Tribal ecoAmbassadors

2011-2012 Program

EPA and Tribal Colleges and Universities work together to solve environmental problems in tribal communities.

EPA United States Environmental Protection Agency

Sara Plaggemeyer, LBHC Tribal ecoAmbassador, discusses project at EPA Tribal Science Council Meeting.
Photo courtesy of Erica Newland, AIHEC.

Front cover: TMCC ecoAmbassador student interns Ethan Martell and Roxanne Allery collecting water samples at outdoor water spigot. Photo courtesy of TMCC.

Tribal ecoAmbassadors

Environmental protection includes and affects everyone. With that in mind, the U.S. Environmental Protection Agency (EPA) seeks to strengthen partnerships with local communities to implement innovative solutions to today's most pressing environmental issues. Agency priorities under EPA Administrator Lisa P. Jackson include cleaning up communities, strengthening state and tribal partnerships, and elevating the national discourse on environmental issues. The agency is also interested in reaching out to communities—in particular, tribal communities—that have been disproportionately affected by environmental health issues.

In the United States, tribal governments deal with vast unmet needs. According to the U.S. Department of Health and Human Service's Indian Health Service, about one percent of Americans lack wastewater treatment services in their communities. Among American Indians, that number is 13 percent. To address such great environmental needs, EPA is now strengthening its partnership with the 37 Tribal Colleges and Universities (TCUs) in the United States, in addition to its strengthening of partnerships with tribal governments.

TCUs serve as centers of knowledge and educational excellence; they also serve as community centers and preserve tribal culture and Indigenous knowledge. TCUs act as cornerstones for many American Indian and Alaskan Native communities. Recognizing the importance of TCUs—and heeding President Barack Obama's 2011 Executive Order to better collaborate with tribal educational institutions—EPA has implemented the Tribal ecoAmbassadors Program.

The Tribal ecoAmbassador Program supports research in partnership with Tribal Colleges and Universities. One or more TCU professors are selected to serve as project ecoAmbassador, leading project staff and students in the use of funding and technical support from EPA to solve environmental problems most important to their tribal governments and communities.

As the inaugural year of EPA's Tribal ecoAmbassador Program comes to a close, this report highlights the progress, successes, and challenges encountered by each of the eight Tribal ecoAmbassadors.

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TOCC ecoAmbassador student intern sifting glass. Photo courtesy of TOCC.

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"This group of Ambassadors represents an effective partnership where the tribal community can direct EPA resources to the most pressing environmental problems they face to develop solutions."

—Michelle DePass, EPA Assistant Administrator

Founded in 1972 by the presidents of the nation's first six tribal colleges, the American Indian Higher Education Consortium (AIHEC) serves its network of member institutions through public policy, advocacy, research, and program initiatives to ensure strong tribal sovereignty through excellence in American Indian higher education.

Through AIHEC, Tribal Colleges and Universities (TCUs) have nurtured a common vision and united as a national movement. Today, AIHEC represents 37 colleges in the United States and one in Canada. AIHEC is celebrating 40 years as the collective spirit and unifying voice of the nation's TCUs. AIHEC also provides leadership and influences public policy on American Indian higher education issues through advocacy, research, and program initiatives; promotes and strengthens Indigenous languages, cultures, communities, and tribal nations; and through its unique position, serves member institutions and emerging TCUs.

Recognizing AIHEC's unique relationship and commitment to the 37 TCUs and the important role TCUs play within their communities, EPA has partnered with AIHEC to pilot the Tribal ecoAmbassador Program.

AIHEC assisted EPA in disseminating the Tribal ecoAmbassador call for applications to all 37 TCUs. Applications were accepted and reviewed by a selection committee at EPA comprised of agency tribal program managers and scientists. EPA selected the inaugural eight Tribal ecoAmbassador projects and identified TCU faculty members to serve as the project ecoAmbassadors, guiding staff and students in their individual research projects. The Tribal ecoAmbassadors at each TCU received a financial award and technical assistance for a year-long initiative directed toward a pressing environmental issue.

Throughout the inaugural year, AIHEC staff worked directly with the TCUs to promote and disseminate information about the program, respond to inquiries, provide project support, and highlight the significant strides that each of the eight Tribal ecoAmbassdor projects made in tribal environmental research.

The Tribal ecoAmbassador program reached out to faculty at TCUs, awarding financial and technical assistance to Tribal ecoAmbassadors for a year-long initiative directed toward a pressing environmental issue. Together AIHEC and the EPA aim to provide ongoing project support, promote environmental education, and find solutions to environmental problems in tribal communities.

TCU ecoAmbassadors and EPA Scientists

"Strengthening Tribal partnerships is one of my top priorities." ~ EPA Administrator Lisa P. Jackson.

Tribal ecoAmbassador group at the 2012 Summer Tribal Science Council Meeting.Photo courtesy of EPA.

To further strengthen the TCU-EPA partnership and promote knowledge-sharing, each Tribal ecoAmbassador partnered with an EPA scientist. The partnerships supported the projects and fostered further collaboration with other EPA scientists, as well as with employees of other federal agencies. Each Tribal ecoAmbassador produced quarterly check-ins and reports and completed final presentations to EPA's Tribal Science Council, which includes EPA and tribal science representatives.

Throughout the inaugural year, eight Tribal ecoAmbassador projects engaged with more than 60 students, many of whom have presented or plan to present project results to their communities. Two online courses were developed, and many of the Tribal ecoAmbassador projects can be developed for or transferred to other tribal communities. Each of the eight projects has had positive impacts within their respective tribal colleges and communities.

In addition to the strengthened partnership between EPA and the eight participating TCUs, the pilot year of the Tribal ecoAmbassadors program initiated several new partnerships, including with other federal agencies, NGOs, tribal governments, and mainstream universities. Turtle Mountain Community College, for example, received technical assistance for its water monitoring project from the Centers from Disease Control and Prevention. Diné College upgraded air quality monitoring equipment with assistance from the University of Colorado - Boulder. And various research institutes and scientific journals sponsored and published work from Fort Peck Community College.

Tohono O'odham Community College (TOCC), Sells, AZ ecoAmbassador—Dr. David Stone

TOCC ecoAmbassador student intern Richard Pablo operating the glass crusher.
Photo courtesy of TOCC.

Carbon-Negative Building Products from Recycled Materials

Dr. David Stone and two Tohono O'odham Community College students worked to find a solution to the challenges of having too much waste, too little building material, and a housing and job shortage. The Tohono O'odham Nation's Solid Waste Facility transports 500 tons of waste each month 65 miles to Tucson, and of this, approximately 50 tons is glass, primarily bottles. By using this glass, along with other scrap metals, they created a carbon-negative building product based on traditional building materials.

