

STEM training for Native American students

The Research Experience for Undergraduates Programme offered at United Tribes Technical College gives Native American students the opportunity to conduct ecological research on their home reservations. This programme not only aims to restore the ecology of tribal lands, but it also engages tribal students who would not normally have access to STEM research projects.

Since 2009, the United Tribes Technical College in Bismarck, North Dakota has been recruiting Native American students to participate in The Tribal College REU (Research Experience for Undergraduates) Programme, funded by the National Science Foundation. Each summer, eight students are selected to conduct environmental ecological research critical to the preservation of tribal lands in the Plains, Prairies and Grasslands of the United States. Dr Jeremy Guinn, Certified Wildlife Biologist® and Chair of the Tribal Environmental Science Department at United Tribes Technical College, explains further: “While the curriculum contributes to the restoration of Native American lands, the main focus of the programme is to increase recruitment and retention levels among Native American students in science and give them the foundation to pursue a graduate education beyond tribal universities.”

then established in the 1970s. In 1994, the US Congress authorised them as land-grant colleges. Land-grant colleges focus on teaching practical and technical agriculture, science, and engineering and are eligible to apply for funding directed at providing these types of trainings.

Typically located on or near Indian reservations, TCUs provide access to post-secondary education, accredited degrees, and vocational training to both Indian and non-Indian students. Educational programmes also integrate North American indigenous cultures and traditions into the curriculum. In general, enrolment has increased significantly since the 1970s, and today, there are 37 accredited TCUs in the United States serving over 30,000 students. This upsurge in attendance certainly indicates an interest in using education to improve economic situations and protection of natural resources.

TCUs – A BRIEF HISTORY

Tribal colleges and universities (TCUs) are minority-serving institutions controlled and operated by North American indigenous tribes. The first was founded by the Navajo Nation in 1968 in Arizona with intent to preserve and pass on the Navajo culture, language and traditions. Several others were

A MULTIFACETED PROGRAMME

The Tribal College REU Programme is a ten-week research immersion rewarded to eight students every summer in the form of a generous stipend and travel expenses. Students are recruited from across the Northern Plains and beyond, with priority given to students matriculated at tribal

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REU participant and mentor work to understand Loggerhead Shrike (*Lanius ludovicianus*) populations



Initial water quality field tests before samples are transported to the lab

colleges. Applicants are selected based on their research interests, classroom skills, and dedication to science. Once selected, students are required to engage in individual and team research projects that focus on a range of environmental issues that might include: restoration ecology; insect behaviour and ecological impacts; integrated bison prairie management; the effects of oil development on natural resources; conservation biology; and geospatial applications to ecological research.

A handful of mentors, all of whom are experienced faculty members and researchers from major TCUs, are then asked to guide each of the research projects. The programme provides training in research ethics, project design, field techniques, advanced laboratory technology, and concludes with a Summer Research Symposium where students must practise analysing and presenting data. The purpose of this event is to encourage students to present at regional and national conferences and to publish their research results in scientific journals.

The programme model does not stop with the students, however. It also includes a second element called Research Experience for Teachers (RET), which provides research training and mentoring opportunities to STEM teachers from grade schools within the reservation school system. A group of selected teachers work alongside REU participants for six weeks, as a way of gaining more exposure to the local, relevant research. This includes collecting and managing data, learning key scientific methods and strategies, and becoming familiar with the

The programme provides training in research ethics, project design, field techniques and advanced laboratory technology



Study of medicinal compounds in native plants connects traditional culture and science



Left: Snapping turtles provide an exciting model to study biological and ecological phenomenon
Right: A collaborative urban coyote study provides hands-on experience with wildlife and partners



local ecology. As Dr Guinn points out: "The programme is multifaceted in that it increases STEM training and research capacity for both tribal students and faculty. Building collaborative research teams that include students, teachers and scientists, allows us to provide full-spectrum mentoring to students who would normally not have access to such research projects, help Math and Science teachers develop their teaching skills, tackle ecological issues on reservations and strengthen our networks across the various tribal institutions."

PARTNERSHIPS AND COLLABORATIONS
Committed to providing a pathway for Native American students to obtain careers

in science, founders of the Tribal College REU Programme have been working hard to broaden the awareness of on-going research at smaller colleges in the region and to build partnerships with regional research institutions and faculty members of various Life Science departments. Strong relationships have already been established with the ND EPSCoR Programme and the Department of Biological Sciences at North Dakota State University. Such collaborative efforts have opened doors for REU participants, giving them access to graduate programmes that are local to their home reservations.

