

Remediation of Soil and Ground Water Using Native Desert Phreatophytes (part of the EvER Water Quality Internship)

The U.S. Department of Energy Office of Legacy Management, NMSU, and Diné College are evaluating natural and enhanced attenuation processes in search of sustainable remedies for soil and ground water contamination at a former uranium mill near Monument Valley, Arizona. During the 1960s, ammonia and ammonium nitrate were used to precipitate uranium following an acid heap-leaching process. Ammonium and nitrate remaining in the vadose zone after site cleanup are a continuing source for an alluvial plume spreading north of the site. In 1999, *Atriplex canescens* and *Sarcobatus vermiculatus* were planted and irrigated (0.32 to 0.36 m yr⁻¹) at a 2-m spacing in the source area. Monitoring of soil moisture profiles and percolation flux indicate that the planting has curtailed recharge and leaching and has removed nitrate from the source soil. By 2006, vigorous growth (2 m² per plant canopy cover) was maintaining a deficit soil water balance and had removed approximately 190 kg of N. Plant uptake alone, however, cannot account for the loss of soil nitrate (> 50%) and ammonium (> 25%) from the vadose zone during the period. Enrichment of ¹⁵N and greater N₂O flux in the irrigated soil support the hypothesis that N loss is primarily a response to microbial denitrification and then nitrification when source soils are wet and dry, respectively. Except for a long history of overgrazing, *A. canescens* and *S. vermiculatus* populations would also dominate the natural vegetation of the plume area. Exclosure studies suggest that restricting grazing combined with replanting of these native phreatophytes could increase the phytoremediation capacity for the plume from 25 to 181 kg ha⁻¹ yr⁻¹ N, greatly increase transpiration, and thereby slow plume migration. Management of large-scale plantings in both the source and plume areas could also, in time, improve rangeland condition and produce a valuable native plant seed crop. Additional plots have been started at the UMPTRA site located in Shiprock, NM. Interns will monitor and maintain plots and take a variety of samples, working with state-of-the-art field instrumentation.

Water Quality of Rural Water Sources in the Northern Agency

The objective of the water quality survey project is to document the continued use of unregulated water sources by the Navajo public in areas impacted by past and present environmental degradation and related activities, the following preliminary assessments will be performed:

- Document the location, number, types, frequency of usage of unregulated water sources by Navajo residents.
- The Region 9 Water Quality Survey will involve interviewing community members about their knowledge and concerns regarding their water quality and quantity. (NNIRB approved)
- Document any symptoms and illnesses and environmental exposures through continued usage of unregulated water sources.
- Provide feedback to the Navajo Nation government for remedial programs

Interns will collect and analyze water samples from these sources and determine relative degree of risk. Analysis of samples will include metals (zinc, copper arsenic, lead, total uranium), nitrates, sulfates, phosphates, micro-organisms, organic/inorganic chemicals).

Navajo Ant Project

The major goal of this project is to collaborate with Harvard University and the Diné Environmental Institute to extend the capabilities of their study to conduct the first comprehensive scientific field study of the distribution and abundance of ants on Navajo Nation land. The project will extend the capabilities of the Navajo Ant Project to **1)** document all ~300 ant species occurring on the Navajo Nation; **2)** create an image catalog; **3)** develop a spatial database (ArcMap) that can be used to parameterize species distribution modeling for climate change studies; **4)** Conduct education outreach by initiating ant inventories at Navajo nation elementary schools and presenting biodiversity talks for Navajo k-12 and general public audiences; **5)** help train Navajo Nation participants to conduct biodiversity studies; and **6)** gain a better understanding of cultural views regarding biodiversity. All of these goals will contribute towards making the Navajo Ant Project a model for similar projects under the Global Ant Project umbrella <http://gap.entclub.org/>

Canyon de Chelly, National Park Service

All research is based in Canyon de Chelly, and interns must have own transportation to canyon and be able to hike 8-12 miles per day with equipment, night work and overnight camping required. Interns work with a researcher on a variety of projects which may include radio tracking of black bears, spotted owl surveys, and other species surveys as well as possible invasive vegetation work. Students will be assigned to multiple projects and will work with various scientists doing research in the canyon. This internship may lead to future employment with the National Park Service.

NASA Opportunities (for faculty and students)

NASA-SRE for Faculty

A cohort of faculty will be selected (6-8 members) to receive one week of training in GIS and Remote Sensing. Should the faculty desire, they may continue their training online and receive assistance in curriculum development and even be able to become certified ESRI trainers. Contact Marnie Carroll at 505 368-3556 for more information.

NSA-SRE for students/faculty/staff

Tribal NASA – Interns will receive 3 weeks of GIS/Remote Sensing training provided by another tribal college (4 colleges have submitted proposals to do the training). The next 7 weeks interns will return to their home campus and support ongoing research projects by

creating maps of the data being collected for analysis. A faculty member may also accompany the students. This training opportunity is also open to staff interested in improving their GIS capabilities. Contact Marnie Carroll at 505 368-3556 for more information.

NASA Robotics

This project will take place at SIPI and will involve 6 weeks of engineering oriented work in the areas of robotics and various sensor technologies. The last 1-2 weeks interns will travel to the Johnson Space Center in Houston to present their work. For more information please contact Vali Manavi at 505 368-3537.

Shiprock EPA CARE Project

Diné College, in a partnership with the Diné Policy Institute and through a US-EPA Cooperative Agreement grant plan to identify and work with local partners. The research involves engaging in a collaborative dialogue to discuss, identify and prioritize environmental toxins and their impacts to the Shiprock community. The goal of the project will be to create an effective, long-term partnership, which can take action, mobilize resources and, through additional funding and voluntary actions, improve the environmental quality of the Shiprock community. The intern will assist with the documentation and research of this project.

Land Grant Internships

Interns work primarily out of the Land Grant Office located at the Tsaille campus. They are responsible for maintaining the Tsaille and Shiprock Demonstration Farms and Greenhouses. They also support a wide variety of extension services involving 4-H programs, rangeland management, Junior Rodeos and healthy activities for youth. For more information about this internship contact Benita Litson at 928 724-6940.

IT Internships

Interns are expected to be self-starters and eager to learn more about hardware and software applications and support. The role of the intern is to support the staff in the IT department in their busy daily activities. The goal of this internship is to provide interns a chance to see what working in an IT department is actually like and hopefully will lead to a greater workforce for this well paying field. For more information contact Marnie Carroll at 505 368-3556.