Hoping to resolve the challenge of too much waste and too little building material, the Tribal ecoAmbassador project at Tohono O'odham Community College (TOCC) proposed taking a positive and holistic approach to seemingly separate environmental issues by focusing on the central principle of materials management. TOCC was guided in its effort by EPA's "2020 Vision" which promotes sustainable materials management through a life cycle assessment of the entire material flow process, from raw materials acquisition to the disposal of used products.

The Tohono O'odham Nation's Solid Waste Facility, in the center of the Tohono O'odham Reservation, collects roughly 500 tons of waste each month, which must be trucked 65 miles to a landfill south of Tucson, AZ. About 50 tons of the monthly waste consist of glass, primarily glass bottles. TOCC envisions initiating a recycling program that does more than just collect this glass waste, but instead uses the waste in a new and permanent form as building materials.

The Tohono O'odham Nation also faces a chronic housing shortage that is aggravated by the expense of transporting all building materials to the reservation. The nation's vast land holdings include sand and gravel yards that are inactive, though not depleted, and TOCC was once advised to construct a small cement plant. But traditional cement manufacturing is energy-intensive, uses large amounts of fossil fuels, generates pollution, and produces one ton of carbon dioxide for every ton of cement. Instead of following that route, TOCC is pioneering alternative solutions.

Pavers and blocks developed through Green Building Materials course. Photo courtesy of TOCC.

Dr. David Stone, TOCC Tribal ecoAmbassador, initiated a project to produce sustainable building materials using glass waste from the Tohono O'odham Reservation. The building materials consist of glass waste and steel particulates (also waste). Bound together, they form a cement of iron minerals that aggregates into a solid mass. The hardening agent used in Stone's product is carbon dioxide gas, which reacts with the iron and forms an iron carbonate mineral. The final product traps a portion of the greenhouse gas making it "carbon negative." TOCC is working to develop these building materials in a sustainable and responsible manner.

Through the Tribal ecoAmbassador project, TOCC experimented with the most effective formulas for iron-augmented adobe blocks, pavers, and other construction materials. Then with partners at the University of Arizona and Arizona State University, the tribal college tested the different formulas for compressive strength, stability, weather resistance, and other qualities.

As part of the project, Stone and his students collected glass waste found scattered across the reservation. Initially they crushed bottles by hand to a consistency suitable for use in the building material composite. Through the Tribal ecoAmbassador project, TOCC was able to purchase a glass-pulverizing machine that can reduce more bottles to cullet (glass aggregate) in one hour than student participants could crush by hand in an entire day. The project also inspired collaborations with other organizations across the Tohono O'odham Nation. The Solid Waste Department placed recycling bins for glass around the

community and the Tohono O'odham Environmental Protection Office and the Public Safely Police Department have coordinated clean-ups with Stone and his students. All of these cleanup efforts have helped foster community involvement.

As a part of the TOCC Tribal ecoAmbassador project, Stone also developed and taught a green building materials course.

Six students enrolled in the initial course and four student interns worked on the project. Stone used scientific concepts and principles to teach students about building material types, material characteristics and testing, building material functions, balancing costs and functions, life cycle assessments, leadership in energy and environmental design (LEED), and sustainability. Using classroom lessons and hands-on experiences (including collecting waste, crushing bottles, and experimenting with various materials and binding processes), Stone and his students created a single bench made entirely of the glass/iron composite that enhances the TOCC campus and demonstrates the durability and functionality of the building material.

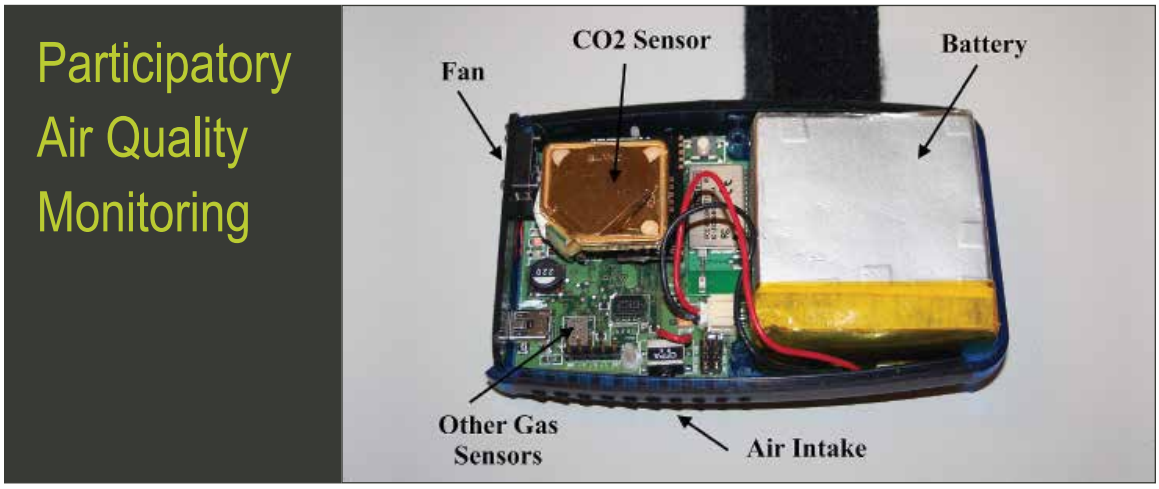
Faculty members at TOCC incorporate *himdag* (culture) into all courses offered through the college, and the green building materials course naturally aligned with many traditional teachings and practices. "For a model of how to build on a large scale, we found our way back to the ancient masters of desert architecture, the Hohokam ("those who are gone"), the progenitors of the Tohono O'odham," says Stone. "The excavated ruins of their villages at Snaketown and Casa Grande National Monument reveal that they too had expertly practiced the same essential principles of optimal building in an arid environment just like the Anasazi, the Mogollon, and the other ancestral desert peoples."

The TOCC Tribal ecoAmbassador project produced a sustainable material and explored traditional architecture. While collecting and recycling glass—which consisted primarily of empty alcohol bottles—project participants also confronted historical trauma and the presence of alcohol abuse within the Tohono O'odham Nation. ***"I remember the first day that we went out picking glass bottles, there was so much just in one area that it took a few days just to clear it up,"*** says Richard Pablo, a TOCC Tribal ecoAmbassador student. ***"While we picked up glass bottles, all kinds of thoughts started to develop in my mind."*** For Pablo, collecting glass has had so much more meaning.

