The GLOBE Program

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NATIONAL SCIENCE FOUNDATION

UNITED STATES DEPARTMENT OF STATE

The GLOBE Program

Global Learning and Observations to Benefit the Environment

An International Environmental Science and Education Program

GLOBE is a hands-on, school and community-based science and education program that unites students, teachers, and scientists in study and research about the dynamics of the Earth's environment. Over a million GLOBE students in more than 21,000 schools located in 110 countries have taken important environmental measurements. Their data are used in their own research activities as well as by scientists around the world. More than 44,000 teachers have attended GLOBE professional development activities.

The goals of the GLOBE Program are to:

- Improve science education;
- Increase scientific understanding of the Earth as a system; and
- Enhance the environmental awareness of individuals worldwide.

"GLOBE is the quintessentially ideal program for involving kids in science."
Nobel Laureate Dr. Leon Lederman.

The GLOBE Program is implemented through a worldwide network of primary and secondary schools. GLOBE students learn about their local environment by:

- Taking environmental measurements at or near their schools using GLOBE measurement protocols and appropriate, calibrated measurement equipment.
- Reporting their observations to the GLOBE database via the GLOBE Web site or email.
- Using tools on the GLOBE Web site to create maps and graphs from their own data, to analyze GLOBE data sets, and to share their data with other schools around the world.
- Conducting real research in collaboration with scientists and other GLOBE students worldwide.

GLOBE students have reported over 18 million measurements in the areas of Atmosphere/Climate, Hydrology, Soils, Land Cover/Biology and Phenology. GLOBE improves student understanding by involving students in conducting real science – taking measurements, analyzing data, and participating in research collaborations with other students, as well as with scientists engaged in cutting-edge Earth Systems Science research.

Scientists and educators have developed environmental measurement protocols and educational materials as a resource for GLOBE teachers. Professional development workshops provide teachers with content information and pedagogical strategies to support student research.

Broad international participation is an integral part of the GLOBE Program. Bilateral agreements establish partnerships between the United States and its international partner countries, which are then responsible for designing program implementation in their own countries. Implementation in the United States depends upon the efforts of more than 100 state and local partner organizations. GLOBE is funded by the National Aeronautics and Space Administration (NASA), supported by the National Science Foundation (NSF) and the U.S. Department of State, and implemented through a cooperative agreement between NASA, the University Corporation for Atmospheric Research (UCAR) in Boulder, Colorado and Colorado State University in Fort Collins, Colorado.

Visit the GLOBE Program at www.globe.gov

NASA NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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GLOBE PROGRAM SUMMARY

Over a million primary and secondary students around the world are working in partnership with scientists to collect important data for research about the Earth's environment. These students and their teachers are part of the GLOBE Program – a hands-on science and education program focusing on Earth system science. More than 44,000 teachers from over 21,000 schools have received GLOBE training. More than 100 countries participate in the program.

GLOBE students measure and report physical, chemical and biological properties of Atmosphere/Climate, Hydrology, Soils, Land Cover/Biology and Phenology. The resulting global data sets are publicly available via the Web at **www.globe.gov** to users including the worldwide environmental science community. GLOBE students access these data for classroom studies, research, student-scientist partnerships, and worldwide school-to-school collaborations.

GLOBE supports education by providing hands-on experience in authentic science. GLOBE students are doing science, not just learning about the work of others. Students build from the measurement of individual environmental parameters to an understanding of how the Earth functions as a system.

SCIENCE

GLOBE students measure and report physical, chemical and biological properties of Atmosphere and Climate, Hydrology, Soil, Land Cover/Biology and Phenology. GLOBE students have collected and entered more than 17 million data for their use as well as by scientists studying the Earth system. Scientists use GLOBE data for research about the current state of the Earth as well as to look at the dynamics of environmental change. According to Dr. Elissa Levine of NASA's Goddard Space Flight Center, "The comprehensive suite of GLOBE measurements that is being collected by students is critical for Earth science research – for assessing current conditions, for monitoring changes and for driving, testing and creating models for predictions into the future."

The next step in the evolution of the GLOBE Program, referred to as the "Next Generation GLOBE" (NGG), is aimed at increasing the number of student inquiry-based research projects focused on international large-scale science initiatives, encouraging student involvement in international GLOBE School Networks as well as in locally relevant research projects and strengthening GLOBE Learning Communities through the development of Regional Consortia of GLOBE countries around the world.

The National Aeronautics and Space Administration (NASA) and the National Science Foundation (NSF) have identified 4 new Earth System Science Projects (ESSPs) to add to the suite of educational activities and resources GLOBE has offered to students and teachers since 1995:

- Watershed Dynamics
- From Local to Extreme Environments (FLEXE)
- Seasons and Biomes
- Carbon Cycle

NGG highlights GLOBE's essential elements of being both education and Earth system science, a bridge between these two international communities, a worldwide collaborative community of practice, and a program that employs inquiry-based educational activities that involve students in "authentic" hands-on science, the analysis of data and the use of scientifically-tested protocols.

EDUCATION

Improvement in science and mathematics education has focused on the importance of students' learning appropriate scientific methods through scientific inquiry. GLOBE provides students the opportunity to do research using their own data and that of their peers around the world. GLOBE students propose testable hypotheses, take measurements, analyze data, draw conclusions and publish their results on the GLOBE Web site – in short, they experience the discovery and excitement associated with scientific research using a database they helped to create.

