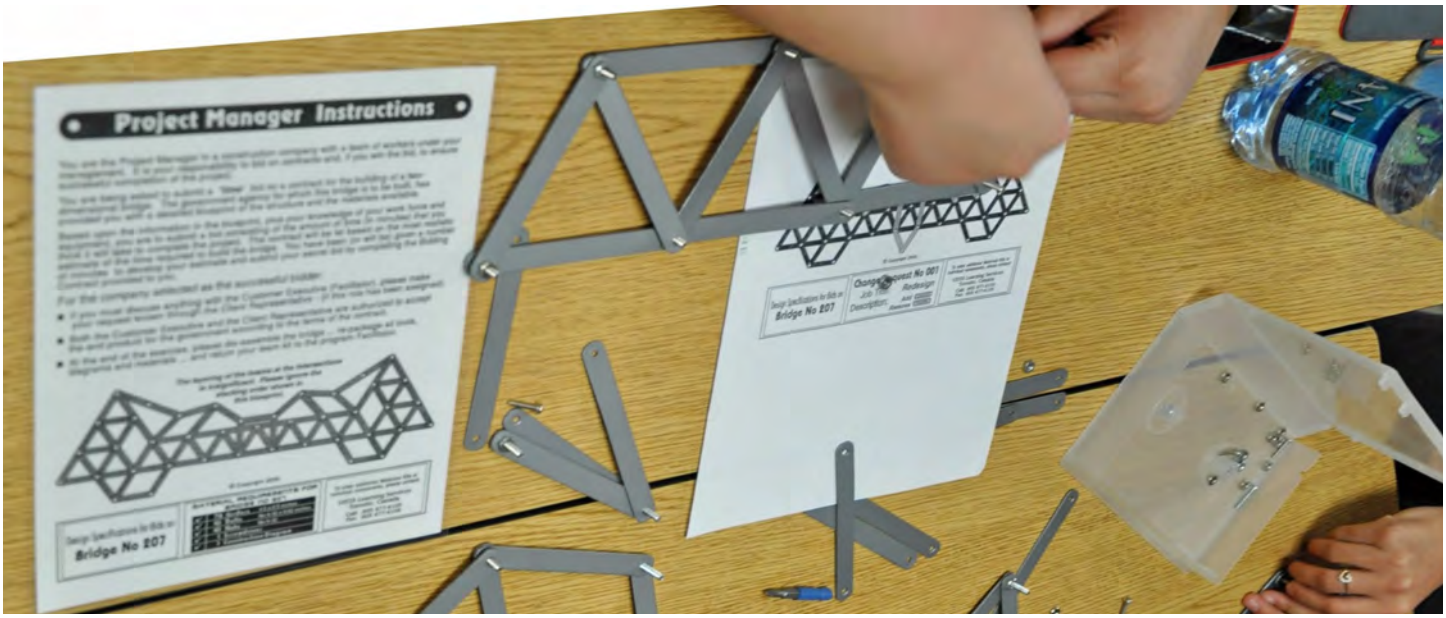
Program Engineers Community-Focused Research Programs for Native American Students

by Ace Charette



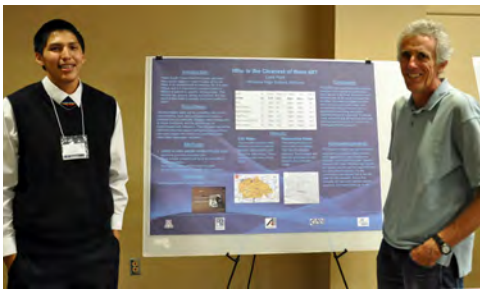
NASEP participants learn concepts related to science and engineering as they create environmental-related projects within their communities. // Photo courtesy: Ace Charette

The Native American Science and Engineering Program (NASEP) connects selected high school students with Native American undergraduate, graduate, and doctoral students at the University of Arizona (UA) to conduct community-driven environmental research projects.

In collaboration with the American Indian Science and Engineering Society (AISES), NASEP provides participants with a week-long summer program and year-long academic support that emphasize environmental issues faced by tribal nations in Arizona.

The AISES Geosciences Outreach Program, a feature of NASEP, guides participants through a research process that facilitates learning and skill development by exposing them to UA faculty and researchers from the Department of Geosciences, the Department of **Hydrology** and Water, and the Department of Agriculture and Biosystems Engineering.

Hydrology: the scientific study of water



Luke Washburn, 2014 NASEP participant, presents his poster at UA College Day. // Photo courtesy: Ace Charette

During their experience, NASEP participants return to their home communities to form research questions and hypotheses that they may explore. They conduct research by taking measurements, utilizing databases, evaluating research articles, and applying mathematical concepts that allow them to test their hypotheses and arrive at a conclusion. The final steps in the research process require students to design and present a university-level research poster. Broad topics for the research posters are given to NASEP participants by UA AISES chapter members and staff from the UA Office of Early Academic Outreach.