The TOCC Tribal ecoAmbassador project is still in its early stages. As community groups continue working in alliance with one another, project participants at TOCC hope glass recycling will become routine on the reservation. Participants also hope their recycling project will grow into a self-sustaining economic venture across the Tohono O'odham Nation and also play an important role in alleviating several of the Tohono O'odham Nation's serious problems, including unemployment, housing shortages, recycling and waste disposal challenges, and the need for science education and technical training. Beyond that, the TOCC Tribal ecoAmbassador project participants envision the revival of an ancient desert architecture—an architecture that will be critical to the survival of the desert people as the climate becomes warmer and drier in the decades to come.

Diné College (DC), Tsaile, AZ
ecoAmbassador—Dr. Mark Bauer

Portable air quality monitoring equipment, m-pod (interal view). Photo courtesy of DC.



Dr. Mark Bauer designed a program requiring students to wear personal air monitors over the course of several weeks to record levels of air pollutants in their immediate environment. By presenting their findings to family and friends, students will strengthen community education and improve community health. The project empowers students and local residents to monitor their community's air quality and public health.

Diné College's Diné Environmental Institute (DEI) in Shiprock, NM, developed a Tribal ecoAmbassador project using portable air quality monitoring equipment, called "m-Pods," designed and provided by mechanical engineers from the University of Colorado - Boulder with design input from the National Center for Atmospheric Research (NCAR).

Two large coal-fired power plants are located within 20 miles of Shiprock, NM, as are thousands of natural gas wells, each with a diesel engine. During the winter, air pollution is highly visible because thermal inversions trap particulate matter and smog near the ground. The poor air quality is further exacerbated by the use of wood and coal stoves in residential homes (Bunnell, Garcia, Furst, Lerch, Olea, Suitt, Kolker, 2010).

Despite the community's rural setting, the rates of asthma and pulmonary diseases are comparable to those found in highly populated urban areas. In fact, Shiprock Indian Health Service Center sees five times the number of children with upper respiratory health problems than other Indian Health Service Centers on the Navajo Nation.

Dr. Mark Bauer, Diné College Tribal ecoAmbassador, led project staff members Perry Charley and Joni Nofchissey and several cohorts of students in the collection and analysis of air quality samples using m-Pods.

Intern wearing an mpod.

Photo couretsy of Dine College

In summer 2011, the initial student interns traveled to University of Colorado - Boulder for m-Pods training. The one-week workshop included instruction on air sampling techniques and sampling instrumentation for two projects

The first project consisted of a study of current, regional-scale carbon dioxide fluxes in complex terrain—specifically the Rocky Mountain West, the southwestern United States (Navajo Nation), and Kenya, Africa. In cooperation with Diné College and the U.S. Bureau of Indian Affairs, a carbon dioxide analyzer was situated on Roof Butte in the Red Valley community of the Navajo Nation.

The University of Colorado workshop also enhanced the second project, the Tribal ecoAmbassador project, by training students to effectively collect regional data and analyze the data to determine local and regional air quality in the Shiprock area.

During the 2012 spring semester, a third group of students received training on collecting baseline air quality data with the m-Pods and used logs to document supporting qualitative data. The data was uploaded daily into NCAR's website using Android smartphones.

Student interns from the spring semester presented their project goals and preliminary results to community members and other environmental organizations at the 2012 Nahasdzáán Nihimá Baaháanízin Green Awareness Day at Diné College - Shiprock North Campus sponsored by Navajo Green Jobs.

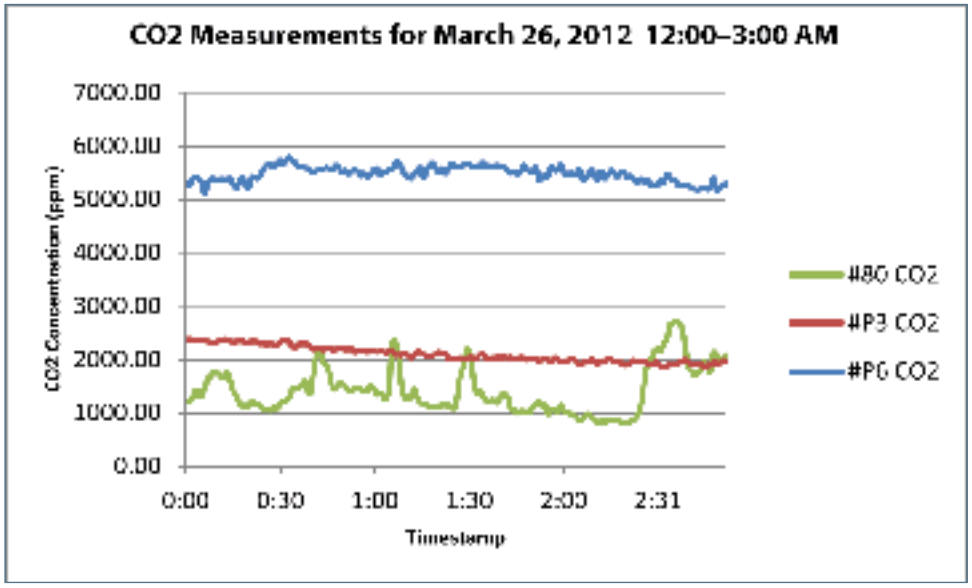
Finally, six summer DEI interns received training in "Air Quality Detective Work" and m-Pod use from the University of Colorado team. Two of the students developed a preliminary sampling protocol that will decrease variability in sampling conditions. An additional intern gave a presentation entitled "Air Quality: Contributors to Unhealthy Air Quality on the Navajo Reservation" in Shiprock, NM, and Cove, AZ.

During the course of the project, students collected data concerning nitrogen dioxide

(NO2) levels in homes on Navajo Nation.

Nitrogen dioxide (NO2) is produced when natural gas or other fuels undergo incomplete combustion. According to the Illinois Department of Public Health (IDPH) 2011 Guidelines for Indoor Air Quality, the recommended level of NO2 over a period of 24 hours should not exceed 0.05 ppm. Each of the three residences tested exceeded the recommended healthy levels of 0.05 ppm for the entire three hours sampled.

