

Declining Vegetation Indices in the Upper San Pedro: Climate change or Ground water Pumping?

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Introduction:

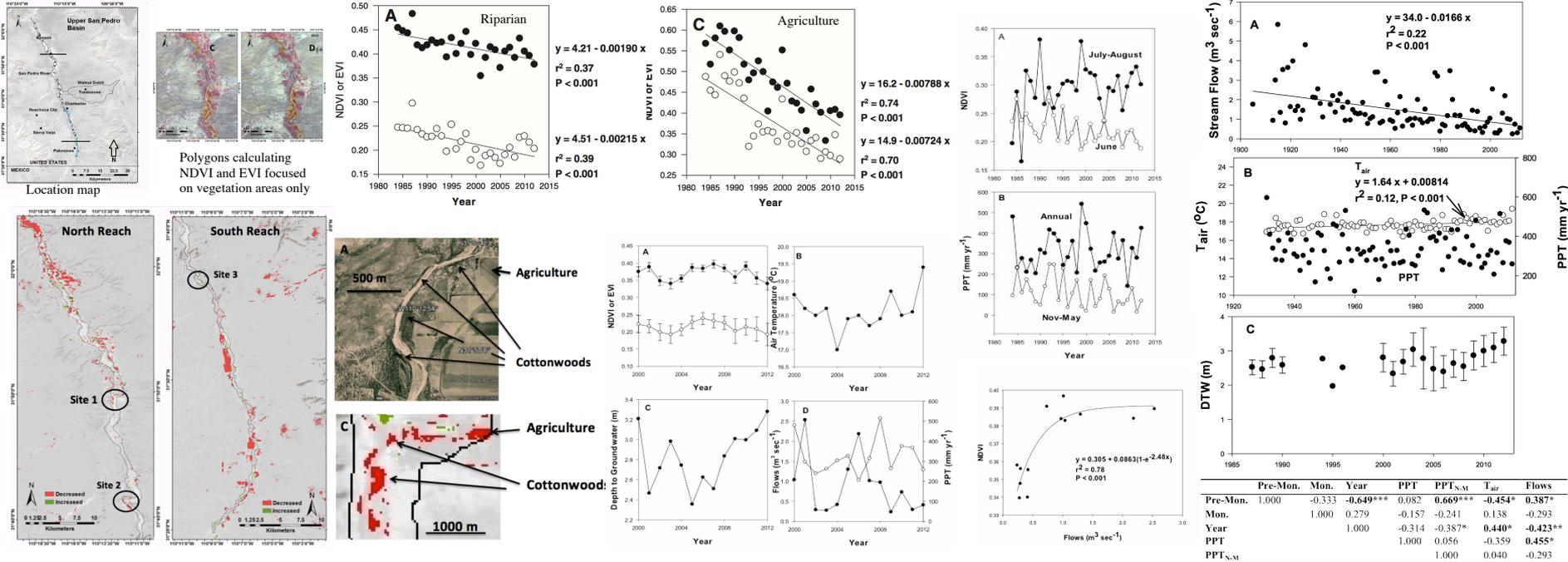
The Upper San Pedro River is one of the few remaining undammed rivers that maintain a vibrant riparian ecosystem in the southwest United States. The riparian forest is threatened by diminishing groundwater and surface water inputs, due to either changes in watershed characteristics such as changes in riparian and upland vegetation, or human activities such as regional groundwater pumping.

Materials and Methods:

- Satellite vegetation indices quantified from Landsat (30m) 1984-2012 and MODIS (250m) composite 2000-2012
 - Depth to Water Table (DWT), Flows :USGS Charleston station, Temperature, Precipitation :Tombstone NOAA Cooperative Station

Results:

The river was divided into a southern, upstream (mainly perennial flow) reach and a northern, downstream (mainly intermittent and ephemeral flow) reach. Pre-monsoon (June) Landsat normalized difference vegetation index (NDVI) values showed a 20% drop for the northern reach ($P < 0.001$) and no net change for the southern reach ($P > 0.05$). NDVI and enhanced vegetation index values were positively correlated ($P < 0.05$) with river flows, which decreased over the study period in the northern reach, and negatively correlated ($P < 0.05$) with air temperatures in both reaches, which have increased by 1.4 °C from 1932 to 2012.



Conclusions:

Climate change, regional groundwater pumping, changes in the intensity of monsoon rain events and lack of overbank flooding are feasible explanations for deterioration of the riparian forest in the northern reach.

References:

Nguyen U., Glenn E.P., Nagler P.L., Scott R.L. 2014. Long-term decrease in satellite vegetation indices in response to environmental variables in an iconic desert riparian ecosystem: the Upper San Pedro, Arizona, United States. *Ecohydrology* (on-line first) DOI: 10.1002/eco.1529.