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GLOBE Mission Earth – Using NASA Assets and the GLOBE Program to Connect Learning to STEM Careers

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AGENDA

- What is GLOBE Mission EARTH?
- The GLOBE Program
- NASA Assets
- Connecting Learning and STEM Careers

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What is GLOBE Mission EARTH?



- Funded by NASA
- Engage teachers and students to collect/submit GLOBE data and use NASA
- Provide K-12 teacher professional development (PD)
- Engage the public in using GLOBE and NASA resources

Connecting Teachers and Students to GLOBE and NASA



High School Students measure soil nutrients at MetSacramento High School

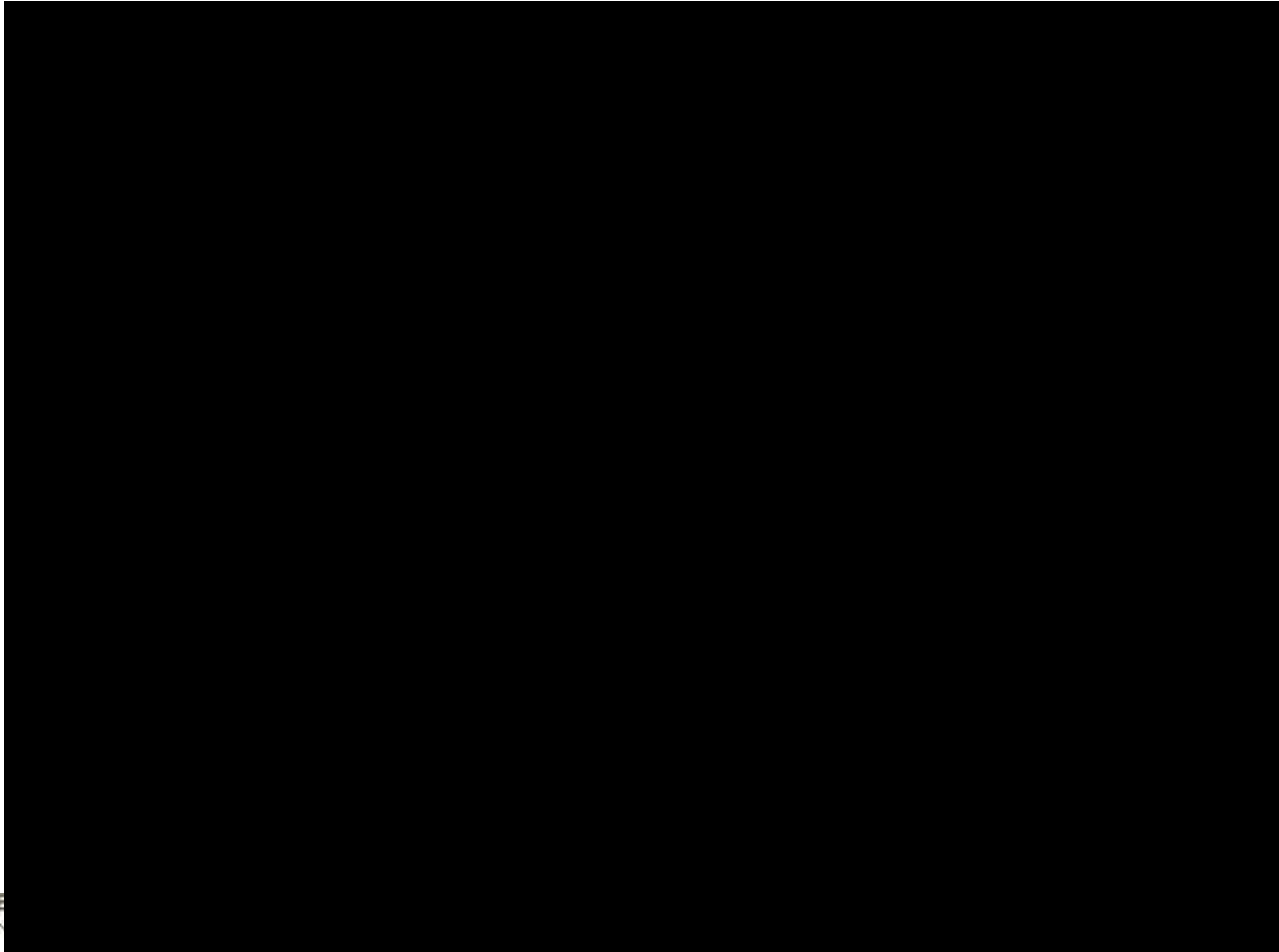


Elementary students test local waterways for invertebrates identification and pH.