Further testing showed high levels of carbon dioxide (CO2) in homes. High CO2 readings may indicate elevated levels of other pollutants or indicate a structure is not well-ventilated. According to the IDPH Guidelines for Indoor Air Quality, the recommended range of CO2 concentration indoors is 600–1000 ppm. In one of the three homes, the

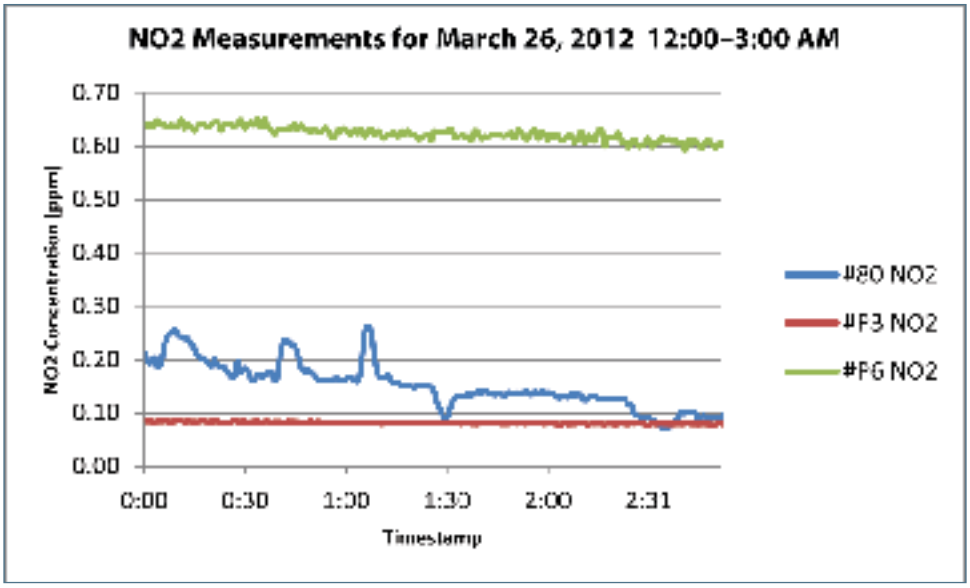


readings were more than five times the maximum recommended healthy range set by IDPH.

The Diné College Tribal ecoAmbassador project faced delays due to the short battery life of the m-Pods and other minor project inhibitors such as an intermittent wireless connection to upload data. But the project's preliminary results allowed researchers to identify which areas in the Shiprock region of the Navajo Nation require additional monitoring using state-of-the-art equipment.

By testing the use of m-Pods, program participants are assisting the m-Pod design team at the University of Colorado - Boulder in identifying issues to address before the technology can be more widely used.

Bauer and the Diné Environmental Institute will continue this project by offering student



interns additional opportunities for further training with the University of Colorado and NCAR. They will continue training students in data consistency and quality and digitizing files—and complete the project report for community use. The Institute will also design a lab course that explores air quality using the m-Pod technology.

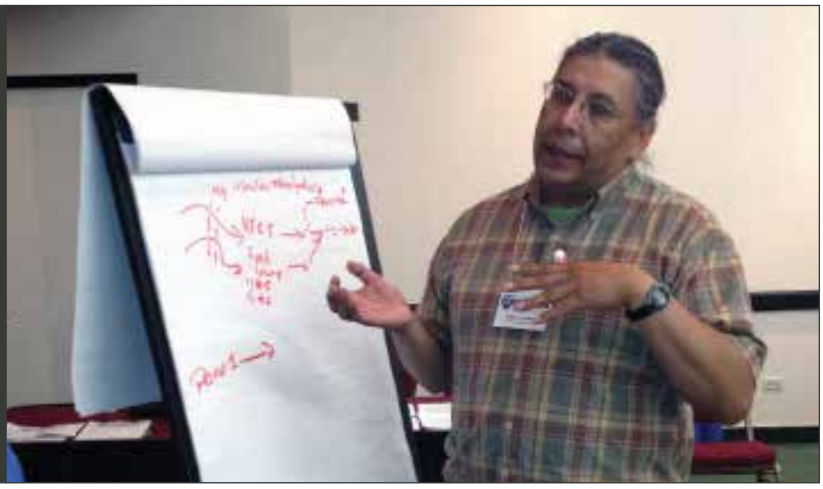
As students continue analyzing data and sharing its implications with the community, the Diné College Tribal ecoAmbassador project will give Diné community members in the Shiprock area a better understanding and awareness of air quality issues. The project participants provided insight to the developers of the m-Pod technology on how to improve the air quality monitors—and stressed the importance of exploring alternative heating sources (such as solar, wind, and biomass) to improve residential air quality.

Dine student analyzing air quality data logged by an mpod device.

Fort Peck Community College (FPCC), Poplar, MT
ecoAmbassadors—Renee Dufault and Zara Berg

Tribal Science Council meeting speaker John Crawford (FPCC).
Photo courtesy of Erica Newland, AIHEC.

Epigenetics/
Obesity/
Toxics
Exposure



The Fort Peck Community College Tribal ecoAmbassador project resulted in a transferable online course focused on the impacts mercury and other toxics have on human health. Toxics exposure in tribal communities tends to be very high because of high fish consumption rates and the presence of local contaminated sites.

Fort Peck Community College (FPCC) developed a Tribal ecoAmbassador project to determine if an online macroepigentics course might serve as an effective intervention tool in reducing student risk of insulin resistance, a risk factor for developing Type-2 diabetes.

Macroepigenetics is an analytical approach to understanding how environmental and dietary factors interact to regulate genes that protect health or make an individual more susceptible to disease.

FPCC ecoAmbassadors Renee Dufault and Zara Berg modified the Food Ingredient and Health Research Institute's introductory Macroepigenetics Nutrition Course and created an online course for FPCC students, titled Nutrition 270, Applied Macroepigenetics. Nutrition 270 is offered through the Food Ingredient and Health Research Institute website, and is the first online class offered at FPCC. Eleven tribal college students successfully completed the course.

During the course, students learned the role environmental factors, such as food, play in regulating genes that protect health or lead to disease. To measure changes in student knowledge about how toxic substances in the food supply impact gene regulation, diet, and health status, the FPCC Tribal ecoAmbassador project administered online surveys before and after the completion of Nutrition 270.

The survey results indicate that the class improved the students' knowledge of toxic substances in the food supply and that students also made significant dietary changes—these changes resulted in a reduction in the mean waist-to-hip ratio by the end of the course period.

That the FPCC Tribal ecoAmbassador project observed a reduction in the mean waist-to-hip ratio by the end of the course suggests that the online delivery of macroepigenetics nutrition education may be a viable method for delivery of structured diabetes prevention programs. The online survey included questions designed to determine if student knowledge of toxins in food ingredients and the food supply increased over the period of the course. The pre- and post-survey results indicate that students significantly increased their knowledge of toxins in food ingredients and the food supply.

