

Sustainable Agricultural Water Conservation in the Rio Grande Basin



2004-2009
Project Summary

Sul Ross State University

A Member of the Texas State University System
Alpine, Texas



This project is administered by the Rio Grande Research Center at Sul Ross State University

Overview

Since 2004, the Sustainable Agricultural Water Conservation (SAWC) research project has focused on identifying and analyzing constraints to the sustainable use of this important transboundary water system, with the goal of developing real solutions that can be effectively implemented by land managers.

The overarching concept behind the SAWC research is the advancement of a basin-wide perspective for integrated management and sustainable use of the resources of the Rio Grande Basin.

The project is funded by the United States Department of Agriculture National Institute of Food and Agriculture [NIFA] (previously Cooperative State Research, Education, and Extension Service [CSREES]). It is administered by the Rio Grande Research Center at Sul Ross State University.

Participating Organizations:

- Texas State University – San Marcos
- Sam Houston State University, Huntsville
- Lamar University, Beaumont
- Angelo State University, San Angelo
- New Mexico State University, Las Cruces Rocky Mountain Bird Observatory
- Utah State University, Logan, Utah
- University of Texas—Pan American, Edinburg
- Rio Grande Basin Initiative, Texas A&M, College Station
- Big Bend National Park, National Park Service
- United States Fish & Wildlife Service
- World Wildlife Fund
- International Boundary and Water Commission
- SEMARNAT (Secretariat of Environment and Natural Resources) and IMTA (Mexican Institute of Water Technology)

This project material is based on work supported by the United States Department of Agriculture National Institute of Food and Agriculture Program Agreement Numbers: 2004-38899-02181; 2006-38899-03586; 2008-38869-19174; and 2009-38899-20017.

Cover photo

Photo looking downstream, near Silber Canyon, September 2008 (*photo courtesy of National Park Service, Billie Brauch*).

