



# Research Experiences for Undergraduates in Environmental Sciences at Northern Arizona University

## Shima' nahasdza'a'n bee 'iina' (Mother Earth Gives Life) (DBI-0244221)

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### Abstract

The National Science Foundation Research Experiences for Undergraduates (REU) Site at Northern Arizona University (NAU) involves students in a 10-week summer research experience. The NAU REU "Shima' nahasdza'a'n bee 'iina (Mother Earth Gives Life)" program has provided research opportunities for 8-10 students in each of the past three summers. The majority of students are drawn from regional 2-year tribal colleges. Due to the proximity of NAU to the largest Indian nation in the country, research projects often focus on tribal land issues, such as the impact of grazing on grasslands, arsenic and uranium concentrations in groundwater, land use and the relationship to erosion, and agricultural ecology. Students choose from a diverse list of research projects representing a variety of environmental disciplines. Faculty Mentors from seven departments and programs at NAU have participated.



Hands-on learning at a Merriam-Powell Center for Environmental Research Elevational Gradient site.



Planning sample collection at the Clarksdale Mine tailings.

### Host Institution

Northern Arizona University is a publicly assisted university with approximately 13,000 undergraduate and 6,000 graduate students. One of NAU's goals is to be the Nation's Leading University Serving Native Americans. In Fall 2004, NAU enrolled over 1,300 Native American students representing over 40 tribal affiliations from around the United States.

Located in an ecologically diverse region surrounded by federal, tribal, and state lands on the southern Colorado Plateau, NAU is an ideal place to train environmental scientists. The Center for Environmental Sciences & Education (CESE) has developed a strong tradition of collaboration across departmental and college boundaries.

### Program Description

#### Overview

Eight to ten students participate in the program each summer. The majority of students are recruited from regional 2-year tribal colleges, including

**Diné College (Tsaile, AZ and Shiprock, NM)**  
**Crownpoint Institute of Technology (Crownpoint, NM)**  
**Southwestern Indian Polytechnic Institute (Albuquerque, NM)**

Students are also recruited from the Arizona community college system. Students earn 6-units of university credit for completing the intensive 10-week summer program. A stipend, on-campus lodging and meal plan, and access to campus facilities (e.g., library, student recreation center) are provided. Students are paired with Faculty Mentors for individualized research projects and participate in a rigorous Student Development Program and a number of fieldtrips. The program concludes with a poster session and luncheon.

#### Faculty Mentors & Research

Mentors from seven departments and programs have participated:

**Biological Sciences (B)**  
**Center for Environmental Sciences & Education (CESE)**  
**Chemistry & Biochemistry (C)**  
**Environmental Engineering (EE)**  
**Geology (G)**  
**Institute for Tribal Environmental Professionals (ITEP)**  
**School of Forestry (F)**

#### Summer 2005 Research Projects<sup>a</sup>

Bark Beetle Investigations Across an Elevational Gradient (F)  
Chemical Genotoxicity of Uranium & Hexavalent Chromium (C)  
Effects of Fire & Herbivory on Ethnobotanical Communities & Harvests (B)  
Effects of Forest Management on Nesting Birds (CESE)  
Mercury Deposition in Lakes via Fire & Subsequent Erosion Events (EE)  
Microbial Biofilm Defense Mechanisms against Human Immune Responses (B)  
Potentially Carcinogenic Uranium Species on Navajo Lands (C)  
Working with Highschool Students to Study Surface Waters in the Flagstaff Area (ITEP)

<sup>a</sup> Anticipated projects at time of printing

#### Student Development

**Group field-based research project.** **New this year!** Three 2-day/2-night group research experiences at the Walnut Creek Research Station (WCERS) have been added to the program. Students collaborate on a field-based group research project, allowing the students to learn a common set of basic field skills and get to know each other in a relaxed and informal environment. Students present several short individual and group oral presentations about their work at the field site to develop their public speaking skills.

**Student development seminars.** During Week 1, students participate in a number of orientation seminars, including **Laboratory Safety**, **Basic Laboratory Equipment**, **Keeping a Laboratory Notebook**, **Tour of Instrument & Computer Labs**, and **Introduction to Research**. During Weeks 2-10, students spend one afternoon per week in seminars on **scientific communication**, **scientific ethics**, and special topics related to the WCERS group research project (e.g., **data analysis**). In the scientific communication seminar, students prepare a poster on their individual research project.



A student answers questions about his research at the end-of-program Poster Session.

**Poster Session.** Students present their findings in a poster session held jointly with cooperating summer research programs at NAU, including the NSF Undergraduate Mentoring in Environmental Biology (UMEB) and NIH Bridges to the Baccalaureate programs. Faculty Mentors and interested graduate students and faculty attend the poster session. Students gain confidence in discussing scientific topics and in answering questions about their research.

**Field trips.** Four all-day field trips are fun and educational, and introduce students to a variety of possible environmental science career opportunities. Students visit the **Navajo Generating Station**, **Lowell Observatory**, the **Flagstaff Arboretum**, **Merriam-Powell Center for Environmental Research Elevational Gradient sites**, the **Museum of Northern Arizona**, and the **Grand Canyon Air Monitoring Network**.