	Pre Course	Post Course
Percentage of students who were able to correctly identify salt compounds that add to their risk of developing hypertension	36.4%	70%
Percentage of students who were able to correctly identify which toxic elements may be found in some common food color additives	72.7%	100%
Percentage of students who were able to correctly identify a food ingredient related to the development of both autism and ADHD	45.5%	90%.
The percentage of students who were able to correctly identify sources of mercury in the American diet	36.4%	90%.

The pre- and post-survey results also indicate that students changed their diets by the end of the intervention course. Specifically, more students said they avoided consumption of harmful food ingredients associated with the development of heart disease and insulin resistance, and more students said they were eating foods known to improve health. For example, students increased their fish consumption in an effort to increase their omega-3 fatty acid intake. They also reduced their sugar and fructose intake by reducing consumption of sweet snacks and sweetened beverages. They decreased their intake of salty snacks, reduced their consumption of red meat, and increased their consumption of fresh vegetables.

	Pre Course	Post Course
Students reporting that they never eat freshly caught fish	90.9%	50%
Students reporting that they eat canned salmon once a week	0%	20%
Students reporting that they drink sugar sweetened beverages [not diet] such as Coke, Pepsi, Kool Aid, Hi-C, Fruit Punch, Gatorade several times a day	18.2%	0%.
Students reporting that they eat "sweet snacks' such as candy, cookies, popsicle [not diet] several times a week decreased from	45.5%	10%.

"This class has definitely changed my diet for sure. I think I am way healthier now than I was back then. I actually feel better with the choices I have made and the changes as well," explained one of the students.

"As for my family, some of them went on the wagon with me—my younger sister is a health nut now! There are a few family members that didn't quite go into it. We have no HFCS [high-fructose corn syrup] ketchup in our house now, along with a few other things."

Overall, the FPCC Tribal ecoAmbassador project assessment survey was a successful tool in determining student achievement based on the course standards.

Student	Pre Waist-Hip Ratio (WHR)	Post Waist-Hip Ratio (WHR)
1	0.87	0.88
2	0.94	0.84
3	0.88	0.82
4	1.00	0.99.
5	0.88	0.80
6	0.74	0.71
7	0.96	1.04
8	1.02	1.04
9	1.02	1.03
10	0.84	0.81
mean	0.92	0.90

Waist-to-hip, height, and weight measurements were also taken for each student before and after the course. This data indicates there was a small decrease in the mean waist-to-hip ratio among the students. The World Health Organization considers a waist-to-hip ratio above 0.90 for males and above 0.85 for females to indicate risk for the development of diabetes and heart disease (World Health Organization, 2008). A mean decrease in waist-to-hip ratio from 0.92 to 0.90 occurred during the course. Should students continue their dietary changes, their waist-to-hip ratios may decline further as their health status continues to improve. **"I have learned more than I expected. The knowledge in the new area of macroepigentics has put me on a course to little or no**

HFCS, and reading labels for salt, and sodium in my diet," said another student. ***"It has also helped me look at what is incorporated into my diet in a critical eye, and to start to ask the difficult questions."***

Nutrition 270, Applied Macroepigenetics is the first course to be offered on the topic of macroepigenetics nutrition at FPCC. While enrolled in the online course, students used their research skills to mine and interpret data and then discussed their findings with their classmates.

Employing macroepigenetics to look at gene-environment interactions is a new approach—and one only recently published by ecoAmbassador Renee Dufault and her colleagues (Dufault, Lukiw, Crider, Schnoll, Wallinga, & Deth, 2012).

The FPCC course contributed greatly to the body of knowledge in the epigenetics field. The FPCC Tribal ecoAmbassador project demonstrated that the concepts of macroepigenetics can be taught within a nutrition course and can also lead to dietary changes among students that may improve their health.

The project had a positive impact on students. It provided them with opportunities to conduct their own research and to correctly interpret their findings and apply what they learned about nutrition to their own lives.

Tribal ecoAmbassador Renee Dufault continues her work in the field of macroepigenetics and is building community awareness around this emerging field. "Nutrition education needs to include information on food toxins and how they create conditions for the development of disease," she says. "Students want to understand why certain food ingredients are harmful. Nutrition education provided in the context of gene-environment interactions gives the reasons why."

Dufault was recently invited to serve as the keynote speaker at the 2013 Learning Disabilities Association of America forum. She will discuss how toxic exposures, nutrition, and genes interact to affect brain development. Both Dufault and Berg intend to follow this project with a more in-depth study focused on correlating environmental toxins and student biomarkers.

Turtle Mountain Community College (TMCC), Belcourt, ND ecoAmbassador—Dr. Deborah Hunter

TMCC ecoAmbassador student interns Roxanne Allery and Ethan Martell collecting water samples. Photo courtesy of TOCC.

Monitoring Drinking Water from Private Wells

The Turtle Mountain Community College Tribal ecoAmbassador project tested the water quality of private wells on and surrounding the Turtle Mountain Reservation, and helped to educate the community on the need for such water quality testing.

Turtle Mountain Community College (TMCC) developed a Tribal ecoAmbassador project to investigate the quality of drinking water from private wells in and around Turtle Mountain tribal lands.

There are currently more than 100 private wells in use throughout this area. Although the EPA has established guidelines to regulate the quality of drinking water from public water facilities, drinking water from private wells is not regulated under federal, state, or tribal laws.

The United States Geological Survey (USGS) has conducted water quality testing from test wells within two aquifers: the Shell Valley aquifer, which is now the primary source of rural drinking water for the Turtle Mountain Indian Reservation, and the Fox Hills aquifer system, which underlies all but the eastern townships in Rolette County and includes the Turtle Mountain Reservation and surrounding lands. The results of

the Fox Hill aquifer testing indicated the water was of poor drinking water quality and the USGS recommended the Shell Valley Aquifer be used to supply rural drinking water to the reservation (Strobel, 1997, Randich & Kuznlar, 1984).

The water quality of the drinking water from many of the private wells in the area has not been tested since the wells were first constructed, or has been tested infrequently.

TMCC ecoAmbassador student interns Ethan Ethan Martell and Roxanne Allery in the lab.
Photos courtesy of TMCC.

Now, the TMCC Tribal ecoAmbassador project is testing a selection of private wells and sharing the results with the EPA and community members.

The Turtle Mountain Reservation is located in Rolette County, ND. In 2012, Rolette County ranked 44 out of 46 in health outcomes in the state of North Dakota (University of Wisconsin Population Health Institute, 2012). According to the Centers for Disease Control and Prevention, the presence of contaminants in water can lead to health issues, including gastrointestinal illness, reproductive problems, and neurological disorders (Centers for Disease Control and Prevention, 2012). Although it is currently unknown how poor quality drinking water contributes to the poor quality of health and high mortality rates among tribal members, the TMCC Tribal ecoAmbassador project has investigated the status of water quality on and around the Turtle Mountain Reservation. Additionally, the project results are helping educate community members on the importance of water quality, and these results will be available as a resource for future researchers investigating water quality and community health.

