lehigh University

(3) Broughal Middle School



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



Environmental Literacy and Inquiry Group

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

Alec Bodzin - Science and Environmental Education, Instructional Design

David Anastasio – Earth and Environmental Science

Dork Sahagian - Earth and Environmental Science

Violet Kulo – Instructional Design

Lori Cirruci – Lead classroom science teacher

Denise Bressler – Science Education

Tamara Pepper – Environmental Education

Christopher Dempsey – GIS; Earth and Environmental Science

Ryan McKeon – GIS; Earth and Environmental Science

Laura Turner – Instructional Design and Web Development

Matt Bennett – GIS; Earth and Environmental Science

Matt Diltz – Computer Science and Web interactivities

Jeff Remling and Scott Rutzmoser – Web GIS

Farah Vallera – Data management

Middle school science teachers



ELI middle school curriculum

- Energy (40 days)
- Climate Change (21 days)
- Land Use Change (20 days)
- Tectonics (6 Web GIS investigations forthcoming)

eli Environmental Literacy & Inquiry



Curriculum ▾
Energy
Climate Change
Land Use Change

Research ▾



Environmental Literacy and Inquiry (ELI) is an inquiry-based middle school curriculum that uses geospatial information technologies including Google Earth and GIS to investigate environmental issues. The Web site includes the following curriculum units: **Energy, Climate Change, and Land Use Change**. Materials best used with the Firefox Web Browser and Google Earth version 5.2 or higher.

ELI is sponsored in part by the Lehigh Environmental Initiative. Supported by the National Science Foundation (DRL -1118677), the Toyota USA Foundation, and the NASA Explorer Schools program. Video production supported in part by the Boeing Company.



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ELI middle school curriculum

- Geospatial curriculum approach:
 - Curriculum framework
 - Design principles
 - Instructional model for the development of learning activities with GT
 - Educative materials to support teacher enactment
- Align instructional materials and assessments with science and environmental literacy learning goals.
- Use geospatial technology as a tool for learners to explore and investigate problems.
- Iterative stages of development: Prototype, pilot test, and field test with diverse 8th grade urban classrooms.

Design Principles

1. Design curriculum materials to align with the demand of classroom contexts.
2. Design activities to apply to diverse contexts.
3. Use motivating entry points to engage learners.
4. Provide personally relevant and meaningful examples.
5. Promote spatial thinking skills with easy to use geospatial learning technologies.
6. Design image representations that illustrate visual aspects of scientific knowledge.
7. Develop curriculum materials to better accommodate the learning needs of diverse students.
8. Scaffold students to explain their ideas.

Energy Home

Overview

Instructional
Framework

Instructional
Sequence ▸

Student Resources

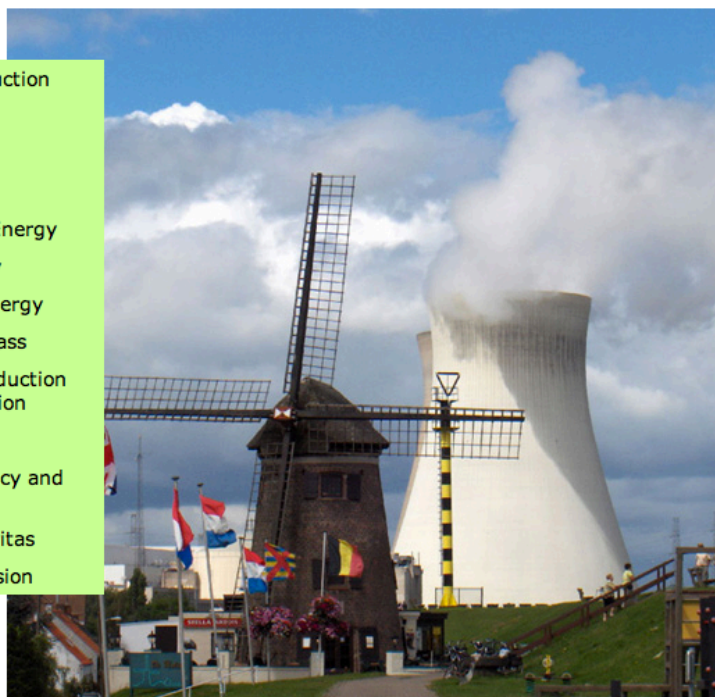
Assessments

Instructional
Resources

Support Materials

Energy Home

- Energy Introduction
- Solar Energy
- Wind Energy
- Tidal Energy
- Hydroelectric Energy
- Nuclear Energy
- Geothermal Energy
- Biofuels/ Biomass
- US Energy Production and Consumption
- Fossil Fuels
- Energy Efficiency and Conservation
- The Isle of Navitas
- Energy Conclusion

