My NASA Data - GLOBE Connections

GLOBE Connections: Scale, Proportion and Quantity

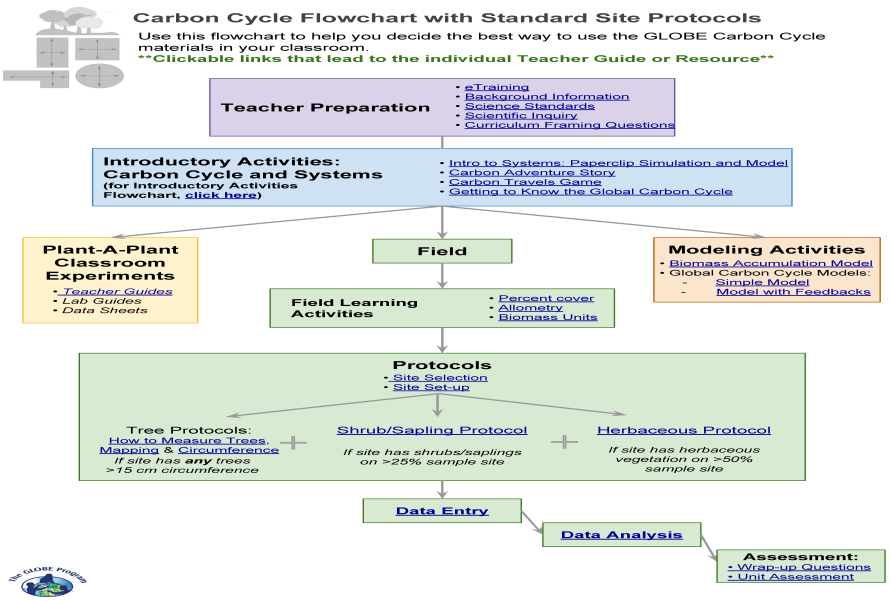
Scale, Proportion, and Quantity

GLOBE protocols help students to study and model phenomena that are too large or small to directly observe, such as change over time and space. Many GLOBE protocols can be used to study changes over time. These changes would include seasonal, as well as long term changes. In addition, data can be retrieved and examined on local, regional and global scales. A few of the protocols and learning activities that especially highlight these ideas are outlined on this page. For information on all GLOBE protocols, see the Do GLOBE page on the GLOBE website.

For more information on Scale, Proportion, and Quantity, visit the My NASA Data page dedicated to this cross-cutting concept.

Protocols

Carbon Cycle The Globe Carbon Cycle project is one of four Earth System Science Projects (ESSPs) funded by NASA and NSF to develop hands-on, intermediate, and secondary school-based science activities for the GLOBE Program.



Source; GLOBE Biosphere eTraining Carbon Cycle Introduction

GLOBE Carbon Cycle is focused on bringing the most cutting-edge research and research techniques in the field of terrestrial ecosystem carbon cycling into the classroom. It uses a systems-thinking approach to gain a foundation in the carbon cycle and its relation to climate and energy. The materials incorporate a diverse set of activities geared toward upper-middle and high school students. The protocols are found on the GLOBE Biosphere Protocols Teacher's Guide page.

Land Cover Classification: Determine the major land cover type at a Land Cover Sample Site.

Source: (GLOBE Website)

Learning Activities

Biomass Units

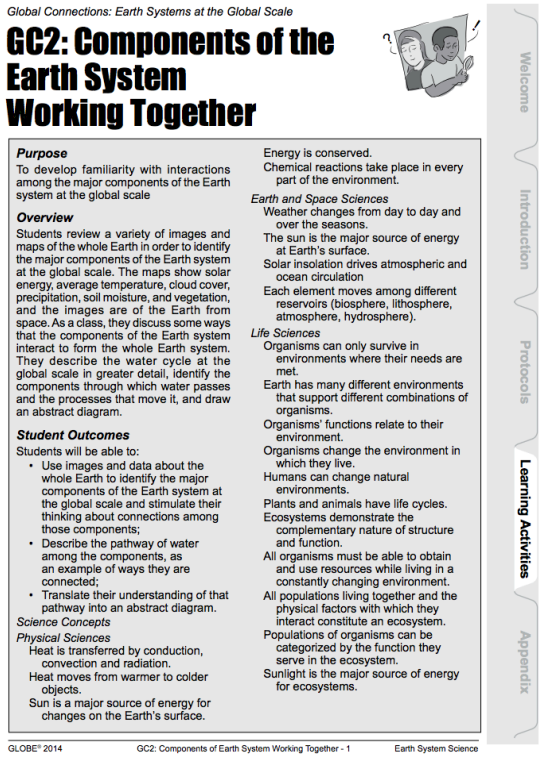
Overview: In this activity, students will calculate the biomass of their classroom using an estimate of the total dry mass of students in the class as well as the classroom area. Students calculate current carbon storage in the classroom. Students consider vegetation biomass across global biomes.