Under the direction of Dr. Deborah Hunter, TMCC Tribal ecoAmbassador, and Ms. Audrey LaVallie, participating students identified, collected, and tested water from more than 40 privately-owned wells on the Turtle Mountain Reservation and adjacent tribal lands.

"My experience with the ecoAmbassador project has not only been educational but a good experience within our community. I have found that people are willing to participate in our project willingly and with good faith," says Roxanne Allery, a TMCC ecoAmbassador student intern. "A simple phone call, a short explanation, and a friendly gesture were the only requirements needed for their cooperation. The Tribal ecoAmbassador project not only opened the door for me in regards to career choices but has also given me a newfound respect for my community."

Students collected the well water samples and tested for pH, conductivity, biological oxygen demand, nitrates, nitrites, total chlorine, total organic chemicals, fluorine, iron, lead, hardness (calcium), orthophosphates, aluminum, turbidity, and coliforms. In addition, students used an atomic absorption spectrophotometer to test water samples for lead, sodium, cadmium, silver, iron, and nickel, and other metals. Fifteen of the 40 water samples are also being tested for organic contaminates using a gas chromatograph mass spectrophotometer equipped to test for thousands of different chemicals.

The TMCC results indicate many of the wells have higher sodium concentrations and higher iron levels than recommended by the EPA.

The TMCC Tribal ecoAmbassador project has had a positive effect on the local community. Not only have project participants tested drinking water wells in the community, they have also educated community members about the need for water quality testing. Two of Dr. Hunter's students designed a brochure that explained the collection and testing process and the need for drinking well tests across the reservation.

In addition, all student participants gained valuable research experience. "The students have developed good lab note-taking skills, have gained confidence and interest in learning new scientific methods to determine chemicals present in the water samples, and actually enjoy analyzing and comparing the data results," says Hunter. ***"The students are proud of their work and it shows. It makes me proud to be a part of the students' research experience."***

Little Big Horn College (LBHC), Crow Agency, MT

LBHC ecoAmbassador research student Thane Gray is preparing equipment to record physical water quality parameters of the Little Big Horn River. Photo courtesy of LBHC.

Assessing Non-point Sources of Contamination on Little Big Horn River

The Little Big Horn College Tribal ecoAmbassador project tested sites along the Little Big Horn River to assess the water quality of the river which is used for many purposes. Final results of the water quality testing will be shared and discussed within the local community.

Little Big Horn College (LBHC) developed a Tribal ecoAmbassador project to assess the water quality of the Little Big Horn River system on the Crow Reservation. Impairment of drinking water sources and recreational waters is a great concern to the community. Microbial contaminants in area waters come from both point and nonpoint sources.

The Little Big Horn River is used for recreation, drinking water, and ceremonial purposes. The quality of its waters, therefore, impacts community health and is also culturally significant to the Crow tribe.

Under the direction of Sara Plaggemeyer, LBHC Tribal ecoAmbassador, students enrolled in the Field Water Quality Laboratory course conducted a water quality monitoring research initiative aimed at identifying pollutants and sources of pollution. Though the course's field laboratory experience, students learned about the hydrological cycle, water chemistry, water quality parameters, ecological impacts, and societal impacts. The project monitored sites on the Little Big Horn River to identify

nonpoint sources of coliform that are seriously impacting water quality in the lower stretch of the river. Previous water quality monitoring of the Little Big Horn River has shown significantly higher fecal coliform and *E. coli* counts in the lower area of the river during the summer months; at times, *E. coli* levels exceed those recommended by EPA for safe recreational use.

Trisheena Kills Pretty Enemy, a student working on the LBHC Tribal ecoAmbassaor project, understands the community impact this project will have. "I think that it will make a good impact for the community," she says. ***"I come from a traditional family and the river plays a big part in our everyday lives.*** We use the water for the sweat lodge, the sundance, and peyote meeting."

Four previously-monitored sites were selected for updated water quality data, as were five newly-established sites identified during the project. Sites were monitored for both physical and biological parameters, including dissolved oxygen, conductivity, pH, coliform enumerations, and *E. coli* enumerations. A specialized probe measured all these parameters simultaneously. In addition, water samples from each site were processed in the LBHC laboratory for turbidity, total suspended solids, coliform, and *E. coli* enumerations. The bacterial tests of each water sample were conducted by student interns.

Five student participants received microbial and molecular training. Each week, students collected and processed the physical parameters and biological parameters of the river, and are working on the analysis of data and the distribution of the results to the community. ***"Water quality is a very big issue here in my community so I do enjoy learning about it and knowing what's going on,"*** says Melarie Pretty Paint, a student participant.

Participants in the LBHC Tribal ecoAmbassador project continue to collect and analyze water quality testing results. Tribal ecoAmbassador, Sara Plaggemeyer explains that preliminary results show that the E. coli enumerations exceed the EPA standard for recreational waters on the lower reaches of the river.

"We are still in the process of collecting samples, and will be utilizing those results to get a final assessment of the water quality of the river during this summer," Says Plaggemeyer.

"Once the final assessment is done, the results will be presented to the community through student presentations at a community- based environmental steering committee meeting, to students in the community through a curriculum developed around the work done this summer, and through Little Big Horn College."

United Tribes Technical College (UTTC), Bismarck, ND
ecoAmbassador—Dr. Jennifer Janecek-Hartman

UTTC student Delett Siegfried (*left*) and Jamie White Mountain of the UTTC Housing Department.
Photo courtesy of UTTC.

Green Fitting of Student Housing

The United Tribes Technical College Tribal ecoAmbassador project provided energy efficiency updates and energy efficient appliances to students in married or family housing at UTTC. The project continues to educate students on how to reduce their carbon footprints by "greening" up and reducing their energy use.

The United Tribes Technical College (UTTC) Tribal ecoAmbassador project is based upon a successful pilot project that helps students in married or family housing at UTTC reduce their carbon footprints by "greening up" and reducing their energy use.

Under the direction of Dr. Jennifer Janecek Hartman, UTTC Tribal ecoAmbassador, the program has selected six houses to be retrofitted with appliances and other "green" or sustainable items to help reduce their overall carbon footprints. Students selected for this project are competing against one another to "Green Fit" their homes. Initially, student participants were given the opportunity to choose from a list of energy-saving options to apply to their home ranging from the installation of Energy Star appliances to insulating crawl spaces.