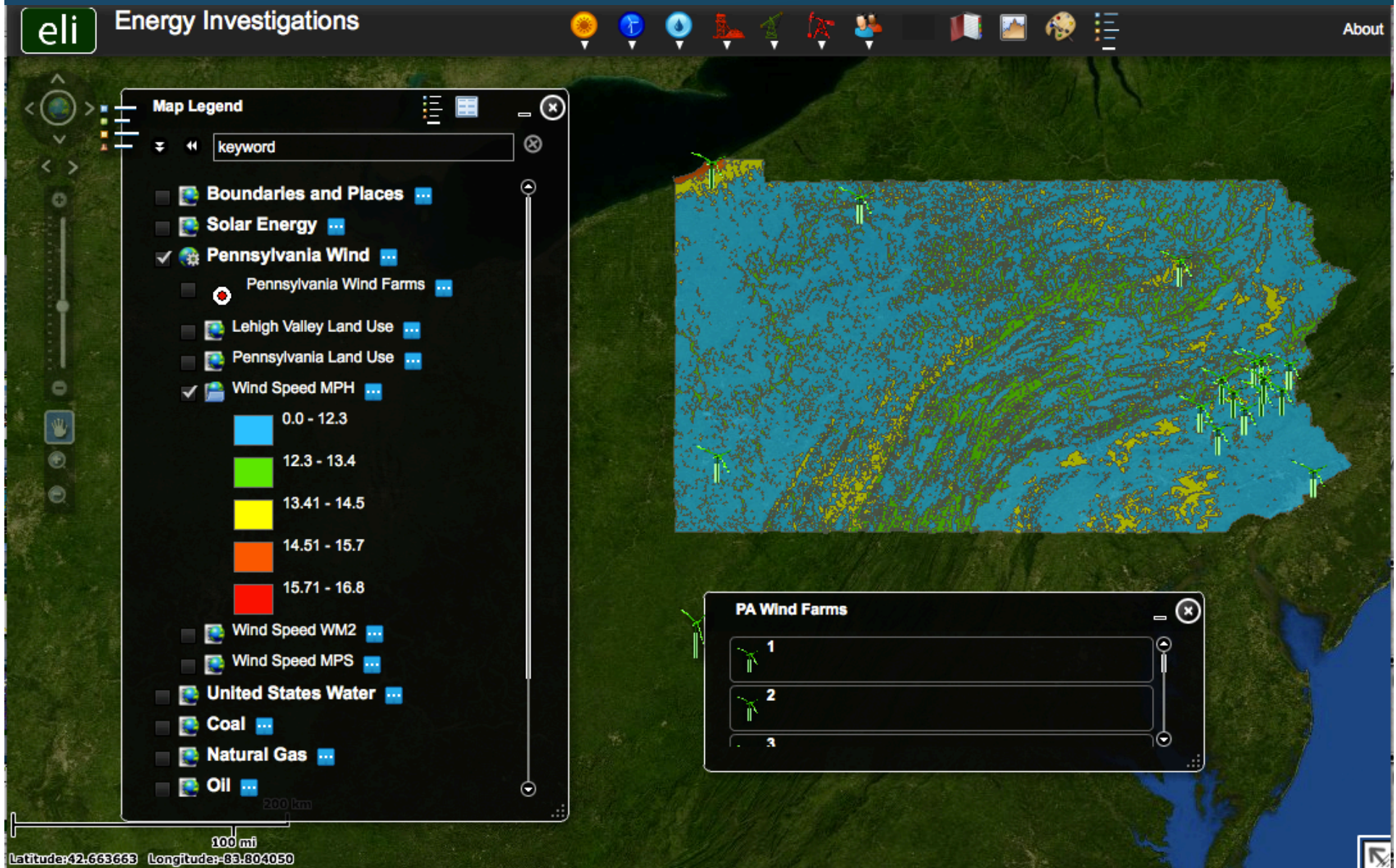


Energy is an interdisciplinary technology-supported middle school science inquiry curriculum. This curriculum focuses on the world's energy resources. Students use geospatial information technology (GIT) tools including GIS (My World GIS or Web GIS) and Google Earth, and inquiry-based lab activities to investigate energy sources, production, and consumption. **Energy** is aligned to national science and environmental education standards.