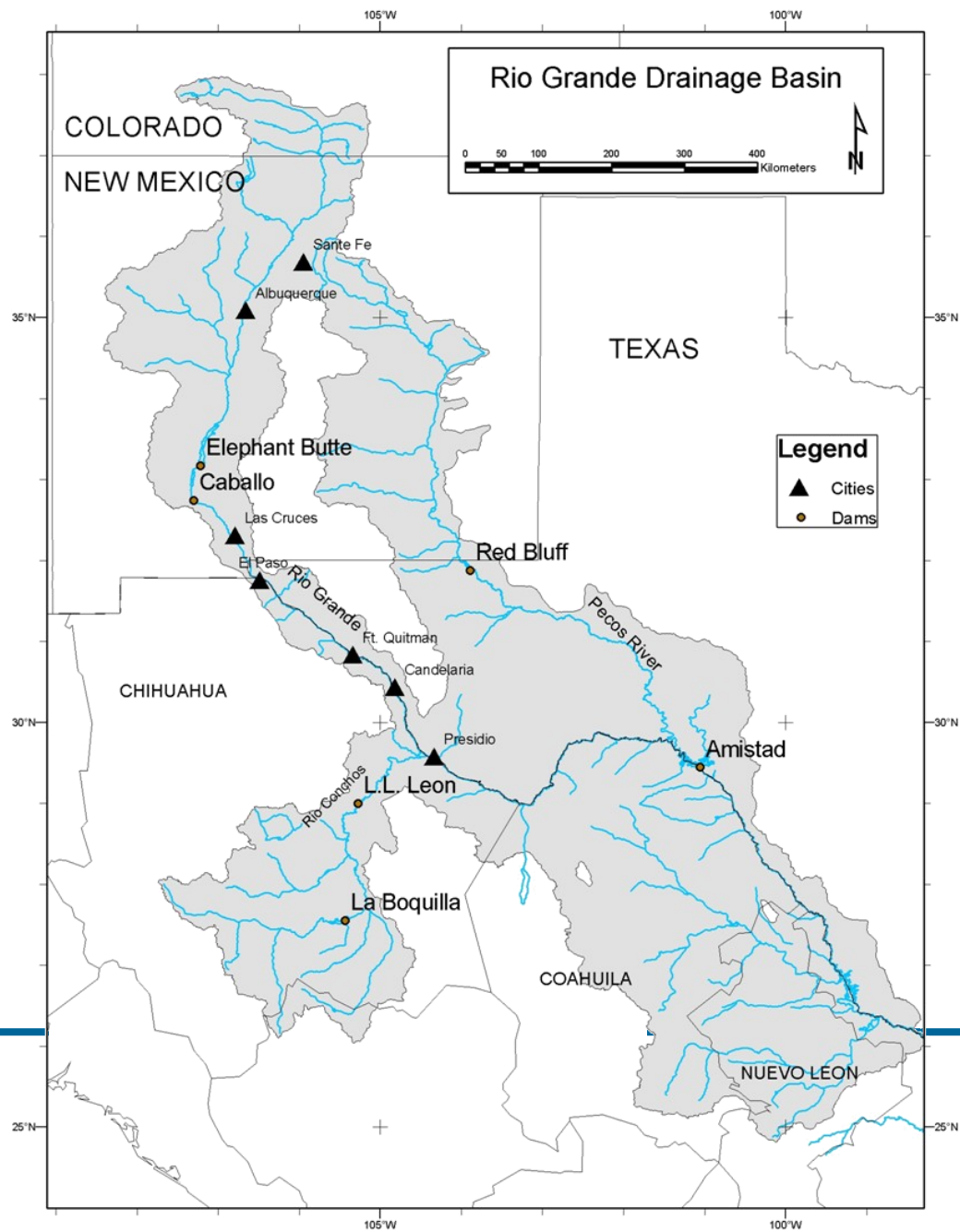
Executive Summary

The sustainable use of the Rio Grande and its transboundary resources remains an elusive goal, with significant economic and ecosystem implications for both the United States and Mexico. The magnitude and impacts of agricultural water use identify it as a major consideration in this study. Rapidly-growing urban areas, *colonias* and the proliferation of *maquiladoras* on both sides of the border further exacerbate the already-serious water scarcity in this arid region. It is evident that the current piecemeal approach to managing and allocating the scarce water resources of the Rio Grande is inadequate and self-defeating.

Utilizing the diverse expertise and skills of researchers from universities across the Texas State University System and collaborating universities, the **primary activities undertaken in this project focus on identifying and analyzing the constraints to the sustainable use of this important water system and understanding the root causes of problems within the transboundary region.** Through the results of these analyses, the project seeks to identify effective and realistic solutions to identified problems that we face in the Rio Grande Basin watershed.

A crucial tool employed in this study is the Transboundary Diagnostic Analysis outline. It is the framework for identifying research areas and integrating results of this project for the benefit of stakeholders. **The Transboundary Diagnostic Analysis provides a basis for the subsequent development of a basin-wide management-action plan.** Ongoing research activities are directed toward improved understanding of the Rio Grande and the factors affecting its sustainable use. Methods for expressing the project results in a manner that can be understood and readily-utilized by scientists, land managers, decision-makers, the public and other major Rio Grande stakeholders are a project priority. Study outcomes will facilitate workable solutions acceptable to water stakeholders on both sides of the border.

Area of Study



2004 - 2005 Projects

Award No. 2004-38899-02181

Texas State University—San Marcos

Transboundary Diagnostic Analysis Framework
Walter Rast, Ph.D.,

Creation of the Rio Grande Research Center
Andrew Sansom, B.S.,

Identification of Organizations and Institutions Doing Relevant Research; Rio Grande Basin Repository and Clearinghouse
Emily Armitano, M.A., M.S.

Development of a GIS Management Tool
F. Benjamin Zhan, Ph.D.

K-12 Education & Curriculum Development
Richard Boehm, Ph.D.

Geostationary Operational Environmental Satellites (GOES) Groundwater Monitoring
Matthew Uliana, Ph.D., P.G., Michael Jennings, P.E., P.H.

Testing Spring Discharge and Chemistry in the Trans Pecos Region
Glenn Longley, Ph.D., Craig Watts, David Flores

Amistad Reservoir Water Quality Investigations
Alan Groeger, Ph.D.

Ecological Characterization of Rio Grande Fish Assemblages
Timothy H. Bonner, Ph.D.

Mapping Saltcedar in Rio Grande Basin using Space borne Remote Sensing
Le Wang, Ph.D.

Sul Ross State University, Alpine

Groundwater and Aquifer Characterization
Kevin Urbanczyk Ph.D.,

Surface Water Pathogens in the Rio Grande Basin
Keith Sternes, Ph.D.,

Biological Resources in Terlingua Creek
Bonnie J. Warnock, Ph.D.

Sam Houston State University, Huntsville

Assessment of Effects of Vegetation Disturbance Associated with Urbanization
Justin K. Williams, Ph.D., Mark Leipnik, Ph.D.
Barry Williams, Ph.D., W.P. Spencer

San Angelo State University, San Angelo

Small Mammal Survey
Loren Ammerman, Ph.D., Robert Dowler, Ph.D.

Videography Study
Rod Reed, Ph.D.

Lamar University, Beaumont

Surface Water Quality Simulations: 2 and 3-Dimensional Water Quality Model of International Lake Amistad
Xing Fang, Ph.D., P.E., Mien Jao, Ph.D.

Assessment of the Impact of Airborne Pollutants on the Rio Grande Basin Watershed
Thomas Ho, Ph.D.,
Jerry Lin, Ph.D., Hsing-wei Chu, Ph.D.

Characterization of Water Pollution and Evaluation of Treatment Technologies
Thomas Ho, Ph.D., Jerry Lin, Ph.D.
Hsing-wei Chu, Ph.D., Rafael Tadmor, Ph.D.

Photochemical Treatment of Contaminated Water in the Rio Grande Region
Daniel H. Chen, Ph.D., Bing Wang, Ph.D.
Rafael Tadmor, Ph.D., Xuejun Ye, Kuyen Li

Agricultural Water Optimized Use Recycle and Reuse Through Mobile Advanced Wastewater Treatment Technology
David L. Cocke, Ph.D., Helen Lou, Ph.D., Kuyen Li



2006 Projects

Award No. 2006-38899-03586

Sul Ross State University, Alpine

Groundwater

Kevin Urbanczyk, Ph.D.

Evaluation of Pathogens and Accompanying Risk in the Rio Grande Basin Watershed

Keith Sternes, Ph.D.

Biological Inventory and Watershed Monitoring of Terlingua Creek Watershed

Bonnie J. Warnock, Ph.D.

Rio Grande Research Center

Kevin Urbanczyk, Ph.D., Leslie Hopper

Sam Houston State University, