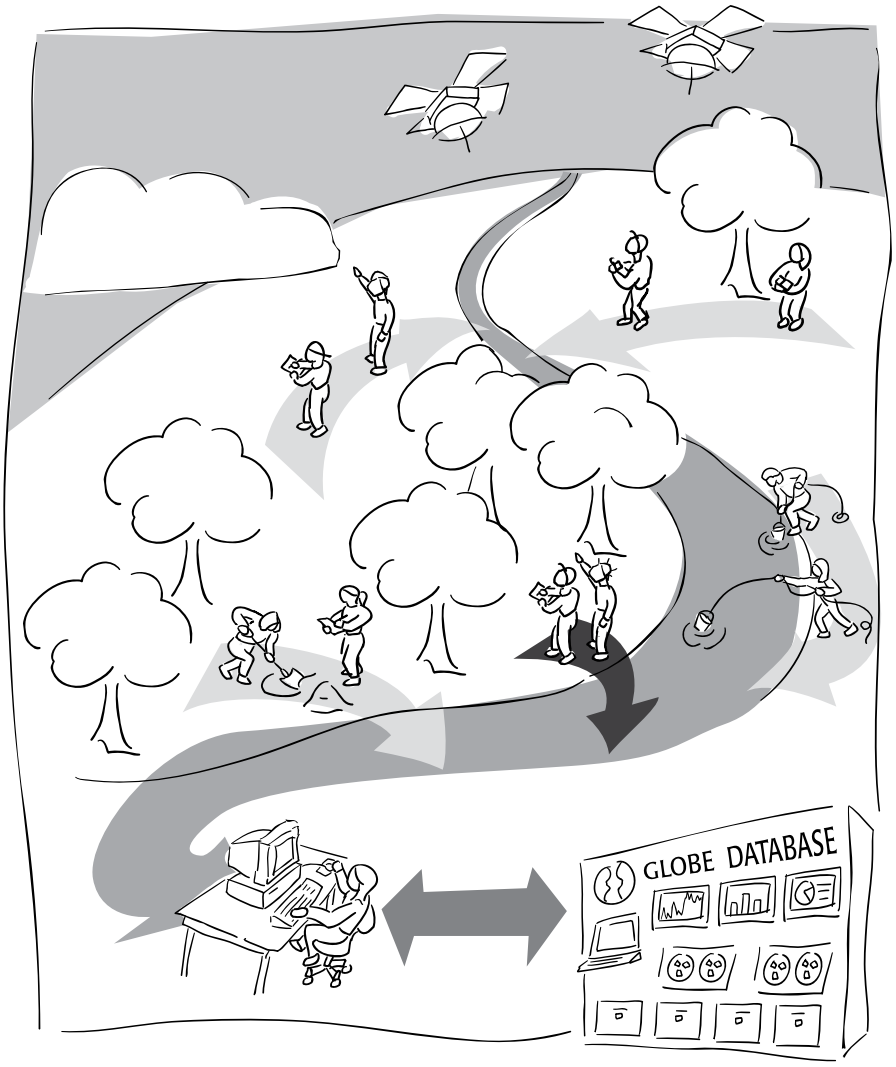
Biosphere Investigation



A GLOBE® Learning Investigation

Biosphere Investigation at a Glance

Protocols

Daily and Bi-Weekly, Seasonal Measurements

Cloned and Common Lilacs (daily, Seasonal)
Green-Up (bi-weekly, seasonal)
Green-Down (bi-weekly, seasonal)
Ruby-Throated Hummingbirds (daily or bi-weekly, seasonal)
Phenological Gardens (daily or bi-weekly, seasonal)
Arctic Bird Migration (every other day from 2 weeks prior to expected arrival)

Monthly

Seaweed Receptacle Reproductive Stages (four months in a row)

Once Per Site (or when land cover type has changed)

Land Cover Sample Site Protocol *(*Data collected once for each site: GPS location, photographs, land cover classification)

Biometry Protocol *(*Data collected once to determine land cover class of Land Cover Sample Sites or more often to study changes in biomass over time: canopy cover and ground cover, tree, shrub and/or graminoid height, tree circumference, graminoid biomass, dominant and co-dominant vegetation)

Suggested Activities

Note: Certain Learning Activities are desirable prior to implementing Protocols.
Read the Introduction to become familiar with concepts of the biosphere, land cover and phenology.

Land Cover
Read the *Measurement Logistics* and *Suggested Methodology in the Introduction*.
Perform *Getting to Know Your Satellite Imagery* and *GLOBE Study Site Learning Activity*.
Make a densiometer and clinometer (*see Investigation Instruments*).
Review how to pace and use a compass, densiometer, clinometer and tape measure (*see Investigation Instruments*).
Practice the *GPS Protocol* (see GPS Chapter) and the Biometry Protocol.
Choose appropriate Land Cover Sample Sites within your Study Site (review *Sample Site Selection and Set-up*).
Perform the *Site Seeing Learning Activity (Beginner, or Intermediate)* - introduces systems concepts.
Perform the *Leaf Classification Learning Activity* - introduces the concepts of classification.

Practice using the MUC System to classify land cover.
Perform Land Cover Sample Site Protocol at each Sample Site.
Perform the *Odyssey of the Eyes Learning Activity (Beginning, Intermediate, or Advaced)* - introduces remote sensing.
Perform the either the *Manual Mapping: A Tutorial for the Beverly, MA Image* (from the Appendix) if you will be doing a manual map or the Unsupervised Clustering Tutorial if you will be doing a computer-aided map.
Perform either *Manual* *or* *Computer-aided Land Cover Mapping Learning Activity* using a Landsat satellite image.
Perform the *Bird Beak Accuracy Assessment Learning Activity* to introduce accuracy assessment.
Perform the *Accuracy Assessment Tutorial* from the Appendix to analyze the accuracy of your land cover type map.
Perform the *Land Cover Change Detection Learning Activity*.
Perform the *Discovery Area Learning Activity* - uses the satellite images and maps students create.
Using GLOBE Data to Analyze Land Cover Learning Activity - relates land cover data to other GLOBE investigation measurements

Phenology
If you intend on doing the Phenological Gardens Protocol, the best time to plant your garden is in the spring or autumn. Also, you must wait a year before collecting data.
Green-Up Cards, *A Sneak Preview to Budburst*, and a *First Look at Phenology* learning activities set the stage for taking plant phenology measurements.
Choose one of the Phenology Protocols to start (Green Down or Hummingbirds in the fall; Green Up, or Hummingbirds in the spring); Phenological Gardens throughout the year).
A Beginning Look at Photosynthesis and *Investigating Leaf Pigments* learning activities help students better understand the process of photosynthesis.
Global Patterns in Green-Up and Green-Down and *Limiting Factors in Ecosystems* help students to explore global trends in green-up and green-down and to explore why these patterns occur in different ecosystems.

Table of Contents

Phenology