Energy has been field-tested in both urban and non-urban middle schools. Materials best used with the Firefox Web Browser and Google Earth version 5.2 or higher.

ELI is sponsored in part by the Lehigh Environmental Initiative. This material is based upon work supported by the Toyota USA Foundation.

Where is the best place to locate a new wind farm?



“Educative” Support Materials

- Pedagogical and content support for teachers
- Instructional Web GIS handouts: teacher guide, student handout, investigation sheet, assessment information
- WebGIS video tutorials

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Curriculum ▾ Research ▾




Energy Home
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Support Materials

Wind Energy

Definition of Wind Energy

Wind energy is energy from moving air.

Air has mass. When it moves, it has kinetic energy. Kinetic energy is the energy of motion.




How does wind form?

Wind forms when the sun heats one part of the atmosphere differently than another part. The heat warms the air causing it to expand. The heated air has less pressure than cooler air. Air always moves from high pressure to lower pressure. The movement of air is wind.

What is wind energy used for?

Wind energy can be converted into mechanical force or used to generate electricity.



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Web GIS Wind Handout

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


Wind is moving air and is a locally plentiful source of energy. In this activity, you will use Web GIS to examine wind speed patterns and land use in Pennsylvania to determine the best place to locate a new wind farm. You will

1. Examine wind speed patterns in Pennsylvania.
2. Examine land use patterns in Pennsylvania and in the Lehigh Valley.
3. Determine the best place to locate a new wind farm in the Lehigh Valley and in Pennsylvania.



Read all instructions and answer **each** question on your investigation sheet.

 **Step 1: Download data.**

- a. Open your Web browser. Go to www.ei.lehigh.edu/learners/energy/
- b. Click on **Where is the Best Place to Locate a New Wind Farm with Web GIS?**

