University of Utah
UNDERGRADUATE RESEARCH JOURNAL

VALIDATION OF DYNAMICALLY DOWNSCALED PRECIPITATION OVER NAVAJO NATION

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Forests are susceptible to being threatened by changes in climate conditions including precipitation and drivers of evapotranspiration including temperature. About a third of the global population relies on forests to provide heating and cooking fuel and in total, their economic livelihood. Changes in climate have been associated with changes in phenology (the timing of seasonal events in the life cycle of plants and animals) and changes in the frequency, extent, duration, and severity of fires and outbreaks of forest pathogens (Fleishman et al., 2013). Understanding is limited on how the future trajectory of climate in the Southwest region will affect pinon-juniper woodlands, and how human harvesting will interact with these changes. Degradation of this important ecosystem would harm wildlife and human life in the surrounding areas. This project focuses on residents of the Navajo Nation in the Southwestern U.S., who rely on pinon-juniper woodlands for fuel and economic enrichment. These woodlands are threatened by the impacts of climate change as well as overexploitation, both of which alter the dynamics structuring ecosystem health. Analyzing the dynamics and future of this coupled human-natural system requires detailed and validated simulation of climate (Figure 1). This project thus focuses on historical validation of high-resolution climate modeling performed for the Navajo Nation by Professors Court Strong and Adam Kochanski.

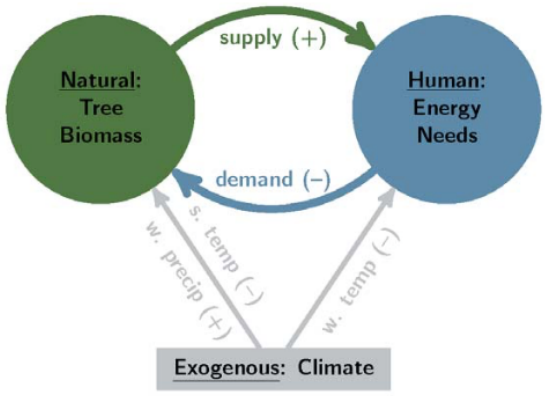

Figure 1. Simplified diagram of the coupled human-natural system. Natural system dynamics are structured primarily by climate gradients. Human system dynamics are driven by access to fossil fuels. Both systems are affected by exogenous climate (s. and w. indicate summer and winter, respectively). The human and natural components are coupled by supply and demand.

The simulation data I worked with were hourly, 4-km resolution NetCDF output from the Weather Research & Forecasting (WRF) model. I focused primarily on precipitation. All of this work was done through the program MATLAB. For validation I used a recently assembled and published proprietary monthly precipitation data set collected by the Navajo Nation. The locations and types of measurements in the Navajo Nation data set are shown in Figure 2.

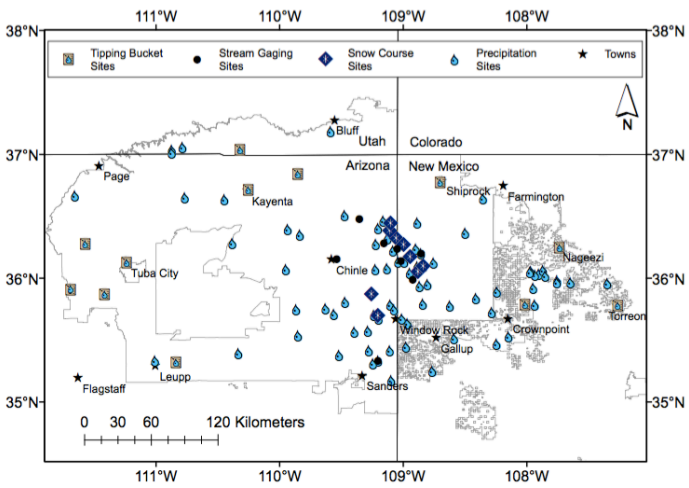

Figure 2. Navajo Nation Water Management Branch's Water Monitoring and Inventory Section hydrometeorological sites, including 90 rain gages, 12 tipping buckets, 8 snow courses, and 8 stream gauges.