Student Outcomes:

- Determine the biomass of the classroom by calculating the total students' dry mass within the classroom area.
- Calculate differences in classroom biomass when the classroom area or students' dry mass changes.
- Investigate and discuss connections between basic biomass concepts (mass/ area) and the amount of biomass in natural systems (biomes).

Global Connections (GC2) -Components of the Earth System Working Together:

Overview: Students review a variety of images and maps of the whole Earth in order to identify the major components of the Earth system on a global scale. The maps show solar energy, average temperature, cloud cover, precipitation, soil moisture, and vegetation, and the images are of the Earth from space. As a class, they discuss some ways that the components of the Earth system interact to form the whole Earth system. They describe the water cycle at the global scale in greater detail, identify the components through which water passes and the processes that move it, and draw an



Global Connections: Earth Systems at the Global Scale

GC2: Components of the Earth System Working Together

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Purpose

To develop familiarity with interactions among the major components of the Earth system at the global scale

Overview

Students review a variety of images and maps of the whole Earth in order to identify the major components of the Earth system at the global scale. The maps show solar energy, average temperature, cloud cover, precipitation, soil moisture, and vegetation, and the images are of the Earth from space. As a class, they discuss some ways that the components of the Earth system interact to form the whole Earth system. They describe the water cycle at the global scale in greater detail, identify the components through which water passes and the processes that move it, and draw an abstract diagram.

Student Outcomes

Students will be able to:

- Use images and data about the whole Earth to identify the major components of the Earth system at the global scale and stimulate their thinking about connections among those components;
- Describe the pathway of water among the components, as an example of ways they are connected;
- Translate their understanding of that pathway into an abstract diagram.

Science Concepts

Physical Sciences

Heat is transferred by conduction, convection and radiation.
Heat moves from warmer to colder objects.
Sun is a major source of energy for changes on the Earth's surface.
Energy is conserved.
Chemical reactions take place in every part of the environment.

Earth and Space Sciences

Weather changes from day to day and over the seasons.
The sun is the major source of energy at Earth's surface.
Solar insolation drives atmospheric and ocean circulation
Each element moves among different reservoirs (biosphere, lithosphere, atmosphere, hydrosphere).

Life Sciences

Organisms can only survive in environments where their needs are met.
Earth has many different environments that support different combinations of organisms.
Organisms' functions relate to their environment.
Organisms change the environment in which they live.
Humans can change natural environments.
Plants and animals have life cycles.
Ecosystems demonstrate the complementary nature of structure and function.
All organisms must be able to obtain and use resources while living in a constantly changing environment.
All populations living together and the physical factors with which they interact constitute an ecosystem.
Populations of organisms can be categorized by the function they serve in the ecosystem.
Sunlight is the major source of energy for ecosystems.

GLOBE® 2014 GC2: Components of Earth System Working Together - 1 Earth System Science

abstract diagram.

Student Outcomes:

- Use images and data about the whole Earth to identify the major components of the Earth system at the global
  scale and stimulate their thinking about connections among those components
- Describe the pathway of water among the components, as an example of ways they are connected
- Translate their understanding of that pathway into an abstract diagram

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Determining Scale and Calculating Area

Overview: Students will determine a scale for the aerial photo or map they are using to investigate their carbon cycle sample site. The map scale is then used to calculate a given area, such as that of forest in the schoolyard. A vegetated area is required to make an estimate of the total above-ground carbon stock within the schoolyard or other desired location, which may be needed for a variety of research questions. Calculating area can be done using several methods; these range from a paper map and grid, as described here, to a more complex geographic information system (GIS) and image analysis techniques.

Student Outcomes:

- Use an aerial photo or map, a tape measure, and math to determine scale.
- Calculate the area of a real-world object using a map scale and a gridded overlay.
- Develop and implement a method to determine carbon stocks in the vegetated areas of the schoolyard or other desired location.

(*Source: GLOBE Determining Scale and Calculating Area*)

Land Cover Change Detection

Overview: Using Multispec software, evaluate and investigate changes that have occurred in the major land cover types of your GLOBE Study Site by examining the digital files of two Landsat satellite images that were acquired a few years apart.