 **Step 2: Basic Features of Web GIS**

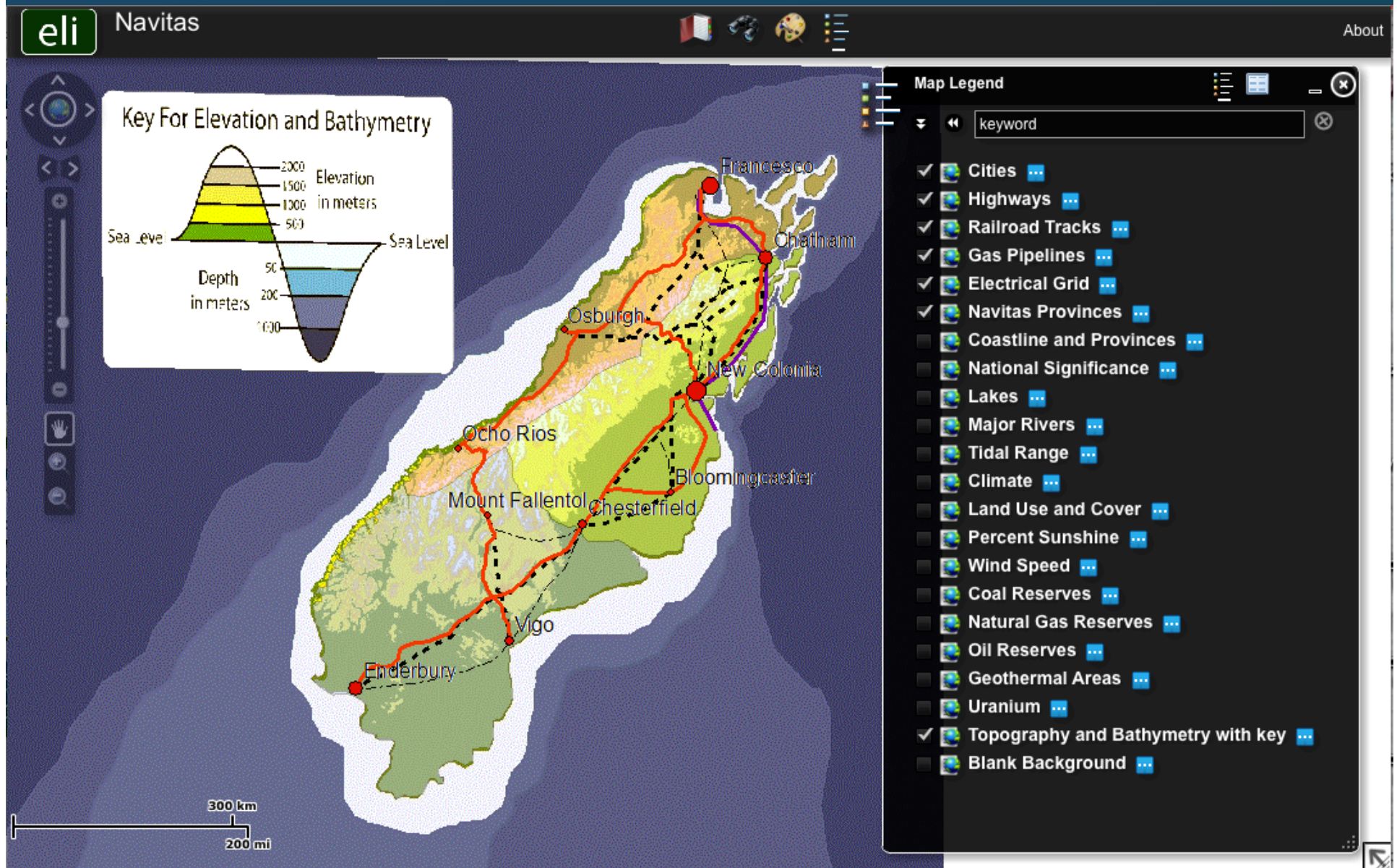
- a. Your screen should open to a global view as shown in the picture to the right.
- b. To navigate in Web GIS you can use the navigational tools (# 1) or the hand (# 2). You can move around the map by selecting different areas or scrolling to them.
- c. You can zoom in on an area by using the zoom in tool options (# 3).
- d. You can find your exact location on the map by viewing the latitude and longitude location of your cursor in the bottom left corner of the map (# 4).
- e. You can also get back to the main view by using the **Bookmark** icon in the toolbar at the top of the screen (# 2). In the box that appears, select **World View**.
- f. The data for each activity can be activated using the **Map Legend Tool** (# 1). Click on the Map Legend Tool. The Map Legend window will appear. In the Map Legend window, activate a data layer that you wish to display by clicking in the checkbox. You can expand or shrink a legend item by clicking on the globe icon next to each data layer label.
- g. To observe the legend for a specific data layer, select the globe icon next to that item in the list (# 3).



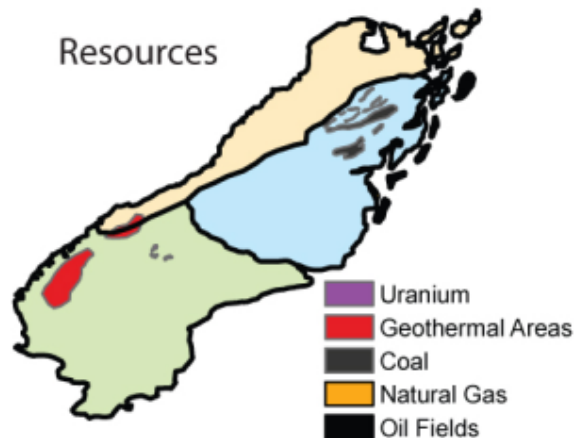
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<http://www.ei.lehigh.edu/eli/energy/support>