The GLOBE Program is implemented in schools, in the United States and internationally, under the guidance of teachers who have participated in teacher-training workshops. These professional development workshops provide scientific content and pedagogical strategies to enable teachers to guide students in taking GLOBE measurements according to scientific protocols, in using classroom computers and the Internet in a meaningful way, in using GLOBE data, as well as other sources of scientific data, in student research, and in creating partnerships among students at GLOBE schools around the world via GLOBE school networks. More than 37,000 inservice and preservice teachers have participated in GLOBE workshops in preparation for implementing GLOBE in their schools.

The GLOBE Teacher's Guide, developed by scientists and educators as a resource for GLOBE teachers, contains the protocols for GLOBE measurements, information about environmental science topics as a context for the measurements, and age-appropriate, inquiry-based learning activities to involve students in the whole process of science. These resources include 54 scientific protocols (in the areas of Atmosphere/Climate, Hydrology, Soil, Land Cover Biology and Phenology), 60 Learning Activities associated with the GLOBE protocols, and supplemental resources and activities such as the Earth/Solar Energy Kit, the Understanding GLOBE Student Data resource guide, Primary-level literacy books (Elementary GLOBE series), Online teaching and learning modules, GLOBE at Night activities and many other products. GLOBE Partner countries adapt GLOBE to meet their national environmental, educational and scientific needs.

The GLOBE Teacher's Guide and other program materials are translated into the six United Nations languages: Arabic, Chinese, English, French, Russian, and Spanish. GLOBE is not a curriculum but rather a resource that GLOBE teachers can adapt for use in their schools and classrooms to align with their state or country curriculum to achieve high level learning goals.

PROGRAM EVALUATION

SRI International conducted program evaluations for the first ten years of the GLOBE Program using student and teacher surveys, pre- and post tests, interviews and site visits. SRI found that participation in GLOBE increases the likelihood that teachers will engage their students in *doing* science, for example, making measurements or observations, applying concepts, and interpreting data, rather than limiting their students to memorizing concepts and definitions of terms. Teachers reported that GLOBE improves students' higher order thinking skills through activities such as interpreting data and drawing inferences. Further, teachers also reported that involvement in GLOBE activities increases not just students' ability to take the environmental measurements included in the program, but also their ability to apply more broadly principles of sound sampling and data collection and to interpret data. Program evaluations are located on the GLOBE Web site at: http://www.globe.gov/fsl/html/templ.cgi?evaluation&lang=en&nav=1. SRI concluded that GLOBE is "an ambitious attempt to put the concepts of authentic learning, student-scientist partnership and inquiry-based pedagogy into practice on an unprecedented scale." Several GLOBE countries and U.S. states have developed and implemented assessments that provide evidence that GLOBE enhances science and mathematics learning, such as data analysis and graphing.

GLOBE PROGRAM MANAGEMENT

GLOBE is an interagency program funded by the National Aeronautics and Space Administration (www.nasa.gov) and the National Science Foundation (www.nsf.gov), supported by the U.S. Department of State (www.state.gov), and implemented through a cooperative agreement between NASA, the University Corporation for Atmospheric Research (www.ucar.edu) in Boulder, Colorado and Colorado State University (www.colostate.edu) in Fort Collins, Colorado. It is also a cooperative effort of schools in partnership with colleges and universities, state and local school systems, and non-government organizations. Internationally, GLOBE is a partnership between the United States and other countries.

• ***U.S. PARTNERSHIPS:*** Implementation of the GLOBE Program in the United States depends upon the efforts of more than 100 U.S. Partners – universities, state departments of education, school districts and other non-profit organizations. U.S. Partners raise their own funds, leveraged off the Federal investment in the program, to deliver GLOBE in their areas. U.S. Partners recruit schools, train teachers, provide follow-up support, and help in the adaptation of the program to state and local standards and curricula.

• ***INTERNATIONAL PARTNERSHIPS:*** Because broad international participation is integral to the implementation of the program, GLOBE enters into formal agreements with countries all over the world. In these partnerships, GLOBE provides the program infrastructure. Each international partner manages and provides funding for its own implementation, acquiring the resources from government, private sector and non-profit sources. GLOBE partners determine implementation strategies consistent with their countries' educational systems and priorities.

The GLOBE Program Office (GPO) develops and supports the worldwide infrastructure for participating schools, scientists, and communities. The GPO staff includes experts in education, science, partnership development, customer service and information, Web site, and database technologies. NASA, NSF, and key members of UCAR and CSU management provide high-level policy guidance to the GPO. An external, GLOBE international advisory Committee (GIAC) is currently being constituted and will consist of leaders in education, science, industry, and public policy, as well as representatives from GLOBE regional consortia. The GIAC will provide advice on strategic international program directions such as helping schools/teachers/students to connect with cutting edge science projects, supporting collaborative student research on the environment, identifying regional or community generated projects of highest priority to the GLOBE community, and suggesting strategies for program growth and long-term program sustainability.

THE UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH (UCAR)

On 16 June 2003, the University Corporation for Atmospheric Research (UCAR) in partnership with Colorado State University (CSU) was officially awarded a Cooperative Agreement from the National Aeronautics and Space Administration (NASA) to assume primary responsibility for development and administration of the GLOBE Program.

UCAR is a non-profit consortium of over 100 university members and affiliates founded in 1960 to enhance the capabilities of the universities and to focus on scientific problems that are beyond the scale of a single university. UCAR carries out its mission through management of the National Center for Atmospheric Research (NCAR), and the UCAR Office of Programs (UOP). Major supporters of UCAR/NCAR programs include (but are not limited to) NSF, NASA, NOAA, and the U.S. Department of State.