GLOBE Observer Land Cover
Image Credit: NASA

Student Outcomes:

- Earth has many different environments that support different combinations of organisms
- All organisms must be able to obtain and use resources while living in a constantly changing environment
- All populations living together and the physical factors with which they interact constitute an ecosystem
- Humans can change ecosystem balance
- How to use maps (real and imaginary)
- The characteristics and spatial distribution of ecosystems
- Use land cover data and appropriate tools and technology to interpret change
- Gather spatial data and historical data to determine the validity of change hypotheses

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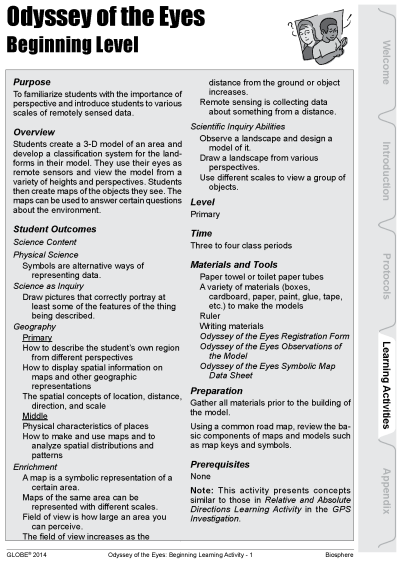
Odyssey of the Eyes

Beginning

Overview: Students explore the importance of perspective and are introduced to various scales of remotely-sensed data.



Odyssey of the Eyes
Beginning Level

Purpose
To familiarize students with the importance of perspective and introduce students to various scales of remotely sensed data.

Overview
Students create a 3-D model of an area and develop a classification system for the landforms in their model. They use their eyes as remote sensors and view the model from a variety of heights and perspectives. Students then create maps of the objects they see. The maps can be used to answer certain questions about the environment.

Student Outcomes
Science Content
Physical Science
Symbols are alternative ways of representing data.
Science as Inquiry
Draw pictures that correctly portray at least some of the features of the thing being described.
Geography
Primary
How to describe the student's own region from different perspectives
How to display spatial information on maps and other geographic representations
The spatial concepts of location, distance, direction, and scale
Middle
Physical characteristics of places
How to make and use maps and to analyze spatial distributions and patterns
Enrichment
A map is a symbolic representation of a certain area.
Maps of the same area can be represented with different scales.
Field of view is how large an area you can perceive.
The field of view increases as the distance from the ground or object increases.
Remote sensing is collecting data about something from a distance.
Scientific Inquiry Abilities
Observe a landscape and design a model of it.
Draw a landscape from various perspectives.
Use different scales to view a group of objects.

Level
Primary

Time
Three to four class periods

Materials and Tools
Paper towel or toilet paper tubes
A variety of materials (boxes, cardboard, paper, paint, glue, tape, etc.) to make the models
Ruler
Writing materials
Odyssey of the Eyes Registration Form
Odyssey of the Eyes Observations of the Model
Odyssey of the Eyes Symbolic Map Data Sheet

Preparation
Gather all materials prior to the building of the model.

Using a common road map, review the basic components of maps and models such as map keys and symbols.

Prerequisites
None

Note: This activity presents concepts similar to those in *Relative and Absolute Directions Learning Activity* in the *GPS Investigation*.

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GLOBE® 2014 Odyssey of the Eyes: Beginning Learning Activity - 1 Biosphere

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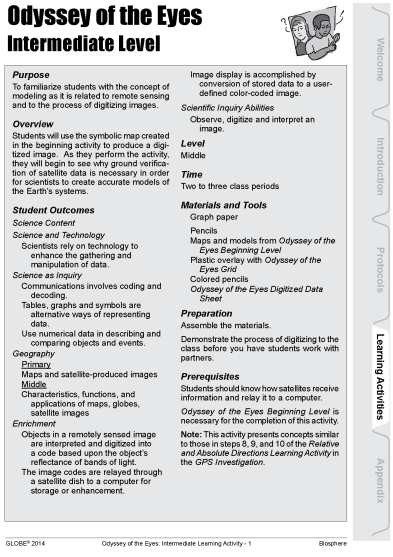
Source: (GLOBE Website)

Student Outcomes:

- Symbols are alternative ways of representing data
- Draw pictures that correctly portray at least some of the features of the thing being described
- How to describe the student's own region from different perspectives
- How to display spatial information on maps and other geographic representations
- The spatial concepts of location, distance, direction, and scale
- Physical characteristics of places
- How to make and use maps and to analyze spatial distributions and patterns

Intermediate

Overview: Students explore the concept of modeling as it relates to remote sensing and to the process of digitizing images.



Odyssey of the Eyes
Intermediate Level

Purpose
To familiarize students with the concept of modeling as it is related to remote sensing and to the process of digitizing images.

Overview
Students will use the symbolic map created in the beginning activity to produce a digitized image. As they perform the activity, they will begin to see why ground verification of satellite data is necessary in order for scientists to create accurate models of the Earth's systems.

