Climate and Land-cover Change Impacts on Stream Flow in the Southwest U.S.

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Abstract. Vegetation change in arid and semi-arid climatic regions of the American West are a primary concern in sustaining key ecosystem services such as clean, reliable water sources for multiple uses. Land cover and climate change impacts on stream flow were investigated in a southeast Arizona and northeast Sonora, Mexico watershed. Using AGWA/SWAT hydrological models in combination with land cover change measurements derived from satellite remote sensing, we investigated the relationships among climate, land use, and stream flow. To gain an historic perspective on climate change and its impact on stream flow in this watershed over time, we used the site specific Bryson Macrophysical climate model to model climate, calibrated to 1961-1990 climate normals; and stream flow calibrated to USGS gauge data, for the Holocene at a 100-yr resolution. Measured stream-flow values collected from the Redington stream gauge (1985-1995) were used to calibrate the Bryson Macroclimate Model stream flow for the site. Landscape composition and pattern metrics were generated from the digital land cover maps derived from the Landsat earth observing satellites and compared over ~25-years (1973-1997).

The relation of stream flow with urban, mesquite cover, and rainfall was analyzed identifying stages of changes in land cover to be linked to either anthropogenic or climate causes. The process demonstrates a simple procedure to document changes and determine ecosystem vulnerabilities through the use of change detection and hydrological process modeling, especially in regard to human-induced degradation processes and natural phenomena that have occurred throughout the western rangelands.

Keywords: climate variation, hydrological process modeling, landscape characterization, ecosystem services, San Pedro River, Macrophysical climate model.