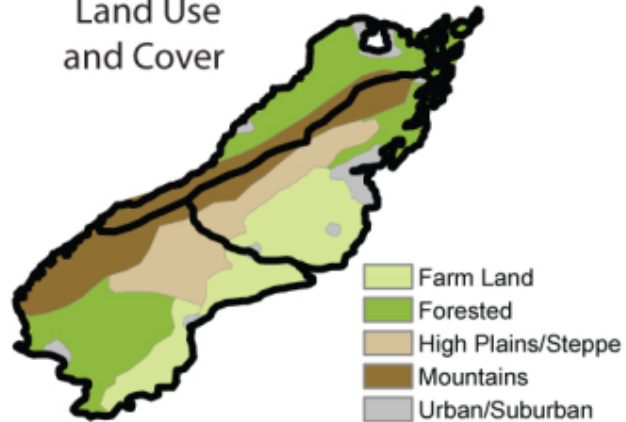
Energy Culminating Investigation: Island of Navitas



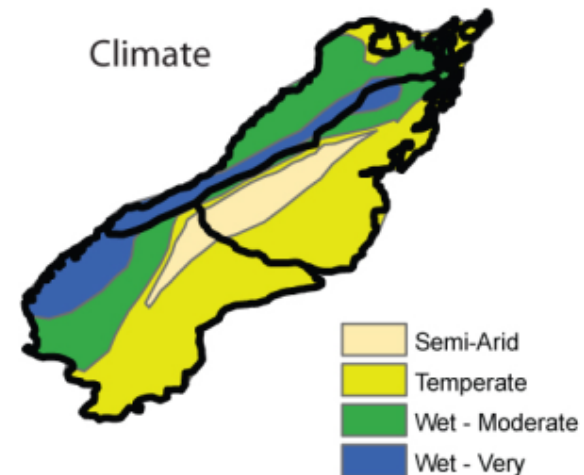
Resources



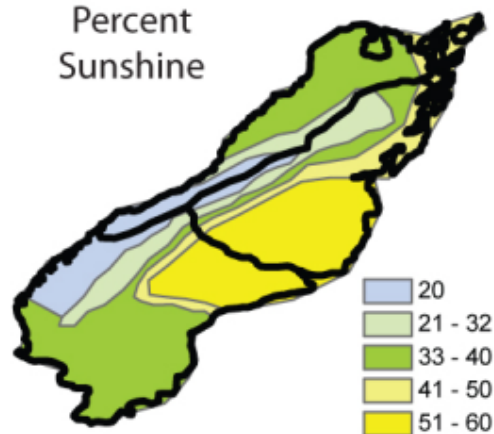