In previous years, the program emphasized weather and climate, water quality, and light pollution as three topics that students learned about. In 2014, aquaponics replaced the topic of light pollution as students explored the alternative growing method that produces some foods at a much higher yield and with significant water savings. Given the focus of water in all three categories, the 2014 program was titled “Sacred Water and Its Many Forms.”

The 24 NASEP 2014 participants presented their ideas and findings to more than 250 people at UA’s Native American College Day last November. Posters ranged from measuring the lettuce and fish production of a potential aquaponic system at a high school to measuring and comparing water quality using hydrology test kits from several local communities. Other participants measured the nutritional output of potential aquaponic systems compared to traditional growing methods, while some analyzed the implications of decreased rainfall over past decades.

Find NASEP eligibility requirements and deadlines on page 26!

Though the aim of the project is to encourage a high level of engagement and learning by using the scientific method, the central component of each student's progress is ensuring that the community aspect is always part of the experimental context. This is reflected in students' posters as they dedicate sections specifically to discussing the community impacts that their research could have. Many students express an interest to continue the research and learning process upon college or university entrance.

Providing feedback about the experience overall, Esai Flores, a 2014 NASEP participant, remarked, "The most important thing I learned about this project is that I am able to gain knowledge from a high standard and able to share this with others and my community," further emphasizing the importance of tribal communities in this research project.

Dressed in professional attire, students presented their posters to students, educators, and parents from various tribal communities at the UA college day event. The presentation allows participants to share and discuss their ideas and processes with others, possibly engendering similar notions about environmental research and community focus in the audience.

"The Geosciences Project helped bring awareness to myself of the importance of school and taking care of our land," said 2014 NASEP participant Kiana Kaye, who presented on water quality in tribal and urban areas.

NASEP inspires hope for the participating students as many of their communities face environmental adversity. With such promise coming from Native youth to educate themselves and to contribute to their communities, a strong vein of hope exists within today's tribal nations.

AQUAPONICS 101

by Jordan Jimmie

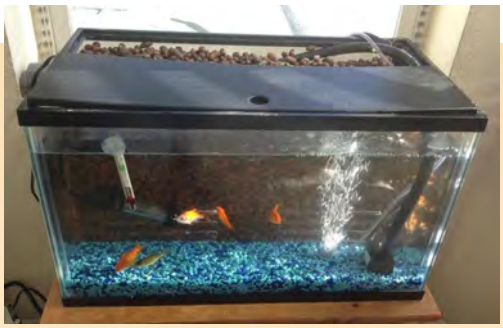


Photo of aquaponics system creted by 2014 NASEP participant Leo Bia. Bia's research project was titled, "How much food can an aquaponics system generate?" // Photo courtesy: Ace Charette

Aqua-what?

Aquaponics is a self-sustaining, symbiotic process between fish, plants, and water. An aquaponics garden is made up of a fish tank and multiple grow beds for plants containing highly porous material, like gravel, which allow water to move freely.

The circle of life: How does it self-sustain?

Warm, freshwater fish provide waste that is dissolved into nutrients by bacteria in the water. This water then flows into the lower tiers of the system, providing the nutrients to plants in each bed. A pump recirculates the nutrient-depleted water back into the fish reservoir once it reaches the bottom of the system. The fish are fed by the water, excrete waste, and the self-sustaining growth system begins again!

Let's talk fish waste.

Solid waste and ammonia are excreted by fish in the system. There are two types of bacteria that convert each type of fish waste into nutrition for plants: heterotrophic bacteria and autotrophic bacteria.

We'll start by discussing heterotrophic bacteria in the system. This type of bacteria converts solid fish waste into nitrates and other types of plant nutrients, and expels ammonia in the process.

The autotrophic bacteria produces nitrates for the garden. One type of autotrophic bacteria is able to convert ammonia into nitrites while another type converts the nitrites directly into nitrates. Nitrates are the end product of this cycle and act as a fertilizer for plant life in each bed. A shortage of plants to absorb the nutrients can cause a buildup of nitrates in an aquaponics system.

What's the BIG deal?

Identifying sustainable, eco-friendly food supply initiatives is crucial as the U.S. Environmental Protection Agency anticipates longer and more extreme droughts in the coming decades. In comparison to soil-based farming, aquaponic gardens use an estimated 90 percent less water. It gives consumers the potential to grow their own food year-round as both an aquaculture system (raising fish to sell) and a hydroponics system (cultivating plants without the use of soil). The energy cost is considerably lower in aquaponic gardening as maintenance is low and fuel- and chemical-dependent tools are not heavily utilized.

Did you know...

Both the Maya and Aztec people are early examples of aquaponic gardeners? These Indigenous communities raised fish and plants alongside one another, with the Aztec creating a system known as chinampas as early as 1000 AD. Chinampas are islands that were created by raising rafts (where plants would grow) atop bodies of water (rich with nutrients to grow plants) surrounding their homelands.