

ACTIONABLE SCIENCE

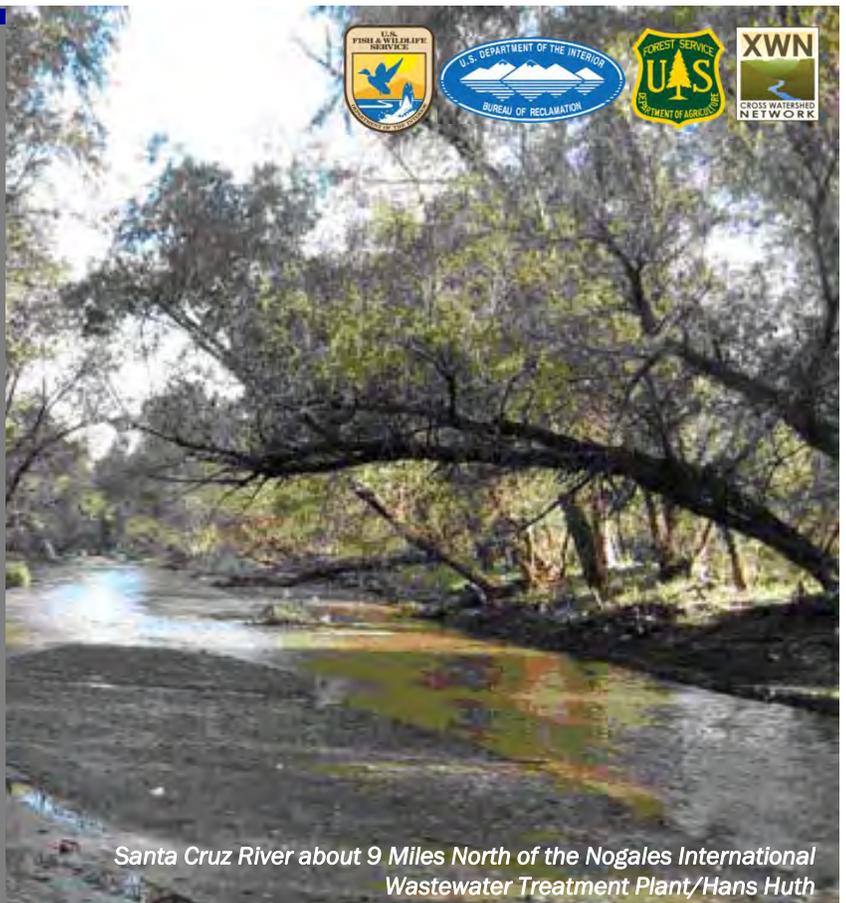
Climate and Land Cover Change Ecosystem Services Analysis: The Santa Cruz Watershed Ecosystem Portfolio Model



The Santa Cruz Watershed (SCW) is located in the Arizona-Sonora portion of the US-Mexico border. In 2010, researchers with the USGS and the EPA began an effort to create a map-based multicriteria evaluation tool for ecosystem services in the SCW. The Santa Cruz Watershed Ecosystem Portfolio Model (SCWEPM) incorporates a series of submodels about biophysical and socioeconomic factors that can be used across jurisdictions to visualize impacts in shared watersheds with a diverse group of stakeholders and inform adaptive management of resources.



Project Location



Santa Cruz River about 9 Miles North of the Nogales International Wastewater Treatment Plant/Hans Huth



KEY ISSUES ADDRESSED

Urban expansion, intensified agriculture, resource extraction, and over-allocated water resources have impacted the people, economy, and natural resources of the SCW significantly. These land cover changes have led to habitat fragmentation and impaired ecosystem integrity, directly driving changes in ecosystem services. Ecosystem services are benefits provided by nature that benefit households, communities, and economies. Changes in climate and land use patterns will continue to impact ecosystem services. Assessing future impacts to ecosystem services in the Santa Cruz Watershed is essential to making informed land-use planning and policy decisions.

PROJECT GOALS

- Work with stakeholders to identify ecosystem services that contribute to physical, biological, and social qualities and resilience of the SCW
- Develop interacting submodels with natural and social scientific information in a framework that recognizes a diversity of values
- Integrate submodels into SCWEPM to demonstrate the effect of land-use and climate changes on ecosystem services that can be used to support decision-making and management objectives

VISUALIZING IMPACTS

The SCWEPM allows users to visualize impacts of natural phenomena and management practices in reference to the location of cultural resources, scenic attractions, water availability, and natural areas.



Housing Developments in the Santa Cruz Watershed near Nogales/William Page

PROJECT HIGHLIGHTS

Dynamically Interacting Submodels: There are three submodels within the SCWEPM, –the Ecological Value Submodel, the Human Well-being Submodel, and the Market Land-Price Submodel–each with various subsets of input data.

Ecosystem Service Value Maps: Value maps are generated by the SCWEPM as a result of interacting submodels and user-specified weighted values for environmental criteria. These models can be run under a suite of climate and population change and impact scenarios to show how changes in land cover will affect ecosystem services over time.

Application to Inform International Policy: The SCWEPM can help provide a scientific rationale to inform international water management decisions. Results from 5 scenarios of instream surface water based on discharge from the Nogales International Water Treatment Plant suggested that policies to maintain the riparian corridor via managed effluent for instream flows, can support biodiversity and provide economic benefits to homeowners in Santa Cruz County, improving regional economics and quality of life.

Collaborators

- U.S. Environmental Protection Agency
- USGS Land Change Science (LCS) Program
- The University of Arizona

Funding Partners

- USGS Land Change Science (LCS) Program
- U.S. Environmental Protection Agency
- U.S. Geological Survey

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Photos courtesy of USGS

LESSONS LEARNED

The aggregation of data across jurisdictional and international boundaries is especially difficult when there are multiple resolutions and classification schemes, not to mention languages.

Especially in regards to increasingly controversial subjects like water management in arid lands, using an ecosystem services approach to examine ecological, economic, and societal effects on human well-being can encourage cross-culture collaboration. It is hoped that continued advancement of interdisciplinary ecosystem service investigations can establish a precedent for binational policy development and implementation. Further improvements to the SCWEPM should incorporate measures of environmental quality and human health, specifically to examine if people living in socio-environmentally vulnerable neighborhoods were impacted by their lack of access to ecosystem services.

NEXT STEPS

- Use ecosystem service quantification information from SCWEPM to motivate policy decisions regarding management of water resources, quality of life, real estate, and habitat availability
- Further examine agricultural and eco-tourism dollars to better inform the cost-benefit analysis of some of the other ecosystem services findings (water provisioning, etc.)

PROJECT RESOURCES

For more information on this project, contact Laura Norman: lnorman@usgs.gov

For additional project resources and case studies, visit the Collaborative Conservation and Adaptation Strategy Toolbox: WWW.DESERTLCC.ORG/RESOURCE/CCAST



A Tributary of the Santa Cruz River/William Page