

# Southwest Ecosystem Services Project



**Nita Tallent-Halsell, Ph.D.**  
U.S. Environmental Protection Agency, ORD, NERL, Environmental Sciences Division, Landscape Ecology Branch



The U.S. EPA Office of Research and Development's Ecosystem Services Research Program (ESRP) is identifying and characterizing the services that ecosystems provide for human health and well-being – the current and future outputs of functioning, complex ecological systems that are enjoyed, consumed, or used by humans and that support their well-being. These environmental benefits include those that supply water, protect water quality, protect against floods, support wildlife habitats, sequester carbon, and provide food and fiber.

As part of this new program, research is being conducted in five representative geographic areas, including:

- The Willamette Valley, Oregon
- Tampa Bay, Florida
- The Upper Midwest,
- The coastal areas of North and South Carolina, and
- The Arid Southwest –

## The Southwest Ecosystem Services Project (SwESP)



The landscape of the Southwestern United States is highly diverse with significant portions of desert, shrub- and grasslands, forest, agriculture, and urban development each providing bundles of services that benefit humans.

This area is facing unprecedented pressures from population growth and climate change. Based on US Census data, over the past 90 years, the population in the Southwestern United States has increased 1,500%.

Changes in climate are projected to increase in the frequency and intensity of drought. The sustainability of basic ecosystem services vital to human health and well-being is becoming compromised.

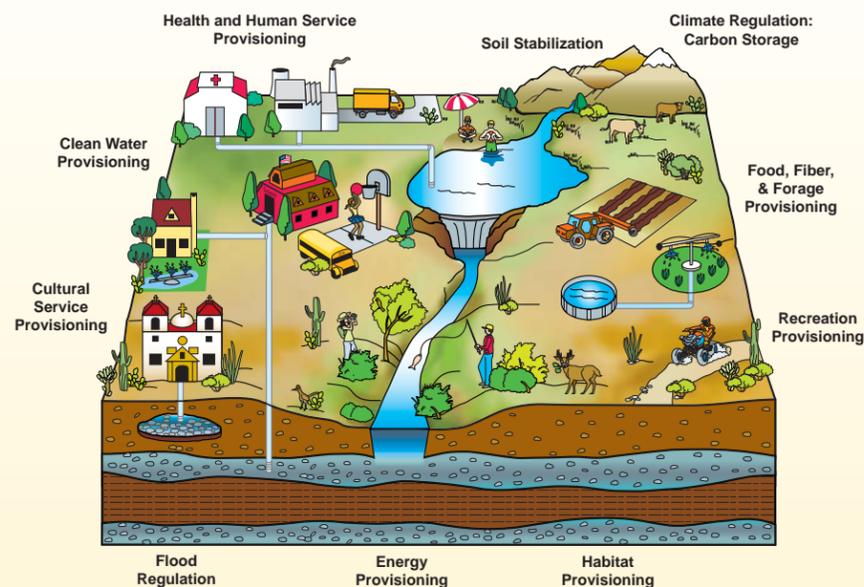
## Research Goals

Specific goals are to:

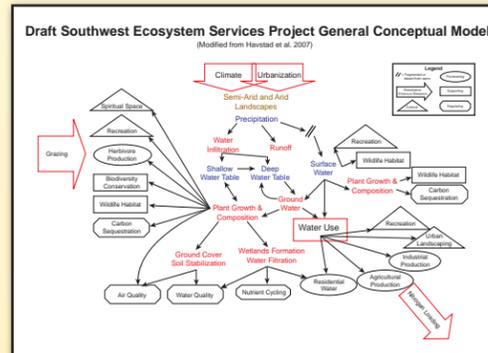
- Identify, locate, and inventory ecosystem services and establish the value of these services (i.e., Riparian Valuation Study), including the costs to society resulting from the loss of these services.
- Map the current condition of ecosystem services (e.g., provisioning of water, food, habitat, and cultural services, supporting nutrient cycling, and regulating soil erosion) using available data and tools (e.g., InVEST Tool).
- Quantify the response of ecosystem services to current and projected conditions and drivers (e.g., climate change, human development).
- Determine the linkages and trade-offs among bundles of ecosystem services in response to climate change and human development (e.g., InVEST Tool).
- Model response of ecosystem services based on alternative scenarios of land use, climate change, water availability, and human development.
- Determine how changes in ecosystem services affect human well-being.
- Develop decision support systems to help decision makers in the Southwest apply the information and methods developed by this project (i.e., Santa Cruz Ecosystem Portfolio Model).

Ultimately, these efforts will be integrated with other community-based ecosystems services projects to create a transferable suite of methods and tools for evaluating ecosystem services. Using these tools, decision makers can implement proactive policy and management decisions to conserve and enhance ecosystem services vital to human health and well-being and support sustainable planning for current and future generations.

## ECOSYSTEM SERVICES OF THE SOUTHWEST



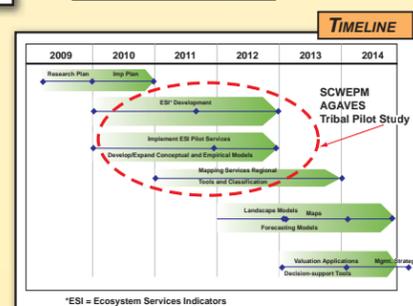
## Creating Conceptual Models of Ecosystem Service Flows and Economics



General conceptual model (draft) for the Southwest Ecosystem Services Project (SwESP). Block arrows represent disturbance drivers or stressors impacting ecosystem processes and shaped textboxes represent ecosystem services by type (see legend). The diagram traces from top to bottom the impact that climate change and/or urbanization may have on the amount and seasonality of precipitation which will directly (e.g., water infiltration and runoff) or indirectly (e.g., plant growth and composition, soil stabilization, wetland sustainability) impact other processes and/or services. Trade-offs resulting from livestock (grazing) and agriculture (nitrogen loading) production will need to be considered. This diagram has been modified from Havstad et al. 2007.