Teachers receive training and support

The GLOBE Program



GLOBE Modules



Atmosphere

Atmospheric conditions can have an important impact on the types of plants and animals that can live in a particular area as well as soil formation. The atmospheric measurements collected by GLOBE students are important to scientists studying weather, climate, land cover, phenology, ecology, biology, hydrology, and soil.



Biosphere

The Biosphere is divided into natural and developed areas. All living things—including humans—depend on their habitat or land cover for survival. Land cover provides shelter, food, and protection. Land cover also has a direct effect on the kinds of animals that will likely inhabit an area.



Hydrosphere

Water participates in many important natural chemical reactions and is a good solvent. Current measurement programs in many areas of the world cover only a few water bodies a few times during the year. GLOBE students provide valuable data to help fill these gaps and improve our understanding of Earth's natural waters.



Pedosphere

Data collection of soil temperature, moisture and chemical properties is invaluable to scientists in many fields: soil scientists, hydrologists, climatologists, biologists and anthropologists.

Earth as a System

The measurements of The GLOBE Program provide students with the means to begin this exploration for themselves. GLOBE students aid in the understanding of how Earth functions as a system through data collection and student research.



NASA Assets

- NASA Langley Research Center (LaRC)
- Liaison to NASA Science Mission Directorate activities and SMEs (subject matter experts)
- MY NASA DATA
- NASA WAVELENGTH
- S'COOL
- Satellite Missions - SMAP/EL NINO
- Air Quality Campaign

NASA & SMAP & GLOBE



THE GLOBE PROGRAM



GLOBE Teacher Resources

Do GLOBE > For Teachers > Teaching Boxes

Teaching Boxes

UCAR Center for Science Education Teaching Boxes combine hands-on learning activities, science content, and additional resources that can be used as a tool for GLOBE Teachers. *Note: All Teaching Boxes are aligned to Common Core and the Next Generation Science Standards, and integrate GLOBE resources.*

- Air Quality
- Climate & Water
- Clouds
- Flash Floods
- Winter Weather

Credit: UCAR SciEd

<https://www.globe.gov/do-globe/for-teachers/resources/teaching-boxes>

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Air Quality Teaching Box

Air pollution takes many forms - from particles of soot large enough to see, to individual molecules of ozone and nitrogen oxides. Air quality measurements let people know when the amounts of pollutants pose a health risk. This teaching box is filled with educational resources that help students explore the science of, and solutions to, air pollution.

Teaching Boxes are collections of classroom-ready and standards-aligned activities, content, and multimedia that build student understanding of science, technology, engineering, and math.

View All Teaching Boxes

- Overview
- Introduction to Air Quality
- Ozone
- Particulate Matter
- Case Study

Goal: Students learn about the sources and impacts of major types of air pollution.

Engage students with images of air pollution.

- Show images of air pollution around the world in the *SMOG: What it looks like and where it comes from* slideshow. Have students consider the colors they see in the sky and where the air pollution is visible in each scene. The second half of the presentation includes images of sources of air pollution. Before showing the slides, assess student knowledge about what air pollution is, what it looks like, and pollution sources.

Explore the sources of air pollution.

- Whirling Swirling Air Pollution:** In this activity, students read a story of a typical day in the life of Edgar, a fictional character, and create a simple model that shows the air pollution that Edgar adds to the atmosphere over a 24-hour period.

Explain how air pollutants form using molecule models.

- Modeling Smog:** Students are introduced to the chemistry of air pollutants using simple models which show how ozone is made at ground level in the presence of sunlight.

Elaborate on how types of air pollution impact health.

- Name That Air Pollutant:** In this guessing game, students describe and identify four major air pollutants and the effects of each on human health. Student understanding of these major pollutants is built through a reading that describes how human activities contribute to air pollution.

Evaluate student understanding of the sources and impacts of air pollution.

- Have students make a list of what could be done to reduce the amount of air pollution, and what could be done to reduce the impacts of air pollution on human health. (Student answers should include reducing the sources of air pollution such as auto emissions and factory emissions. Student answers should also address strategies for reducing the impact on human health such as staying indoors at times of day when air quality is low.)
- Then lead a class discussion in which students share their ideas. Consider which ideas are easy to implement and which would take more effort. Consider which are actions that individuals can take, and which would require communities to act together.

Performance Expectation and Standards:

- NGSS Science and Engineering Practices: Analyzing and Interpreting Data, Asking Questions and Defining Problems, Developing and Using Models
- NGSS Disciplinary Core Idea: HS and MS-ESS3.C: Human Impacts in Earth Systems
- NGSS Crosscutting Concepts: Cause and Effect, Stability and Change

How does GLOBE fit into your curriculum?