In addition to the selected housing upgrades, students will participate in four workshops designed to help them reduce their carbon footprints. Students will learn about energy-saving tactics such as installing low-flow shower heads, lowering the thermostat when not at home, and switching from incandescent light bulbs to

fluorescent bulbs. “We are so excited that the Tribal ecoAmbassador project allowed us to expand our Green Fitting project.” Says Dr. Jennifer Janecek-Hartman.

“Reducing the carbon footprint of our campus is so important and allows us to set a good example in the community of Bismarck. We hope the students continue when they leave our campus as well.”

Installation of upgraded and energy efficient appliances in UTTC student housing. Photo courtesy of UTTC.

UTTC will monitor the utility use and expense for each home over a three-month period. That data will be aggregated based upon a percentage of change as the home and family size varies. The winner of the competition will have demonstrated the largest overall energy savings. The UTTC Tribal ecoAmbassador project demonstrates how easy everyday changes within the home can significantly reduce a family’s carbon footprint.

Tenant Choices for House **(choices need to add up to $1,900 or less)**	
Modification Choices	Prices
Insulate Attic	$1,800
Refrigerator	$625
Stove	$650
H2O Saving Clothes Washer	$475
Dryer	$525
Energy Efficient Lights	$50/unit
Sealing Windows (plastic over interior windows)	$175
Toilet Change-out (water efficient)	$200
Insulate Crawl Space and Pipes	$350

Cankdeska Cikana Community College (CCCC), Fort Totten, ND ecoAmbassadors—Rachel Brazil, Heather Ibsen

CCCC student Leslie Guy estimating plastic water bottle waste. Photo courtesy of CCCC.

Developing a Campus Recycling Sustainability Program

The Cankdeska Cikana Community College Tribal ecoAmbassador project encourages students and college staff and faculty to create a recycling infrastructure throughout the college campus.

The Cankdeska Cikana Community College (CCCC) Tribal ecoAmbassador project, titled, "Encouraging Community Recycling through Campus Sustainability," is designed for student participants to research, identify, and implement a plan of action for enhancing sustainability on campus.

Located on the Spirit Lake Reservation in North Dakota, the CCCC campus requires a sustainable recycling program. Without infrastructure for a sustainable recycling program, CCCC discards tons of recyclable material each year. Throughout the reservation, waste management continues to affect the health of the community and the environment.

The CCCC Tribal ecoAmbassador project conducted background research on the process of recycling, gathered data to determine the composition of waste at the tribal college, and conducted a campus-wide inventory of recyclable items. During implementation of this project, CCCC organized several teams dedicated to supporting and providing leadership in this effort. The CCCC Green Team includes faculty and staff

who are interested in enhancing campus sustainability. Four students are participating in the CCCC Tribal ecoAmbassador project. Two students will be leading efforts to create recycling infrastructure on campus and two students will be leading efforts to address the potential for composting and solidifying connections between the college greenhouse and the college café.

CCCC student intern Leslie Guy assessing newspaper waste at the Valeria Merrick Memorial Library on campus. Photo courtesy of CCCC.

The project began to gain momentum as the CCCC Green Team documented the composition of waste at the tribal college. Using resources from the EPA and the North Dakota Solid Waste and Recycling Association, the CCCC Green Team conducted a facility walk-through to identify current resources and specific needs and gather input from staff, faculty, and students. Data from the facility walk-through will be compiled and analyzed to develop a work plan to guide the Tribal ecoAmbassador, CCCC Green Team, and CCCC student participants in establishing the infrastructure necessary for an on-campus recycling program.

The project has been extended due to a change in staff, and the CCCC Tribal ecoAmbassador continues to work with regional EPA staff to assist with that transition and carry out implementation of the project. Moving forward, the CCCC Tribal ecoAmbassador will lead student participants in interpreting and presenting the data collected during the facility walk-through, making contact with recycling centers and potential vendors to establish a recycling route, and disseminating research findings and the developed plan of action to the community.

This project also closely links to the OnCampus ecoAmbassadors program that works with school representatives and fellow students to implement projects from EPA programs to help green their campuses, promote environmental awareness, and carry out the EPA's mission to protect human health and the environment. CCCC, with EPA's help, will develop a sustainable recycling plan that can be easily transferred to other TCUs.

Fort Berthold Community College (FBCC), New Town, ND ecoAmbassador—Dr. Kerry Hartman

FBCC ecoAmbassador student interns with Dr. Hartman in the lab. Photo courtesy of FBCC.

Sampling Groundwater from Local Wells

The Fort Berthold Community College Tribal ecoAmbassador project is designed for students to collect and test groundwater samples from rural wells on the Fort Berthold Indian Reservation.

The Fort Berthold Community College Tribal ecoAmbassadors project was designed to train students on approaches and procedures for sampling rural wells and transferring groundwater samples to a laboratory for chemical analyses from rural wells on the Fort Berthold Indian Reservation.

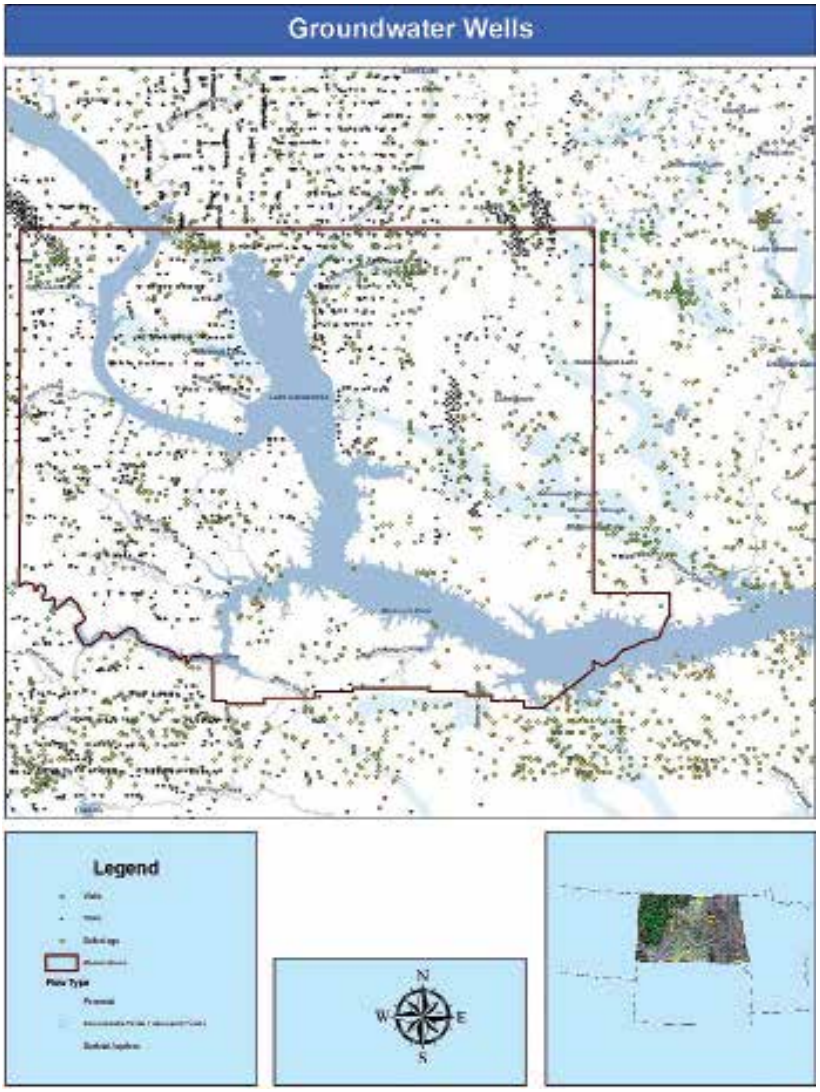
Fort Berthold Community Center (FBCC) developed a Tribal ecoAmbassador project involving the field collection and chemical analyses of groundwater samples from 13 rural wells across the Fort Berthold Indian Reservation.