Ecosystem Services	Biophysical Supply	Value of Ecosystem Services
Clean water for human consumption	Water flow across landscape & water import across landscape	Market value of water availability
Water for irrigation		Market value of crop/agriculture production
Water for reservoirs		Market value of energy production
Water flow through run-of-river power stations		Market value of energy production
Crop / agriculture production	Crop and Agriculture Production	Market value of crop / agricultural production
Environmental quality, natural capital, amenities, fees, and tourism/recreation	Environmental quality and natural capital stock	Total consumer surplus of all visitors
Terrestrial carbon storage and sequestration	Terrestrial carbon storage and sequestration	Social benefits of avoided carbon emissions
Habitat for native fauna (wildlife, fish, and birds)	Species Richness	Market value of ecotourism, hunting, and fishing. Non market value
Cultural / aesthetic attributes of the landscape	Cultural / aesthetic attributes of the landscape	Nonmarket value

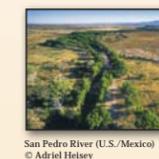
Modified from Tallis & Polasky 2009



## SUBSTUDIES & COLLABORATORS

Research will be conducted through several, integrated, multi-disciplinary, multi-agency partnerships under the SwESP umbrella:

**The Santa Cruz Watershed Ecosystem Portfolio Model Project:** EPA, USGS, and other partners, will develop a geographic information system-based decision support tool that will integrate natural science and economic information in order to conduct a cost-benefit analysis of climate change and urban growth impacts across the borders of three nations, the U.S., Mexico and the Tohono O'odham San Xavier District.



San Pedro River (U.S./Mexico)  
© Adriell Heisey



**The Assessment of Goods and Valuation of Ecosystem Services (AGAVES):** EPA, USGS, ARS, and others will conduct an ecosystem services assessment of the San Pedro River Basin and adjacent watersheds in southeastern Arizona.



**The Estuarine and Coastal Wetland Ecosystem Services of the Southwest Model Project:** A component of the nationwide Wetland ESRP, will investigate the services of southwestern estuaries and coastal wetlands and discern how they compare with other wetland types found throughout North America.

**The Native American Ecosystem Services Tribal Pilot Study** will determine how an ecosystem services assessment can be linked with traditional knowledge to improve natural resource management and to identify decision support options.

## SUGGESTED READING

- Daily GC. 1997. Nature's Service. Island Press. Washington, DC.
- Havstad, KM, DPC Peters, R Skaggs, J Brown, B Bestelmeyer, E Fredrickson, J Herrick & J Wright. 2007. Ecosystem services to and from rangelands of the western United States. Ecological Economics 64: 261-268.
- Kepler WG, DJ Semmen, M Hernandez, & D Goodrich. 2008. Evaluating hydrological response to forecasted land-use change. The North American Land Cover Summit, Association of American Geographers, Washington, DC.
- Kepler WG, DJ Semmens, SD Bassett, DA Mouat & DC Goodrich. 2004. Scenario analysis for the San Pedro River, analyzing hydrological consequences of a future environment. Environmental Monitoring and Assessment 94:115-127.
- Kepler WG, DJ Semmens, DT Heggem, EJ Evanson, CM Edmonds, SN Scott & DW Ebert. 2003. The San Pedro River Geo-Data Browser and Assessment Tools. EPA, ORD, NV EPA/600/C-03-008 and ARS/152432.
- Millennium Ecosystem Assessment. 2005. Ecosystems and Human Well-Being: Synthesis. Island Press. Washington, DC.
- Nelson E. et al. 2009. Modeling multiple ecosystem services, biodiversity conservation, commodity production, and tradeoffs at landscape scale. Available online at: [www.naturalcapitalproject.org/pubs/NelsonetalFrontiersAppendix.pdf](http://www.naturalcapitalproject.org/pubs/NelsonetalFrontiersAppendix.pdf)
- Norman LM., Hirsch DD, & Ward, AW, eds. 2008. Proceedings of a USGS Workshop on facing tomorrow's challenges along the U.S.- Mexico border; monitoring, modeling, and forecasting change within the Arizona-Sonora transboundary watersheds. U.S. Geological Survey Circular 1322.
- Steinitz C, Arias H, Bassett S, Flaxman M, Goode T, Maddock T, Mouat D, Peiser R, & Shearer A. 2003. Alternative futures for Changing Landscapes The Upper San Pedro River Basin of Arizona and Sonora. Island Press. Washington DC.
- Tallis H & Polasky S. 2009. Mapping and valuing ecosystem services as an approach for conservation and natural resource management. The Year in Ecology and Conservation Biology: Annals of the New York Academy of Sciences 1162: 265-283.
- Tallis H et al. 2008. InVEST 1.0.02 Beta User's Guide: Integrated Valuation of Ecosystem Services and Tradeoffs. Natural Capital Project.
- The National EPA-Tribal Science Council 2006. Paper on Tribal Issues Related to Tribal Traditional Lifeways, Risk Assessment, and Health & Well Being: Documenting what we've heard. <http://www.epa.gov/osp/tribes/tribal/TribalIssues.pdf>
- U.S. Environmental Protection Agency 2009. Ecosystem Services Research Program online at <http://epa.gov/ord/esrp/index.htm>

For more information contact:  
Nita Tallent-Halsell, Ph.D., U.S. EPA, tallent-halsell.nita@epa.gov