Land Use and Cover



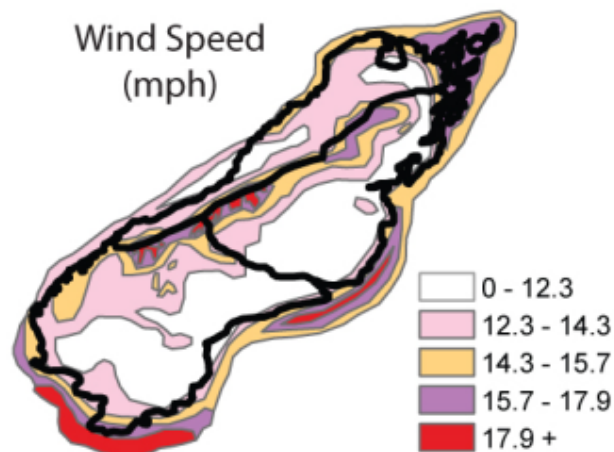
Climate



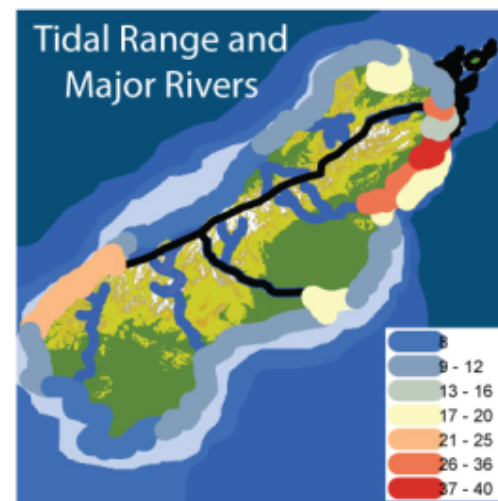
Percent Sunshine



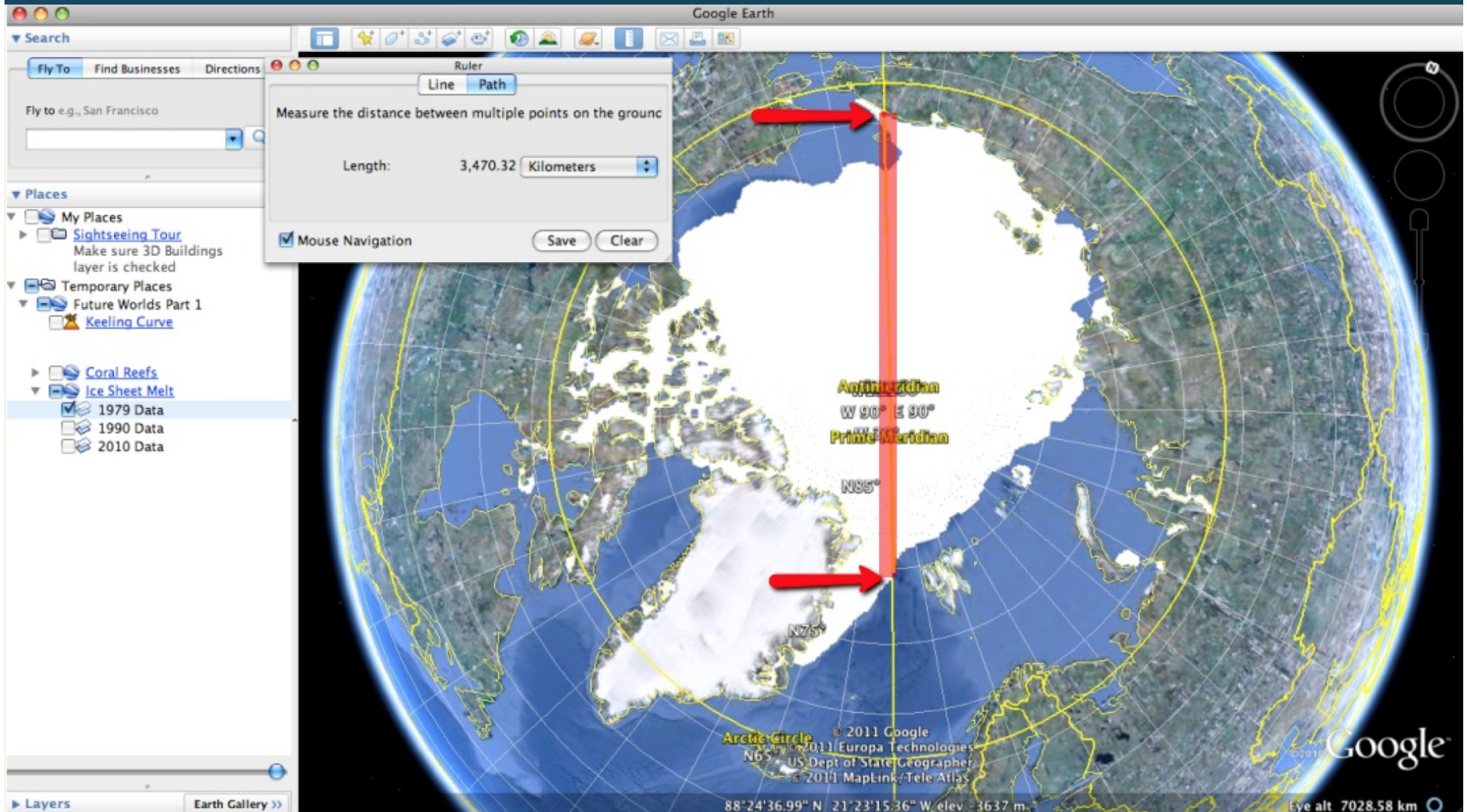
Wind Speed (mph)



