Getting a Master's in Social Geology

It's easy with programs like Michigan Tech's Peace Corps Master's International Program in Geohazards

Seismo-acoustic and high-speed video team from Michigan Tech, New Mexico Tech and the University of North Carolina observing an eruption of Santiaguito volcano, Guatemala from a safe distance.

Courtesy of John Lyons

Essa L. Gross

At first glance, it seems like an obvious solution to a problem: Villagers need vegetables and an aid organization has money to buy tools and seeds. Striving to create a sustainable program, the aid organization develops a training plan to teach the village how to garden, invests in local workshops, and purchases tools to distribute to the participants. All plans seem in order and the project is poised for success. However, the project's managers encounter the first, of potentially many, obstacles when they realize that shovels are impossible to use if you don't have shoes.

This simple example illustrates the nearly ubiquitous problem of overcoming cultural barriers in development work. Solutions proposed by outside experts rarely work for the people they are trying to serve. Scientists and engineers who diligently work to find appropriate technical solutions to some of the most common problems encountered by the poor are frustrated at every turn — frustration fueled by misunderstandings and the failure to grasp basic concepts held by other cultures. Institutions investing in innovative approaches to international research and education hope to produce more culturally aware scientists — and this includes geoscientists. Difficulties borne from inadequate consideration of the social and cultural context are commonly encountered in geologic hazard mitigation and natural resource management.

Peace Corps Master's International student Julie Herrick spent several months living with a local host family in the community of Calabazal, Panama. At right, Julie Herrick works with the community of Quebrada Mina in Panama to complete a water level survey. The information will be used to help design an aqueduct for the village's water supply.

Like much of the developed world, developing countries face potentially hazardous environmental problems. However, their circumstances place them at a distinct disadvantage to cope with disasters. The poor are more vulnerable, as many can afford only to live in high-risk areas such as floodplains, landslide-prone regions or near active volcanoes. They typically do not receive effective government support in the form of disaster relief or insurance, nor do they possess the economic resources to deal with natural catastrophes themselves. Federal and state institutional weaknesses may inhibit a region's capacity to respond adequately. Improper management and use of natural resources affects the poor to a greater degree than those who have the means to endure difficult times, such as in a drought. And finally, they may not have the tools to predict or work through natural hazards. Geologists can and should help. One avenue? The Peace Corps.

The Need

With the tools and ability to provide aid to at-risk populations, geologists also have a responsibility to assist communities in finding and managing water resources, adapting to changing climates and improving natural disaster mitigation. "Social geology" is perhaps the term to describe this effort. One example is Geólogos del Mundo (World Geologists),a European nongovernmental organization based in Spain that has worked in water resources and natural hazard mitigation in Latin America and Africa for 11 years. The program has also recently expanded into Southeast Asia. Two years ago, the Society of Exploration Geophysicists Foundation initiated Geoscientists Without Borders, whose projects focus on using geophysics and satellite-based remote sensing to ameliorate problems caused by water scarcity and earthquakes.

Michigan Tech's Peace Corps Master's International program in geosciences, with a focus on geohazards, is one way for geoscientists to utilize and enhance their training in the developing world.

More than 50 universities currently offer Peace Corps Master's International programs in different disciplines, but only Michigan Tech offers a geosciences-focused program. Peace Corps Master's International started in 1987; master's students in any field can apply to and serve in the Peace Corps

"I like the program because it has allowed me to spend two years in the field, gaining experience within both the scientific and social aspects of volcanic hazard mitigation," says Jemile Erdem, a Peace Corps Master's International student soon to finish her service in Guatemala. To others considering this program, she offers, "I would recommend this program to students who have an interest in creating bridges between the scientific community and the public, and who have the ability to work independently on their master's research." Lara Kapelanczyk, another Peace Corps Master's International student, adds, "and also who aren't afraid to take really cold bucket baths on a regular basis!"

Both courtesy of Julie Herrick

as part of their master's program. At Michigan Tech, Bill Rose, a volcanologist, started the program in 2005. Several other faculty members also advise the master's students in a range of topics from volcanic gas emissions to groundwater research.

