



US and Mexican students at a high-accuracy precipitation gauge site within a high elevation oak savanna ecosystem in northern Sonora, Mexico. The three students (Luis Méndez-Barroso, Tonantzin Tarín, and Lorena Liuzzo) were dynamically calibrating the syphoning, tipping bucket rain gauge (while overlooking the mountainous landscape).

## EES Students Participate in International Field Experiment to Study North American Monsoon in Sonora, Mexico

*By Enrique Vivoni, Assistant Professor of Hydrology*

Every fall, millions of students throughout the US are typically asked: “What did you do during

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your summer vacation?” A group of undergraduate and graduate students in the Department of Earth & Environmental Science have a very unique answer to this recurring question—they spent nearly three weeks in Sonora, Mexico, as part of a large international field campaign to study the North American Monsoon. The students—Alexis Martinez (BS in Environmental Engineering), Whitney DeFoor (BS in Environmental Science), and Luis Méndez-Barroso (MS in Hydrology)—helped plan, organize, and carry out a series of ecohydrological experiments in a remote, mountainous region in northern Sonora. In addition, several EES researchers participated in the field campaign, including Lorena Liuzzo and Luca Martini (visiting students), Soni Yatheendradas (post-doctoral research associate), and Assistant Professor Enrique R. Vivoni.

The North American Monsoon (NAM) is a regional atmospheric phenomenon that controls hydrological and ecological conditions during the summer season in the southwestern United States and northwestern Mexico. Given its regional extent, ecohydrological studies of the North American Monsoon require coordinated research efforts between US and Mexican scientists. New Mexico Tech’s EES Department is playing a key role in these bi-national studies through several projects sponsored by the National Science Foundation and the National Oceanographic and Atmospheric Administration. These efforts have been carried out in close collaboration with scientists from the Universidad de Sonora, Instituto Tecnológico de Sonora, University of Arizona, University of New Mexico, and the National Center of Atmospheric Research. All together, twenty-one students and researchers from US and Mexico participated this year in the Sonora Field Campaign, engaging in scientific and cultural exchanges.

“What exactly were you doing in Sonora?” is a typical question the EES participants have fielded upon their return. Field activities for this year’s summer campaign were quite varied and ranged from the deployment and calibration of a high-density rain gauge network in a mountain basin (see cover photo) to the characterization of evapotranspiration, soil moisture content, and soil properties around a meteorological flux tower (see photo page 3).



**US and Mexican students and researchers dig a soil pit near an eddy covariance tower at a low-elevation subtropical scrub ecosystem in northern Sonora, Mexico. The students (Luca Martini and Javier Navarro), post-doctoral research associate (Enrico Yopez), and Assistant Prof. Juan Saiz Hernandez effectively sampled the pit for subsequent analysis.**

US and Mexican students conducted intensive field measurements, instrument deployments and testing, and sampling of water, plants, soils, and air for isotopic and chemical analyses. These activities were carried out to understand the role that the land surface (including soils, topography, and vegetation) may play on the monsoon, in terms of energy and water exchanges at the land–atmosphere interface. Moreover, the experiments were designed specifically to help parameterize and test numerical models of hydrologic, ecologic, and atmospheric processes in the region.

Our EES students were responsible, in large part, for the success of the Sonora

Field Campaign. For example, Alexis Martinez spent a lot of her time and effort in the design, deployment and calibration of a high-density rain gauge network in the Sierra Los Locos basin, a mountain watershed approximately 100 km<sup>2</sup> in size. The twenty rain gauge locations sample an elevation gradient from 600 to 1600 masl over a diverse set of ecosystems ranging from desert scrub to oak savanna. Whitney DeFoor was heavily involved in the sampling of air, tree leaves, and soil around an eddy covariance tower in order to determine, through isotopic methods, how total evapotranspiration is partitioned into soil evaporation and plant transpiration. This activity will be related to the various

measurements in the tower, including water vapor and CO<sub>2</sub> profiles, as well as soil surface characterization in the tower footprint. As a Jack-of-all trades, Luis Méndez-Barroso was essential in the field campaign, leading several activities and organizing students and researchers alike. His work in the design and deployment of vegetation transects, the rain gauge network, and soil characterization through pits and surface samples will provide critical data sets for remote sensing analysis and hydrological modeling currently underway in this region.

In addition to the contributions of our EES students to the research efforts, a major part of the activities revolved around the binational cultural exchange among student and researcher participants. Many of the memories forged between US and Mexican students resulted from closely working together in the field, from our late-night discussions and research presentations, and from spending several weeks together in a remote, mountainous region. The very active hydrological cycle during the summer monsoon also provided first-hand field experience for our students. On many days, students were able to witness the formation of mountain convection and rainfall, the greening of the landscape in response to recent rains, and the flooding of small and large ephemeral channels during the monsoon season. These observations, in coordination with the experiments, helped participants to appreciate the complexity of this system.

Our current efforts will continue for the summer 2008, with a new set of experiments (and EES students!) tailored to address questions emanating from remote sensing, modeling, and data analysis activities. We hope this work positions New Mexico Tech for a larger set of multi-year, multi-institutional experiments spanning the North American Monsoon climate gradient (from Sinaloa, Mexico, to Colorado, US). More information on the Sonora Field Campaigns, including the experimental design, maps of the region, and data sets resulting from the field activities, can be found at [www.ees.nmt.edu/vivoni/sonora/www/](http://www.ees.nmt.edu/vivoni/sonora/www/) or by contacting Prof. Enrique Vivoni at [vivoni@nmt.edu](mailto:vivoni@nmt.edu).



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## Note from the Chair

The fall semester has begun and this year is more exciting (and stressful!) than any in recent memory. We are implementing the new undergraduate curriculum we developed over the past two years, with the result that most faculty are teaching new courses or greatly revamping established courses. Our motivation is to provide a more interdisciplinary experience for our undergraduates and to improve their problem-solving skills, while giving them more flexibility in tailoring their specific degree programs. Helping us in this effort are our two new geophysics faculty members. Cathy Snelson comes to us from the University of Nevada where as an assistant professor she developed a strong program in active-source seismology and petroleum exploration. Jeff Johnson will arrive in January 2008 from his post-doc at the University of New Hampshire, where he has investigated applications of infrasound in characterizing volcanic activity. We will be interviewing candidates this fall for our open position in hydrology. With that position filled we will have 22 tenure-track faculty, the largest we've been since the formation of our department in the 1950s.

Rick Aster was elected associate chair last January and will take over as department chair in July 2008. Both Rick and I, along with the rest of the faculty, hope to see many of you at the GSA and AGU meetings this fall. In the meantime, keep in touch.