NATIONAL GEOGRAPHIC
Activity*engage*

Using the Land

How do humans use the land?

Overview

Students explore data showing how humans have changed Earth's land. They examine maps showing the distribution of suitable agricultural land and investigate the effect of human development on agricultural lands.

For the complete activity with media resources, visit:
http://education.nationalgeographic.org/activity/using-land/

Directions

1. Introduce the concept of land use by looking at global land use history.

Show the **A Tale of Two Planets** image. (Download the image by clicking on the down arrow in the lower right corner of the media carousel window.) These maps illustrate which land areas have been changed by humans over time. Tell students that humans have changed Earth's landscapes greatly over time. Have students study the evidence of change illustrated on the map models. Then ask:

- *Which areas have been changed by humans for the longest period?* (Europe, Central America, the Middle East, India, and eastern Asia have been used intensively for thousands of years, along with some areas along the Andes Mountains in South America, northeastern North America, and parts of sub-Saharan Africa. The orange to red coloration on the map shows this.)
- *How do you think humans changed the land?* (Humans have used the land for farming as well as housing.)

2. Discuss the role of uncertainty in the scientific process.

Tell students that science is a process of learning how the world works and that scientists do not know the “right” answers when they start to investigate a question. Students can see examples of scientists' uncertainty in forecasting crop yields. Show the **Projection of Maize Crop Yields in France** image from the media carousel above. (Download the image by clicking on the down arrow in the lower right corner of the carousel window.) Tell students that the graphs in this image show the projection of maize crop yields in France over this time period—the average daily precipitation, number of hot days, and yield of maize. The gray line shows the predictions for crop yield based on technological improvements. The pink shading shows the expected yield based on temperature and precipitation influences. The red lines outside the pink shading show the total uncertainty. Ask:

- *Does the technology trend (gray line) accurately predict crop yields?* (No, the technology trend does not accurately predict crop yields. This is because crop yields are dependent on temperature and precipitation as well as technological improvements.)
- *Why do you think the crop models still have uncertainty even after accounting for precipitation and temperature differences year to year?* (Student answers will vary. The crop yield could be affected by a pest infestation.)

Tell students they will be asked questions about the certainty of their predictions and that they should think about what scientific data is available as they assess their certainty with their answers. Encourage students to discuss the scientific evidence with each other to better assess their level of certainty with their predictions.

3. Introduce the concept of stocks and flows in a system.

Tell students that materials flow into and out of systems. The flow of the materials over time can change and can be influenced by many different factors and interacting parts.

Scientists think about how one part of the system can affect other parts of the system. Give students a simple example of a stock and flow in a system, as described in the scenario below.

There is a bathtub with water flowing in from the faucet and water leaving through the drain. Ask:

- *When the drain is plugged, what happens to the level of water in the bathtub?* (The water level will increase because the outflow of water is stopped, but water keeps coming in from the faucet.)
- *When the faucet is turned off, what happens to the level of water in the bathtub?* (The water level will decrease because the inflow of water is stopped, but the water keeps leaving through the drain.)
- *How can the level of water in the bathtub be kept at the same level?* (The water in the bathtub can be kept at the same level by making the inflow equal to the outflow. Then the water that comes in through the faucet will be offset by the water that leaves through the drain.)

Tell students they will be following the flow of materials, in this case the amount of topsoil and nutrients, through a system. Let students know they will be exploring some environmental and human factors that contribute to changes in the quality of soil in the modeled system.

4. Implement the Using the Land interactive.

Provide students with the link to the Using the Land interactive. Divide students into groups of two or three, with two being the ideal grouping to allow groups to share a computer workstation. Tell students they will be working through a series of pages of questions related to the data in the interactive. Ask students to work through the interactive in their groups, discussing and responding to questions as they go.

Tell students that this is Activity 1 of the **Can We Feed the Growing Population?** lesson.

5. Discuss the issues.

After students have completed the activity, bring the groups back together and lead a discussion focusing on these questions:

- *How have humans changed Earth's natural landscape?* (Humans have cut down forests and plowed up prairies for farming and housing. Waterways have been changed for irrigation and to prevent seasonal flooding. Other areas have been less affected by human actions, but there are few places on Earth that have not been affected by human actions.)
- *What is a consequence of turning forested land into farmland or residential land?* (The forests provide homes for many organisms. Many forest lands are sloped, which may not be good for either farming or housing. Forests provide oxygen, prevent water runoff and erosion, and store carbon dioxide.)
- *How has the proportion of agricultural land in the United States changed since 1950?* (Agricultural land has decreased. Urban areas have increased, as have special use areas [parks, wilderness areas, defense/industrial lands]).
- *Why isn't agricultural land spread evenly around the world?* (Agricultural land needs to have good soil, adequate precipitation, and moderate temperature. These features aren't found evenly across Earth.)

Tip

This activity is part of a sequence of activities in the Can We Feed the Growing Population? lesson. The activities work best if used in sequence.

Modification

This activity may be used individually or in groups of two or three students. It may also be modified for a whole-class format. If using as a whole-class activity, use an LCD projector or interactive whiteboard to project the activity. Turn embedded questions into class discussions. Uncertainty items allow for classroom debates over the evidence.

Tip
To save your students' data for grading online, register your class for free at the High-Adventure Science portal page.

Informal Assessment
1. Check students' comprehension by asking them the following questions:

- Has agricultural production kept pace with human population growth in areas around the world?
- What are some consequences of turning agricultural land into suburbs or cities?
- What are some consequences of turning forested land into farmland, suburbs, or cities?
- Why isn't all land equally suitable for agricultural uses?