So far, Michigan Tech has graduated five Peace Corps Master's International students. Nine more students are currently serving in Latin America and Africa; three others have completed their service and are in the middle of thesis writing; and four are awaiting placement in the Peace Corps. "The Peace Corps association gives students an intense field experience that includes a strong social component, which grounds and guides our whole graduate research," Rose says.

Left: Peace Corps Master's International student Rob Hegemann and Moises Guillen, of the NGO Partners of the Americas, pose near a rope-pump well used in a groundwater study. Right: Rob Hegemann takes well water quality measurements with the help of a local Nicaraguan near Boaco, Nicaragua.

The Program

Typically it takes students three and a half years, including their Peace Corps service, to complete a master's under the Peace Corps Master's International program. An academic year of coursework prepares them for their research and their service as a Peace Corps volunteer. Students must define, design and carry out their research over the 27 months while they are serving in the Peace Corps — worlds away from their university and advisors. Upon finishing their service, the students return to campus for at least one semester to write and defend their thesis.

With field sites located thousands of kilometers from campus, the students must rely upon their own knowledge, problem-solving skills, adaptability and self-motivation. The added challenges of working independently in a foreign social and cultural context ultimately create a confident, culturally aware scientist with a grounded perspective of the complexities surrounding cross-cultural hazard mitigation and resource management.

Students may choose either a scientific investigation that contributes to the body of geologic knowledge, like a traditional master's project, or may tackle a practical problem that the people in the field location are facing. The decision is usually made while in the field, with many factors influencing the formulation of a student's research topic: the level of in-country support, community priorities and interest, volunteer interest and language capability, and accessibility to tools, land, maps and materials. In every case, aligning the right combination of variables requires patience and persistence.

"This program is challenging — it's difficult to find a research project in conjunction with Peace Corps service, but taking on that challenge makes it even more meaningful," says Rob Hegemann, a Peace Corps Master's International student a year into his service in Honduras, where he is focusing on water quality. "I want to make a difference in my community and hope that my research will benefit the community members."

So far, the Peace Corps Master's International students at Michigan Tech have developed projects through collaborations with governmental agencies (such as the equivalent of the U.S. Geological Survey) and non-governmental organizations. These collaborations enhance

Peace Corps Master's International student Karinne Knutsen and her dog take a break during rock sample collection for her research of Yeguada volcanic complex in Panama.

Peace Corps Master's International student Hans Lechner takes a fumerole temperature reading at Volcán Izalco in El Salvador.

Clockwise from bottom left: E. Gutierrez; courtesy of Rob Hegemann; courtesy of Essa Gross; courtesy of Karinne Knutsen

Peace Corps Master's International students (l-r) Julie Herrick and Karinne Knutsen and advisor Bill Rose (far right), examine a truncated andesite lava flow off the east side of Volcán Baru in Panama.

Peace Corps Master's International student Jesse Silverman and several locals plant citaria grass to act as a live erosion barrier in his community of Tectitán, Guatemala.

[Left: courtesy of Jesse Silverman; right: courtesy of Julie Herrick]

the potential for their work to directly aid in-country agencies. Additionally, Bill Rose's long history with the Central American institutions that work in volcanic hazards provides a valuable network for many students studying volcanic processes and natural hazard mitigation in that region.

Statistically speaking, the program's numbers are encouraging. Since the beginning of the program, about four Peace Corps Master's International students have become Peace Corps volunteers each year and, on average, three have completed their service. In general, about 89 percent of Peace Corps volunteers finish their service. In this program, students who have terminated their Peace Corps service early have been able to adjust their research project and complete a traditional master's degree. Of the program's students to date, half are female.

Twenty-seven months of Peace Corps service more than doubles the typical time it takes to obtain a master's degree through a conventional program. But from a purely research perspective, the extended field deployment provides the ability to collect data and make observations well beyond what is feasible in typical field studies. As a resident of a field site, Peace Corps Master's International students have the luxury of studying phenomena continuously in a manner that allows them to better observe seasonal effects or sporadic events — important for collecting data from multiple volcanic eruptions, for example.