Student Outcomes
Science Content
Science and Technology
Scientists rely on technology to enhance the gathering and manipulation of data.
Science as Inquiry
Communications involves coding and decoding.
Tables, graphs and symbols are alternative ways of representing data.
Use numerical data in describing and comparing objects and events.
Geography
Primary
Maps and satellite-produced images
Middle
Characteristics, functions, and applications of maps, globes, satellite images
Enrichment
Objects in a remotely sensed image are interpreted and digitized into a code based upon the object's reflectance of bands of light.
The image codes are relayed through a satellite dish to a computer for storage or enhancement.
Image display is accomplished by conversion of stored data to a user-defined color-coded image.
Scientific Inquiry Abilities
Observe, digitize and interpret an image.

Level
Middle

Time
Two to three class periods

Materials and Tools
Graph paper
Pencils
Maps and models from *Odyssey of the Eyes Beginning Level*
Plastic overlay with *Odyssey of the Eyes Grid*
Colored pencils
Odyssey of the Eyes Digitized Data Sheet

Preparation
Assemble the materials.

Demonstrate the process of digitizing to the class before you have students work with partners.

Prerequisites
Students should know how satellites receive information and relay it to a computer.

Odyssey of the Eyes Beginning Level is necessary for the completion of this activity.

Note: This activity presents concepts similar to those in steps 8, 9, and 10 of the *Relative and Absolute Directions Learning Activity* in the *GPS Investigation*.

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GLOBE® 2014 Odyssey of the Eyes: Intermediate Learning Activity - 1 Biosphere

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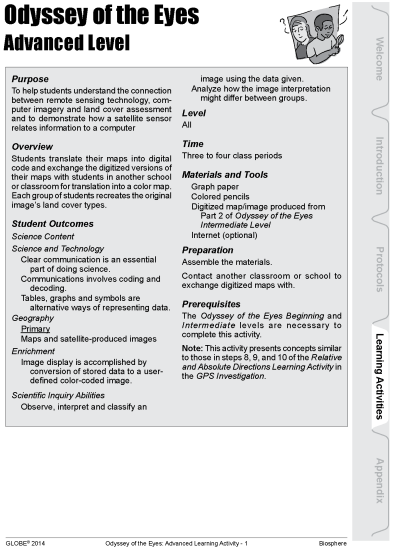
Source: (GLOBE Website)

Student Outcomes:

- Scientists rely on technology to enhance the gathering and manipulation of data
- Tables, graphs, and symbols are alternative ways of representing data
- Use numerical data in describing and comparing objects and events
- Maps and satellite-produced images
- Characteristics, functions, and applications of maps, globes, satellite images

Advanced

Overview: Students investigate the connection between remote-sensing technology, computer imagery, and land cover assessment as well as demonstrate how a satellite sensor relates information to a computer.



Odyssey of the Eyes
Advanced Level

Purpose
To help students understand the connection between remote sensing technology, computer imagery and land cover assessment and to demonstrate how a satellite sensor relates information to a computer

Overview
Students translate their maps into digital code and exchange the digitized versions of their maps with students in another school or classroom for translation into a color map. Each group of students recreates the original image's land cover types.

Student Outcomes
Science Content
Science and Technology
Clear communication is an essential part of doing science.
Communications involves coding and decoding.
Tables, graphs and symbols are alternative ways of representing data.
Geography
Primary
Maps and satellite-produced images
Enrichment
Image display is accomplished by conversion of stored data to a user-defined color-coded image.
Scientific Inquiry Abilities
Observe, interpret and classify an image using the data given.
Analyze how the image interpretation might differ between groups.

Level
All

Time
Three to four class periods

Materials and Tools
Graph paper
Colored pencils
Digitized map/image produced from Part 2 of *Odyssey of the Eyes Intermediate Level*
Internet (optional)

Preparation
Assemble the materials.
Contact another classroom or school to exchange digitized maps with.

Prerequisites
The *Odyssey of the Eyes Beginning* and *Intermediate* levels are necessary to complete this activity.

Note: This activity presents concepts similar to those in steps 8, 9, and 10 of the *Relative and Absolute Directions Learning Activity* in the *GPS Investigation*.

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GLOBE® 2014 Odyssey of the Eyes: Advanced Learning Activity - 1 Biosphere

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GLOBE Observer Land Cover
Image Credit: NASA

Student Outcomes:

- Clear communication is an essential part of doing science
- Communications involve coding and decoding
- Tables, graphs, and symbols are alternative ways of representing data
- Maps and satellite-produced images
- Observe, interpret and classify an image using the data given
- Analyze how the image interpretation might differ between groups