2. Use the answer key to check students' answers on embedded assessments.

Objectives
Subjects & Disciplines
Science
- Earth science
- General science

Learning Objectives
Students will:

- describe some consequences of using land (forests, agricultural land) for other purposes (human development)
- explain why agricultural land is unevenly distributed on Earth's land surfaces
- describe how humans have changed Earth's landscape

Teaching Approach
- Learning-for-use

Teaching Methods
- Discussions
- Multimedia instruction
- Self-paced learning
- Visual instruction
- Writing

Skills Summary
This activity targets the following skills:

- 21st Century Student Outcomes
  - Information, Media, and Technology Skills

        - Information, Communications, and Technology Literacy
    - Learning and Innovation Skills
        - Critical Thinking and Problem Solving
- 21st Century Themes
    - Global Awareness
- Critical Thinking Skills
    - Analyzing
    - Evaluating
    - Understanding

National Standards, Principles, and Practices

National Science Education Standards

• (5-8) Standard A-1:
Abilities necessary to do scientific inquiry
• (5-8) Standard D-1:
Structure of the earth system
• (5-8) Standard F-1:
Personal health
• (5-8) Standard F-4:
Risks and benefits
• (9-12) Standard A-1:
Abilities necessary to do scientific inquiry
• (9-12) Standard A-2:
Understandings about scientific inquiry
• (9-12) Standard C-5:
Matter, energy, and organization in living systems
• (9-12) Standard F-1:
Personal and community health
• (9-12) Standard F-2:
Population growth
• (9-12) Standard F-4:
Environmental quality
• (9-12) Standard F-5:
Natural and human-induced hazards

Common Core State Standards for English Language Arts & Literacy

• Reading Standards for Literacy in Science and Technical Subjects 6-12:
Key Ideas and Details, RST.9-10.1
• Reading Standards for Literacy in Science and Technical Subjects 6-12:
Key Ideas and Details, RST.6-8.3
• Reading Standards for Literacy in Science and Technical Subjects 6-12:
Key Ideas and Details, RST.6-8.1

• **Reading Standards for Literacy in Science and Technical Subjects 6-12:**
Craft and Structure, RST.6-8.4
• **Reading Standards for Literacy in Science and Technical Subjects 6-12:**
Key Ideas and Details, RST.9-10.3
• **Reading Standards for Literacy in Science and Technical Subjects 6-12:**
Craft and Structure, RST.9-10.4
• **Reading Standards for Literacy in Science and Technical Subjects 6-12:**
Key Ideas and Details, RST.11-12.1
• **Reading Standards for Literacy in Science and Technical Subjects 6-12:**
Key Ideas and Details, RST.11-12.3
• **Reading Standards for Literacy in Science and Technical Subjects 6-12:**
Craft and Structure, RST.11-12.4

ISTE Standards for Students (ISTE Standards*S)

• **Standard 3:**
Research and Information Fluency
• **Standard 4:**
Critical Thinking, Problem Solving, and Decision Making

Next Generation Science Standards

• **Crosscutting Concept 1:**
Patterns
• **Crosscutting Concept 3:**
Scale, proportion, and quantity
• **Crosscutting Concept 7:**
Stability and change
• **Science and Engineering Practice 1:**
Asking questions and defining problems
• **Science and Engineering Practice 4:**
Analyzing and interpreting data
• **Science and Engineering Practice 5:**
Using mathematics and computational thinking
• **Science and Engineering Practice 6:**
Constructing explanations and designing solutions
• **Science and Engineering Practice 7:**
Engaging in argument from evidence
• **Science and Engineering Practice 8:**
Obtaining, evaluating, and communicating information

Preparation

What You'll Need

Required Technology

- Internet Access: Required
- Tech Setup: 1 computer per learner, 1 computer per small group, Interactive whiteboard, Projector

Physical Space
- Classroom
- Computer lab
- Media Center/Library

Grouping
- Heterogeneous grouping
- Homogeneous grouping
- Large-group instruction
- Small-group instruction

Resources Provided: Handouts & Worksheets
- Answer Key - Using the Land

Resources Provided: Interactives
- Using the Land

Resources Provided: Images
- A Tale of Two Planets
- Projection of Maize Crop Yields in France

Background & Vocabulary
Background Information
Human populations around the world have increased. Agricultural operations around the world produce more than enough food to feed the human population, due in part to chemical and biological innovations.

However, many high-quality farmlands are threatened by development. Housing, retail, and industrial areas have encroached on agricultural land. Other high-quality fields are used to grow food for fuel, rather than food for food (either animal or human). The question of whether the agricultural revolution will continue to produce sufficient amounts of nutritious food and maintain the land and natural environment is still open.

This activity focuses on the land use changes that have occurred in the United States since 1949. Even so, the general information is applicable to any country that has farmland. Will the farmland continue to be productive in the future?

Prior Knowledge

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Recommended Prior Activities

- None

Vocabulary

Term	Part of Speech	Definition
agriculture	*noun*	the art and science of cultivating the land for growing crops (farming) or raising livestock (ranching).
biosphere	*noun*	part of the Earth where life exists.
land management	*noun*	process of balancing the interests of development, resources, and sustainability for a region.
model, computational	*noun*	a mathematical model that requires extensive computational resources to study the behavior of a complex system by computer simulation.
sustainability	*noun*	use of resources in such a manner that they will never be exhausted.
system	*noun*	collection of items or organisms that are linked and related, functioning as a whole.

For Further Exploration

Reference

- National Geographic Encyclopedic Entry: rural area
- National Geographic Encyclopedic Entry: urban area
- National Geographic Encyclopedic Entry: agriculture
- National Geographic Encyclopedic Entry: fertility
- National Geographic Encyclopedic Entry: humus

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Partner