Regardless of the research benefits that the program offers, however, Peace Corps Master's International students agree that one really must want to be a Peace Corps volunteer first and foremost to succeed in the program. Understandably, this type of program appeals to a particular type of student: one who is independent, resourceful, adventurous, persistent and patient. Most importantly, the student must accept the ambiguity surrounding virtually everything — from things as simple as an unfamiliar facial expression to accepting the months of uncertainty waiting for a thesis project to evolve. With academic research always simmering in the back of the mind, the student must first master the language, get comfortable with cultural norms and create a professional support network. Only then will the student be able to decide how the research will best serve the community. But whatever they choose, their service will last a lifetime.

Gross is a graduate of the Peace Corps Master's International program in the Department of Geological & Mining Engineering & Sciences at Michigan Technological University in Houghton. She now supports the program operations as a member of the Michigan Tech research staff. E-mail: elgross@mtu.edu. **She thanks John S. Gierke, William I. Rose and John J. Lyons (all at Michigan Tech) for their help with the story. Funding for the project was initially supported by a National Science Foundation SGER grant (NSF-EAR-0451447) , and currently from a Partnerships in International Research and Education award (NSF - PIRE 0530109) that is centered on advancing scientific understanding of natural hazards using remote sensing techniques in Latin America (geo.mtu.edu/rs4hazards).**

Volcanism in Guatemala with John Lyons

During John Lyons' service in Guatemala, he lived at the volcano observatory on Fuego, one of Central America's most active volcanoes whose most recent ongoing eruptive phase began in 2002. He worked closely with volcanologists at the Guatemalan National Institute of Seismology, Volcanology, Meteorology and Hydrology, and focused on characterizing Fuego's different styles of eruptive behavior. During the entirety of his Peace Corps service, his goal was to build a catalog of eruptive activity from direct, almost daily, observations and records of the resident volcano observers and other volunteers living near the volcano. He also led two month-long field campaigns to record various stages of the ongoing activity with a high-resolution seismo-acoustic network.

Now back on campus, Lyons is using his catalog and geophysical data to decipher the critical signals produced by the volcano during an eruption. Using those data, he will then model the system to determine the best way to monitor future activity. His 27 months in Guatemala were essential to integrate his findings with the monitoring methods used by Guatemalan scientists. He is now continuing as a doctoral candidate at Michigan Tech, using data he collected while in service and from subsequent field campaigns in his dissertation research.

Guatemalan teachers and Peace Corps volunteer John Lyons in front of an active lava flow during a field trip to the Pacaya volcano to observe the activity and discuss volcanic hazards prior to teaching K-6th graders about volcanic activity and hazards.

Peace Corps volunteer John Lyons conducting gas monitoring on Fuego volcano with a mini-DOAS instrument. Pacaya and Agua volcanoes are visible in the background.

Both courtesy of John Lyons

Above: Peace Corps volunteer John Lyons (MTU), Alex Gerst (University of Hamburg, Germany), and Richard Sanders (New Mexico Tech) observe an explosion of Santiaguito volcano with Doppler radar and thermal cameras as part of a field expedition conducted in 2007.

Above: Peace Corps Master's International John Lyons and local Guatemalan counterparts at the Fuego volcano observatory beginning the process of learning how to use a computer to record daily volcanic and meteorological activity.

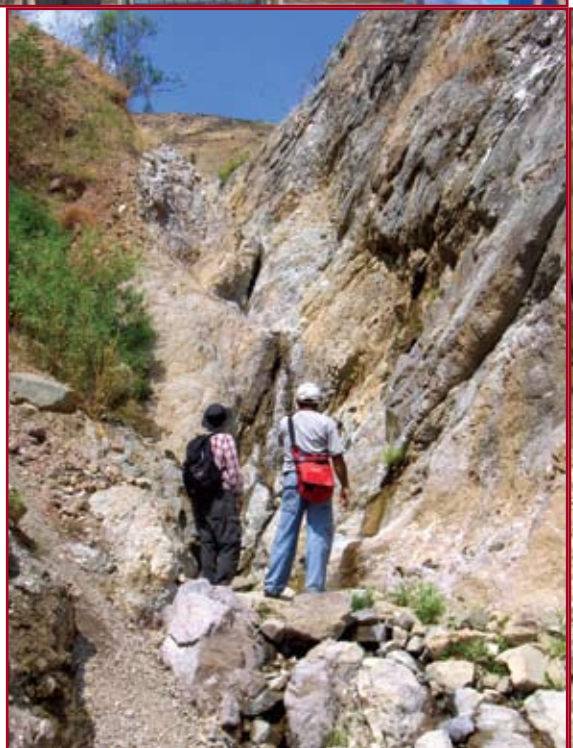
Below: Guatemalan scientists (INSIVUMEH) and Peace Corps Master's International John Lyons conducting gas emission measurements at Fuego volcano as part of routine volcanic activity monitoring.