Teaching Standards

NGSS

Webinars

GLOBE and the Next Generation Science Standards (NGSS)

In the United States, The National Research Council, the National Science Teachers Association, the American Association for the Advancement of Science, and Achieve released the *Next Generation Science Standards* (NGSS) in April 2013. The National Academies of Science released the Framework for K-12 Science Education in 2011. Following the release of the Framework, a team of forty-one writers with guidance from twenty-six state review teams developed the Next Generation Science Standards.

For Teachers and Schools

Interested in learning how you can incorporate GLOBE into your curriculum to address NGSS? This guide walks through the NGSS Disciplinary Core Idea (DCI) Weather and Climate throughout K-12. To learn more, write to help@globe.gov.

View This Teacher Resource (https://www.globe.gov/...)

NGSS



Do GLOBE > For Teachers > Teaching Standards > NGSS

The GLOBE Teacher's Guide

The GLOBE Teacher's Guide is an online collection of background information, science protocols (data collection procedures), and learning activities organized by Earth system: atmosphere, Biosphere, Hydrosphere, and Pedosphere (Soil). The science protocols are intended to be used as written, using instruments that meet certain specifications in order to ensure data accuracy worldwide. Instruments, as well as instrument suppliers, are available from Scientific Instruments for Collecting GLOBE Data. Learning activities, on the other hand, can be modified to fit your time, resource, or content needs.

The science protocols and learning activities also map the education standards that they address. In the United States, many educators are required to focus their teaching on addressing specific standards. Many GLOBE countries, and virtually every state in the United States, have adopted standards for education, including science education. These standards vary, and it is not generally possible to provide a correspondence between GLOBE elements (e.g., science protocols and learning activities) and every set of standards. However, there is often much in common among the different sets of standards for science education.

Teachers Guide Search

Introduction Documents:

- Teacher's Guide Introduction (pdf)
- Implementing GLOBE in the Classroom
- Introduction and Body (pdf)
- Appendix (pdf)
- Toolkit (pdf)

U.S. State Resources

The following links contain the mapping of GLOBE to specific U.S. State Learning Standards, developed by the GLOBE Community within those states. If you have mapped GLOBE activities to your state's standards and would like to have them made available here, please contact the GLOBE Help Desk at help@globe.gov.

Florida - October 2005 Florida Sunshine State Standards Grade Level Expectations, Science Grades 4-8 Alignment with GLOBE.

Idaho - October 2003 Idaho K-12 Science Standards Teachers Guide To GLOBE.

Michigan - GLOBE Connection to the Michigan Curriculum Framework

New York City - New York City Standards and GLOBE: Summary of New York City Science Performance Standards, Elementary School Linkages, Middle School Linkages, and High School Linkages

North Carolina

K-5 North Carolina Science Standard Course of Study & the GLOBE Program, Grades K-5

6-8 North Carolina Science Standard Course of Study & the GLOBE Program, Grades 6-8

9-12 North Carolina Science Standard Course of Study & the GLOBE Program, Grades 9-12

Ohio - Earth and Space Sciences Grade Level Indicators (Earth Systems, Grades four through eleven)

Tennessee - GLOBE alignment to Tennessee Science Standards

Texas - GLOBE Inquiry Skills and science concepts contained in the Texas TOG by grade level

Virginia - GLOBE Protocols aligned to 2010 Virginia Science Standards of Learning

State Connections



Teacher Resource Guide

The Career Dimension

- GLOBE as a form of work-based learning
 - From exposure: Building awareness of career options through exploration and connection to scientists in and out of class
 - To immersion: Building skills, social capital, self-knowledge, and STEM identity by doing real science

Why a Career Dimension?

- Promote an inclusive environment in which any student can engage with science and related subjects and imagine themselves in science or STEM careers (build students' "STEM identity")
- To motivate students in school
- To expose students to options they may never have thought about
- To promote self-knowledge and skills that can be transferred to any endeavor

STEM Jobs

- As of 2011, 26 million U.S. jobs—20 percent of all jobs—require a high level of knowledge in any one STEM field.
- Half of all STEM jobs are available to workers without a four-year college degree, and these jobs pay \$53,000 on average—a wage 10 percent higher than jobs with similar educational requirements.

Career Development Continuum

Work-based Learning Continuum

Pre-K

13+

Career Awareness

Learning ABOUT work.

Build awareness of the variety of careers available and the role of post-secondary education; Broaden student options.

Career Exploration

Learning ABOUT work.

Explore career options and post-secondary requirements for purpose of motivation and to inform decision-making in high school and post-secondary.

Career Preparation: Practicum & Internships

Learning THROUGH work.

