

EARTH CAMP: USING SATELLITE IMAGES TO EXPLORE EARTH CHANGE AND MODEL SCIENTIFIC PRACTICES. S. R. Buxner¹, D. A. Crown¹, A. M. Baldrige¹, D. Colodner², K. Schwartz³, A. Orchard², and A. Titcomb⁴, ¹Planetary Science Institute (1700 East Fort Lowell Road, Suite 106, Tucson, AZ, 85719; buxner@psi.edu), ²Arizona-Sonora Desert Museum, (2021 N. Kinney Rd., Tucson, AZ, 85743; dcolodner@desertmuseum.org), ³Arizona Project WET, University of Arizona, Water Resources Research Center (350 North Campbell Ave., Tucson, AZ 85721; kschwartz@cals.arizona.edu), ⁴ALTA Consulting (Tucson, AZ, (altaconsulting@cox.net).

Introduction: Since 2005, Earth Camp participants have investigated contemporary issues firsthand through a combination of expert-guided investigations and participant-driven field and remote sensing studies. Students and teachers explore such topics as changes in river sheds, water quality, and land use management through analysis of satellite data and collaboration with scientific experts to investigate and answer questions they have developed. As NASA data sets have become more publically available in recent years, Earth Camp has integrated investigations using satellite images into all aspects of the program. Students use satellite data to explore changes on the Earth's surface. Teachers expand their instructional practice by learning to conduct investigations using satellite images through Google EarthEngine and explore earth change through those images, which are then translated in poster displays.

Middle School Earth Camp: Middle School Earth Camp participants are students entering grades 7 – 9. This two-week summer program is built around issues of water resources and sustainability and provides exposure to the use of satellite images for studying the Earth. Campers work with local expert scientists from a variety of diverse fields including botany, hydrology, soil science, tree-ring studies, remote sensing, and planetary science. In addition, they are challenged to take actions in their own homes, schools, and communities to live more sustainably. Campers explore changing conditions on Earth and meet with local community members who are making a difference in the community (e.g. via water harvesting, leading community recycling efforts). The capstone of Middle School Earth Camp is a Learning Celebration in which campers present what they have learned during camp and publicly pledge to take action to balance their personal needs with that of the planet.

High School Earth Camp: High School Earth Camp participants are students entering grades 9-12. This 12-day field experience is centered around exploring the Colorado River Watershed and is designed to educate and inspire youth to build leadership skills through experiential learning and conceptual understanding of earth processes. Campers explore changes in climate, water, and the landscapes of the Colorado Plateau. Recently, many of the investigations have taken place during a 5-day rafting trip down the Green

River's Desolation Canyon in Utah, where students study the history of water resources policy and development of the West. During their investigations, they use historic photographs and satellite images to analyze changes in landscapes and impacts of change at different scales. The capstone of High School Earth Camp is a Learning Celebration in which campers are given an opportunity to share their discoveries with their friends and families and pledge to take action in their own lives that will lead to a sustainable future.

Earth Camp for Educators: Earth Camp for Educators participants are middle and high school classroom teachers. This year-long professional development program is designed to give participants an opportunity to explore relevant content about the Earth and work with scientists and their peers to acquire new scientific practice skills through authentic inquiry. Additionally, they are guided to connect content and practices to those in the recent Framework for K-12 Education [1] and Next Generation Science Standards [2].

Teachers explore environmental change in the Southwest from multiple perspectives, using hands-on field investigations, classroom exploration and modeling, and NASA satellite images. The workshops build science skills, scaffolding from guided investigations to designing their own questions and a scientific approach to investigate those questions. The workshop series includes an overnight field-study designed to deepen content knowledge and apply scientific practice skills as teachers conduct investigations they have designed. In addition, teachers take part in a week-long summer workshop where they use satellite images to conduct an investigation of environmental change and create a poster that will become a part of an exhibit at the Arizona-Sonora Desert Museum designed to demonstrate the value of satellite images to science today. Throughout the workshop, teachers are asked to actively reflect on how to bring the content and practices into their teaching practice.

Evaluation: External evaluation of Earth Camp has been conducted to measure progress towards program goals. Evaluation data collected have included end-of-program surveys, focus groups, and program observations.

Results from the latest evaluation reports [3] have shown that Earth Camp successfully engages middle

school and high school students through program activities, including an under-served population of students. All Earth Camp youth participants publically commit to taking action in their own lives to decrease their impact on the environment, in front of their peers and parents during the final Learning Celebrations. Pre/post surveys showed change in students' attitudes about the environment that aligned with the commitments made during the Learning Celebrations. These commitments are documented on the Earth Camp website hosted by the Arizona Sonora Desert Museum.

Evidence from the feedback surveys and teen journals showed that exposure to a variety of STEM Careers during Earth Camp for Teens shifted their perspectives. In the high school survey, 90% report an increased interest in a science/environmental career. Over half of the middle school students reported an increased interest in a science-related career.

In both the teen and educator programs, each of the hands-on activities required the participants to apply problem solving and critical thinking skills. Teachers appreciated the resources and modeled lessons and investigations that helped them provide more effective inquiry-based and problem solving instruction in their classrooms. They also felt inspired to do more "field work" with their own students recognizing its value in motivating them to learn. Lastly, teachers felt that Google EarthEngine made working with NASA satellite imagery more accessible to them and their students.

Earth Camp was successful in creating a multi-generational learning community that informed teachers' own teaching practices through their interactions with students, the public, and other educators. Some teachers were able to successfully implement projects integrating satellite images for use with their students.

References: [1] National Academies (2012), A Framework for K-12 Science Education. [2] Achieve, Inc. (2013) The Next Generation Science Standards. [3] Titcomb, A. (2012, 2013) Program Evaluation Report.

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Additional Information: Learn more about Earth Camp, read stories, and view posters created at <http://www.desertmuseum.org/earthcamp/stories.php>.