Below: Guatemalan teachers and Peace Corps volunteer John Lyons conducting a workshop on earthquakes prior to teaching students about earthquakes and conducting the first school-wide earthquake drill in several local schools around Fuego volcano.

All courtesy of John Lyons

York Lewis, Peace Corps Master's International student, takes a breather during a fieldwork.

Peace Corps Master's International student, York Lewis works with local students on creating a world map mural.



Peace Corps Master's International student, York Lewis, with geologist Walter Hernandez of SNET, investigate a landslide near Antigua Ocotepeque, Honduras.

Landslides in El Salvador with York Lewis

York Lewis worked in El Salvador for nearly three years, extending his service beyond the standard period to collect more data for his research. He partnered with the Salvadorian National Service of Earth Studies (SNET), where he learned that they felt they did not understand enough about landslides that had occurred in the Central American Highlands over the past 50 years. They feared more landslides could occur in that region, caused by heavy rainfall and/or earthquakes, putting the area's population and infrastructure in jeopardy. So he undertook a study to determine the environmental factors that have led to slope failure in the region.

Identification of these characteristics improves geologists' ability to make accurate landslide risk assessments, which in turn, enhances governmental institutions' efforts to develop successful hazard prevention programs. Extensive fieldwork, always accompanied by colleagues from SNET, enabled him to map several recent landslides, measure bedrock fracture patterns and sample the soils for geotechnical analysis. Lewis recently graduated from the program, and a translated copy of his work will be presented to the Salvadorian institution.

All courtesy of York Lewis

Watershed Protection in Nicaragua with Essa Gross

At left, technicians and local residents of a small watershed take a streamflow measurement during the height of the dry season. At right, ENACAL engineers and technicians perform a pumping test in one of the wells used in Peace Corps Master's International student Essa Gross's study.

Essa Gross developed her research project after working alongside agricultural extension technicians in Juigalpa, Nicaragua. As part of a national directive to complete watershed protection plans, the local technicians were tasked with completing a water resource inventory in a nearby watershed with the aid of the Dutch nongovernmental organization SNV. Surface water was relatively scarce and flow could easily be measured by volumetric analysis. Information on groundwater, however, remained elusive because no economically viable method existed to perform regional-scale well productivity measurements in wells. Over the course of a year, Gross developed and tested a new method in several wells and determined the impact of naturally occurring seasonal water table fluctuations on well productivity.

Dissemination of the pumping test method to other technicians across the country has proven to be one of the most challenging aspects of the work. Recent changes in the government and subsequent personnel changes in federally funded institutions have meant that many of Gross' counterparts have had to find work elsewhere. More often than not in many of the developing countries in which Peace Corps volunteers work, whenever an election places a new party in office, an overhaul of all governmental personnel occurs. For unrelated reasons, SNV decided to focus on other sectors and discontinued funding water development programs. Despite these disappointments, Gross submitted her findings to a journal specializing in developing-world water and sanitation technologies and policy and plans to develop a field manual.

The pipian squash was one of the products of a school garden that Peace Corps Master's International student Essa Gross and students from the school of Quebrantadero created. Unfortunately, this along with six others, were stolen during the night before harvesting them.

Peace Corps Master's International student Essa Gross and Dr. John Gierke, work with locals to perform a pumping test in Santa Rita, Nicaragua.

Bottom photo by N. Roots; top three courtesy of Essa Gross