

## **A Picture is Worth a 1000 Words: What Maps and Land-Sat Images Can Tell Us About Local and Global Land-use Change**

### *Standard(s):*

- 7.1.3.4.1 Use maps, satellite images and other data sets to describe patterns and make predictions about natural systems in a life science context.
- 7.4.4.1.2 Describe ways that human activities can change the populations and communities in an ecosystem.
- 8.1.1.2.1 Use logical reasoning and imagination to develop descriptions, explanations, predictions and models based on evidence.
- 8.1.3.4.1 Use maps, satellite images and other data sets to describe patterns and make predictions about local and global systems in Earth science contexts.
- 8.3.4.1.2 Recognize that land and water use practices can affect natural processes and that natural processes interfere and interact with human systems.
- 9.1.3.3.2 Communicate, justify and defend the procedures and results of a scientific inquiry or engineering design project using verbal, graphic, quantitative, virtual or written means.
- 9.1.3.4.4 Relate the reliability of data to consistency of results, identify sources of error, and suggest ways to improve data collection and analysis.
- 9.4.4.1.2 Describe the social, economic and ecological risks and benefits of changing a natural ecosystem as a result of human activity.

### *Connection to the Nobel Conference:*

- *Bina Agarwal* will speak about the effects of development and regional planning and its relationship to poverty and human rights.
- *Frances Moore Lappe* will speak about the impact of food consumption and production on food security/hunger.
- *Cary Fowler* will speak about the loss of biodiversity.

### *Description of Activity:*

Students will use maps/images to explore changes in local/global land use/land cover over time and the implications of these changes in terms of habitat loss, agricultural land conversion and future global food security.

### *Objectives:*

- Students will be able to use maps/images to measure land-use/land cover for a local and a global location.
- Students will read and discuss current news/scientific articles that illuminate the connections between future local/global food security, available arable land and changes in land-use/land cover due to human activities.

- Students will be able to describe connections between land use changes and habitat loss, agricultural land conversion and future global food security.

*Type of Activity:* Data Analysis Activity

*Duration:* 90-120 minutes

*Timing in relation to Nobel Conference:*

pre-conference activity  
 during conference activity  
 post-conference activity

*Teacher Tips:*

- Explain how Land-Sat images are made/read (this website may help <http://landsat.gsfc.nasa.gov/education/compositor/> ) before the students begin to work with them.
- Be sure that the 2 maps/images that are being compared are the same scale – you may have to adjust them prior to use.
- It works well to print the maps/images on ledger size paper-it is easier for students to see the details.
- Make a registration mark or line on each map/image in the same location for students to line up the grid on the map/image.
- Laminate the maps/images or use a sheet protector.
- Do one small sample map together as a group so students understand how to calculate the percent change.

*Recommended Prior Student Knowledge:*

Ability to calculate percentages

*Concepts, Connections, and Terms addressed in activity:*

Land-use changes  
Food Security  
Land-Sat images

*Materials:*

- maps and images of local and global locations - Each location should have at least 2 maps/images that are separated by at least 10 years ([www.earthshots.usgs.gov](http://www.earthshots.usgs.gov), local county offices, state USGS offices, SWCD for your county, etc.)
- transparent graph/grid overlay - 2 for each group (attached)
- data sheets (attached)
- hand lens

- news/scientific articles about the area to be studied
- report guidelines (attached)

*Procedure:*

*Part 1: Data Collection*

1. Divide students into groups of 3-4.
2. Give each group a packet that contains 2 maps, transparency grid, and data sheet.
3. Assign each group a portion of the map/image to evaluate (for example: Group 1 will complete sections A1, A2, A3, B1, B2, B3).
4. Assign the students a particular change to look for such as *agricultural land to urban* or *forest to agriculture*.
5. Have students work in groups to evaluate the sections they are assigned. Hand lenses may be helpful if the map/image is small. Students should note any changes in a grid on the data sheet.
6. Students can calculate the change by multiplying the number of sub-boxes showing a land use change (there are 25 sub-boxes in each larger grid space) by 4 and write that figure in the appropriate space on the data sheet.
7. Students should then write what the change in land use is in the appropriate space on the data sheet (example: “a change from agricultural land to urban development”).
8. Once students have completed the data sheet for their assigned sections on the map/image they should share their data with the rest of the class and discuss what the overall results say about land use changes in the region/country/state/county/city they are studying.

*Part 2: Relate Data to Issues of Land Use Change*

1. Each group will receive a packet of between 1-3 news articles about the land use/land use changes in the region – consider using podcasts of articles (when available) or reading the articles aloud (either by the teacher or by the students in the group) to allow for differentiation among students reading abilities.
2. As a group, the students will then write a brief report of the results and connect the data to the information in the articles.

*Assessment:*

Evaluate the data sheets and reports to determine if students were able to measure and understand the changes in land use/land cover of the region being investigated.

*Extensions:*

- Compare land use for agriculture to population growth over time for a given region (use numerical data from the WorldBank website, CIA World Factbook).
- Compare land area used for food production for livestock vs. food production for humans and explain significance in relation to trophic levels.
- Discuss future food security and reduction of arable land surrounding urban areas as human population expands.

- Explore how land use changes can affect biodiversity of native vegetation in Earth's ecosystems.
- Explore how land use changes can affect biodiversity of food crop species as there is a need to obtain higher yields from less land (example: ecological impacts of monoculture cropping).