Under the direction of Dr. Kerry Hartman, FBCC Tribal ecoAmbassador, two lead students mentored ten additional students in the development of a sampling strategy for selecting rural wells for sampling, procedures for sampling, preparation of samples and evaluation of analytical data obtained from a laboratory. Once shipped to an analytical laboratory, groundwater samples were analyzed for numerous constituents including dissolved gases, metals and selected cations and anions.

Groundwater sample results were summarized into final reports that will be incorporated into posters and presentations by students to present at the AIHEC student conference and other scientific opportunities.

Dr. Hartman is hopeful that ***"this project will produce some initial observations about the quality of groundwater on Fort Berthold, and that more importantly, students have obtained additional knowledge and field experience regarding the sampling, analysis and data interpretation of groundwater samples collected from rural wells."***

Groundwater wells. Photo courtesy of FBCC.



Tribal ecoAmbassador Program Sustainability

Richard Pablo, TOCC ecoAmbassador student intern sifting glass. Photo courtesy of TOCC.

The EPA looks forward to building on the results of the inaugural Tribal ecoAmbassador projects, and to expanding the program to include not only TCUs, but also non-tribal colleges and universities that have large tribal enrollments.

A primary goal of this program is to develop approaches that can serve as models for other communities, and as a result, can be replicated to address similar problems. To ensure the success and sustainability of the Tribal ecoAmbassador Program, the EPA has established an Alumni Corps comprised of former program professors, students, and their EPA partners. This allows former and current Tribal ecoAmbassadors to share information, provide support, and collaborate to strengthen tribal environmental research at TCUs. The Alumni Corps strengthens the EPA-TCU relationship, and supports the development of future environmental champions.

"This project is a way for me to give back, and has helped me decide that I want to study science and make it part of my life." ~Richard Pablo, Tohono O'odham Community College student

References

Bunnell, J., Garcia, L., Furst, J., Lerch, H., Olea, R., Suitt, S., Kolker, A. (2010). Navajo Coal Combustion and Respiratory Health Near Shiprock, New Mexico. *Journal of Environmental and Public Health*, Article ID 260525, 14 pages doi:10.1155/2010/260525.

Centers for Disease Control and Prevention (2012). *Water-related Diseases and Contaminants in Private Wells*. Retrieved from http://www.cdc.gov/healthywater/drinking/private/wells/diseases.html.

Dufault, R., Lukiw, W.J., Crider, R., Schnoll, R., Wallinga, D., & Deth, R. (2012). Macroepigenetic approach used to identify the factors likely responsible for the autism epidemic in the United States. *Clinical Epigenetics*, 4:6. Retrieved from http://www.clinicalepigeneticsjournal.com/content/4/1/6.

Food Ingredient and Health Research Institute. (2011). *Applied macroepigenetics course*. Retrieved from http://www.foodingredient.info/fihrinews/newepigeneticscourse.html.

Illinois Department of Public Health. (2011) Environmental Health Fact Sheet; Illinois Department of Public Health Guidelines for Indoor Air Quality. Retrieved from http://www.idph.state.il.us/envhealth/factsheets/indoorairqualityguide_fs.htm.

Randich, P.G. and R. L. Kuznlar. (1984) Ground Water Resources of Bottineau and Rolette Counties, North Dakota. U.S. Geological Survey: County Ground-Water Studies 35-Part III (North Dakota State Water Commission) and Bulletin 78-Part III (North Dakota Geological Survey).

Strobel, M. L. (1997) Hydrogeology and Water Quality of the Shell Valley Aquifer, Rolette Count, North Dakota. U.S. Geological Survey: Water Resources Investigation Report 97-4291. Prepared in cooperation with the Turtle Mountain Reservation.

University of Wisconsin Population Health Institute (2012). *County Health Rankings 2012: North Dakota*. Retrieved from http://m.countyhealthrankings.org/sites/default/files/states/CHR2012_ND.pdf

United States Environmental Protection Agency (2012). *Drinking Water Contaminates: National Primary Drinking Water Regulations*. Retrieved from http://water.epa.gov/drink/contaminants/index.cfm

United States. Geological Survey Assessment (2008). *3 to 4.3 Billion Barrels of Technically Recoverable Oil Assessed in North Dakota and Montana's Bakken Formation—25 Times More Than 1995 Estimate*. Retrieved from http://www.usgs.gov/newsroom/article.asp?ID=1911.

World Health Organization. (2008). *Waist circumference and waist-hip ratio: report of a WHO expert consultation*. Retrieved from http://whqlibdoc.who.int/publications/2011/9789241501491_eng.pdf.

Diné College (DC) student and staff talking with Navajo Tribal Utility Authority staff at a CO2 monitoring station. Photo courtesy of DC.

University of Colorado Boulder presenters and DEI interns and staff begin a hike to a high-tech stationary CO2 monitor installed by National Center for Atmospheric Research located nearby at Roof Butte to ground-truth the portable m-POD technology that is being used to collect air quality data. Photo courtesy of DC.

Tribal ecoAmbassadors

Tohono O'odham Community College

Diné College

Fort Peck Community College

Turtle Mountain Community College

Little Big Horn College

United Tribes Technical College

Cankdeska Cikana Community College

Fort Berthold Community College

Publication Number
160R12003