



New Mexico Tech Grad Student Set To Model Rio Puerco Basin

New Mexico Tech graduate student Robert Wyckoff has begun an extensive study of west-central New Mexico's Rio Puerco watershed that will use current data and computer models to better understand the shifting relationships between rainfall and runoff when considering variables such as climate, land use, and surface alterations.

"Semi-arid catchments in New Mexico, such as the Rio Puerco Basin, are susceptible to fluctuations in precipitation, occurring at time scales ranging from annual to daily amounts," Wyckoff explains.

"These rainfall variations in regions of low-water availability can result in dramatic shifts in basin hydrologic response, channel erosion, and vegetation distribution," he says.

Other studies have shown that ecological, hydrological, and land alterations at watershed surfaces are intertwined to varying degrees depending on the amount of available rainfall in the area.

"In this study, which is still in the preliminary stages, we plan to investigate the hydrological dynamics associated with an observed increase in precipitation within the Rio Puerco watershed within the last 50 years," Wyckoff says.

Wyckoff and his research colleagues will begin by using a computer model employing soil, topography, land-use, and rainfall data to simulate evapotranspiration, runoff, and recharge in the basin.

"The Rio Puerco watershed and the corresponding stream network have been delineated using a basic Geographic Information Systems tool package, in conjunction with elevation

data provided by the United States Geological Survey," he says.

In addition, he has completed an investigation of the relationship between two climate indices and stream discharges at various gauges within the Rio Puerco Basin.

"We are also currently gathering radar, rain gauge, soils, land-use, stream discharge, elevation, and well data required to analyze a specific Rio Puerco flood event," Wyckoff adds.

Computer simulations will be conducted in the course of the study using the triangular irregular network (TIN) based Real-time Integrated Basin Simulator, which was developed at MIT.

A TIN provides an accurate approximation of elevation, while simultaneously reducing the computations required to quantify the rainfall-runoff mechanisms for a given watershed.

"However, prior to performing model runs, parameters describing hydrometeorological, soil, and energy conditions must be established," Wyckoff says. "Once calibrated, various model combinations will be performed in an effort to describe climatic and land-use efforts on stream discharge in the Rio Puerco Basin."

Wyckoff's research project, *Climate, Land-use Change, and Hydrologic Response—Modeling the Rio Puerco Basin*, is funded in part by a research grant from the New Mexico Water Resources Research Institute, and is being conducted under the direction of his faculty advisor, Enrique Vivoni, associate professor of hydrology at New Mexico Tech.

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Hydrometeorological and Hydrological Studies in the Rio Puerco



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Photos by Enrique Vivoni



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