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Sustainability and Vulnerability of Semi-Arid Mountain Island Forest in an Atmosphere of Changing Climate

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Hydro-micrometeorological observations made within a mountain Island forested ecosystem in the semi-arid southwestern U.S. established that the type of ecosystems, as represented by the Mt Bigelow site in the Santa Catalina Mountain Ranges, NE of Tucson Arizona, respond to an annual wet-dry cycle instead of a hot-cold (summer-winter) cycle typical of other more temperate/western upland forest ecosystems. Flux measurements from an above canopy tower shows that the ecosystem responds instantaneously and aggressively to the moisture conditions of the synoptic weather systems, and will turn off photosynthetic processes during the (Arizona) pre-monsoon (spring-early summer) period when soil moisture goes below ˜10%. Conversely the trees remain turned on throughout the winter, providing there is adequate precipitation input particularly in the form of snow. The hydro-meteorological condition experienced by this ecosystem is becoming increasingly more frequent in the more expansive sub-alpine forests to the north and northeast of the region as the southwestern climate experience greater and more extreme variability.

Over the past four years, a combination of widespread mountain island forest fires and extreme drought conditions have called into question the vulnerability and sustainability of this ecosystem, particularly in the face of the changing climate. Biophysical data from MODIS coupled with hydro-micrometeorological, and biogeochemical observations is used to analyze the vulnerability of this ecosystem and is used to make projections on the sustainability of the Mountain Island Forest. There has been a steady decrease in the LAI of mountain Island forested pixels since 2001, and a drastic annual

reduction in FPAR for approximately 2 months prior to the onset of the monsoon season. This presentation will explore the vulnerability of theses systems and the impact of its future sustainability on the carbon and water resources on the region.