Apply learning through practical experience that develops knowledge and skills necessary for success in careers and post-secondary education.

Career Training

Learning FOR work.

Train for employment and/or post-secondary education in a specific range of occupations.

Practicum and Internships

Defined as an educational strategy that:

- Links school-based instruction with activity that has consequences beyond the class or value beyond success in school
- Uses the workplace, or in-depth experience with employer or community input, to engage students and intentionally promote learning and access to future educational and career opportunities

Key Elements of Practicum and Internships

1. Purposeful connection to learning — and to standards and curriculum, as well as employer expectations (*not disconnected work experience*)
2. Depth of experience with opportunity to engage in a professional community of practice (*not job shadowing*)
3. Direct, systematic employer and/or community input (*not project-based learning*)

“Career Preparation” Can Happen at All Grades—through Projects!

- Depth of experience
- Direct, systematic employer and/or community input
- Connection to curriculum
- Value to students beyond school

Implemented at school, in the community, or in a workplace, depending on the purpose.

Student Project Opportunities

- Pacific Region - Student Research Symposia
 - GLOBE International STEM Network (GISN)
 - May 18th and 19th
 - NASA AMES
- International Virtual Research Symposia
 - March 1st
 - \$2,000 awards
- School STEM Symposium
- Other and local science fairs/symposiums

Connecting GLOBE to Engineering Practices

- Using Math & Computational Thinking
- Planning & Carrying out Investigations
- Obtaining, Evaluating & Communicating Information
- **Activity – Make a Clinometer**



Students using a clinometer

Enhancing the Career Value of GLOBE: Skills Reflection

- Reflecting on science and project skills:
 - What aspects of their projects did they excel in? Which were most interesting?
 - What was it about the work that they liked or did well?
 - What did they like less well and what was it about the task that was uninteresting?
- Reflecting on “21st Century” skills
 - How did the students use collaboration, critical thinking, creativity, and communication in their projects? What other skills did they use that are transferable to STEM or other careers? (e.g. enhanced precision and accuracy; data literacy)

Enhancing the Career Value of GLOBE: In-Class Events

- Bring scientists and other professionals to discuss their research, how they became scientists or technicians, and how the students' data can be used in the real world
- Have students research how atmosphere or other data are used by professionals to solve real problems



Enhancing the Career Value of GLOBE: Out-of-Class Experiences



- Take students to colleges in their communities, where GLOBE-related majors (STEM majors) are offered
- Take students to workplaces where STEM skills are employed—especially related to GLOBE

Getting Started with a Focus on Outcomes

Start by establishing what you want the students to learn...

Outcomes for Career Awareness

- Can give an example of *how the career field and/or occupations relate* to the student's current interests.
- Can give at least one example of *accepted workplace norms* such as dress, communication, and etiquette.
- Can articulate the *type of post-secondary education and training required* in the career field and its importance to success in that field.
- Can give at least one example of *how core skills* such as math and reading *are used* in the career field and/or occupations.

Outcomes Continued

- Can give at least one example of how each of the following transferable, “college and career-readiness” skills are used in the career field and/or occupations:
 - Collaboration and Teamwork
 - Communication
 - Creativity and Innovation
 - Critical Thinking and Problem Solving
 - Initiative and Self-Management
 - Context and Culture
 - Information Management
 - Professionalism and Ethics
 - Quantitative Reasoning
 - Technology
 - Knowledge of Workplace

Accessing Career Resources

- Work with the school counselors and career center to let them know your
- Use online resources like Green 360 Career Catalyst
- Plug into the career-related initiatives in your district or school: career center, career pathway work, counselors
- Work through existing organizations, like Junior Achievement or your local Rotary or other service clubs
- Strike out on your own to connect with local employers

Accessing Career Resources (continued)

- Check with the parents in your school
- Contact your local Chamber of Commerce and see if they can recommend a speaker/partner
- Reach out to school alumni to see what they are doing professionally
- Teacher Externships: Interview employers yourself and/or participate in a teacher job shadow or externship, to build relationships and bring first-hand knowledge back to your classroom

How Do You Become a **GLOBE** Teacher and get trained?

THE GLOBE PROGRAM A Worldwide Science and Education Program

Join Get Trained Do GLOBE GLOBE Data

- Benefits of Joining
- GLOBE Teachers
- GLOBE Partners
- GLOBE Observers
- STEM Professionals
- Register as an Alumnus
- Opt-In



THE GLOBE PROGRAM A Worldwide Science and Education Program

Join Get Trained Do GLOBE GLOBE Data

- Find a Workshop in Your Area
- Using the GLOBE Website
- Protocol eTraining





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Thank you!

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