Tidal Range and Major Rivers

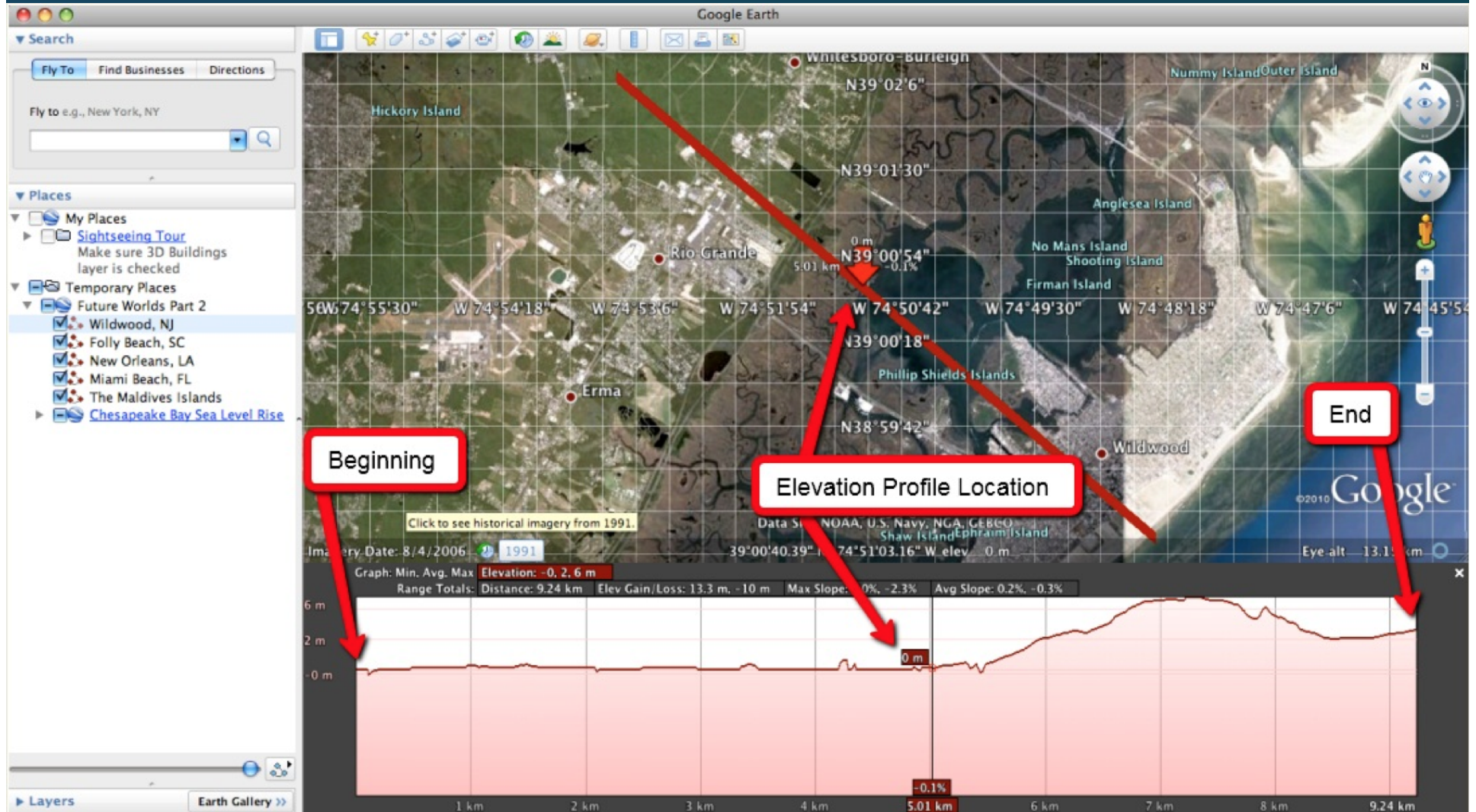


Investigating Future Worlds with Google Earth



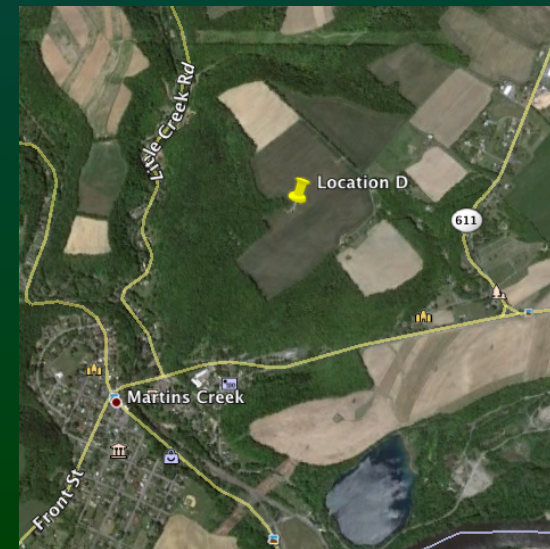
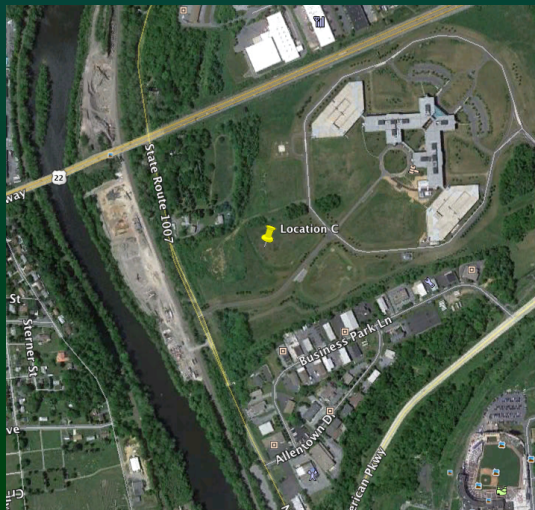
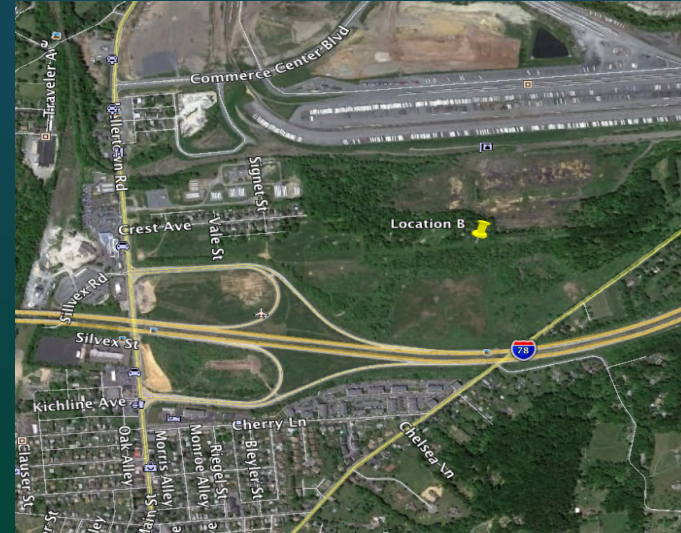
<http://www.ei.lehigh.edu/eli/cc/sequence/day18.html>

Investigating Future Worlds with Google Earth



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

Where is the best place to locate a new Wal-Mart Supercenter in the greater metropolitan Lehigh Valley area that has minimal impact on the environment?



Some Recent Findings

- Increased student geospatial thinking and reasoning skills related to content areas increased (Bodzin, 2011; Bodzin, Fu, & Pfeffer, 2012)
- Geospatial technologies are more effective than business-as-usual methods at promoting spatial thinking and mastery of content (Bodzin, Fu, & Pfeffer, 2012).
- Educative curriculum materials are an effective form of support for teaching with a geospatial-integrated curriculum (Bodzin, Pfeffer, & Kulo, 2012).

Concluding Thoughts

- WebGIS and other geospatial technologies are accessible in today's classrooms.
 - User-friendly interfaces
- Effective curriculum approach for learning with geospatial technologies
- Adopting a new reform-based science curriculum that use geospatial leaning activities is a significant change from the types of classroom learning that typically occurs in science classrooms.

**Abstract and research papers
available at:**

**[http://www.ei.lehigh.edu/eli/
research/pubs.html](http://www.ei.lehigh.edu/eli/research/pubs.html)**

ELI curriculum:

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

To access assessments, use:

Login: eliteacher

Password: 87dja92