The collaborative nature of the programme has created a positive environment for participants to establish themselves as scientists. Not only do they acquire the necessary research skills that prepare them for graduate school or for a scientific career, they also gain confidence in presenting their results and positioning themselves among their peers.

Q&A

What is the current percentage of Native American undergraduates enrolled in STEM education programmes in the United States?

The current percentage of Native American undergraduates enrolled in STEM programmes in the US is, according to NSF figures, about 1% (1.3% STEM AS Degrees and 0.6% STEM BS degrees) <https://www.nsf.gov/nsb/sei/edTool/data/college-11.html>

What percentage of these undergraduates continue their scientific studies at graduate schools beyond TCUs?

Low – using the same NSF dataset from above, Native American students make up 0.5% of STEM MS students and 0.4% of STEM PhD students. Most of the participants in the REU programme participated very early in their academic career, so most of them are still in school (finishing their BS degree). Of the students that have finished, most have obtained employment directly upon graduating and a few have continued on to graduate school. We gauge programme success by including individual successes of participants (obtaining and maintaining STEM jobs in their communities as well as completion of degrees).

Is the REU programme well known? How many applicants do you receive?

The programme has become well known within our tribal college community through constant presentations at scientific and tribal college-oriented meetings. We have a small pool of TCU STEM students and most colleges have alternative opportunities for students. We receive about 30 applicants per year, but this is intentionally small as we let our colleagues from the TCUs recruit students with the greatest potential and encourage them to submit applications.

What is being done to promote the REU programme and TCUs in general?

There are fantastic opportunities at Tribal Colleges. TCUs provide education that is culturally-relevant while exceeding most industry standards. We work hard with

our partners in industry, state, and federal agencies, and other institutions to ensure that our graduates are prepared for the workforce or for moving into graduate research programmes. Most colleges offer fantastic financial aid packages and UTTC is currently providing a Native American Tuition Waiver. STEM programmes usually include some work-study opportunities for students to gain skills while also receiving payment to reduce the expense of attending college. The REU programme is promoted mostly from within the TCU network, as our primary target population is Native American STEM students at TCUs. We post on the website and use direct mailing for recruiting, but most of our applications come from students who were advised, by a mentor, to apply. There is a Tribal College Journal (<http://tribalcollegejournal.org/>) and a Tribal College and University Research Journal (https://issuu.com/collegefund/docs/tcurj_v1_1_full_journal_high-resolu).

What needs to be done to improve the REU programme and attract more applicants?

Many students are interested in summer research programmes, both locally and at other institutions, but there are many barriers to participation. In general, many students have massive time commitments to their families and other community responsibilities. There are also many other competing programmes targeting similar students (Native American and from TCUs). This was not the case ten years ago, but now many federal agencies and institutions recruit our students. Our programmes (thanks to funding from agencies such as the NSF) are now beginning to reduce the disparities in access to quality STEM teaching/learning. Programmes are being established on using science research as an educational tool to help local and rural communities. The summer research programmes will continue to benefit from this and strengthening authentic research partnerships with other scientists will improve both the research and opportunities for students.

Detail

RESEARCH OBJECTIVES

Dr Guinn is involved in a research programme entitled The Tribal College Research Experience for Undergraduates Programme. Each summer, this provides eight students with the opportunity to conduct environmental ecology research critical to Tribal lands in the United States.

FUNDING

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COLLABORATORS

- Alessandra Higa, Jason Tinant, James Sanovia, Dr Hannan Lagarry (Oglala Lakota College)
- Kerry Hartman (Nueta Hidatsa Sahnish College)
- Linda Black Elk, Dr Daniel Buresh (Sitting Bull College)
- Dr Erin Gillam, Dr Britt Heidinger, Dr Julia Bowsher (North Dakota State University)
- Audrey LaValle (Turtle Mountain Community College)
- Dr John Hendrickson, Dr David Toledo (US Department of Agriculture Agricultural Research Service, Northern Great Plains Research Laboratory)
- Dr Van Doze (University of North Dakota)
- Dr Carola Haas (Virginia Tech)
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BIO

Dr Guinn serves as Chair of the Tribal Environmental Science Department at United Tribes Technical College. He holds a PhD in Zoology and is a Certified Wildlife Biologist®. His research focuses on understanding the impacts of human interactions on predator ecology. In 2009, he received the Diversity Award from The Wildlife Society.

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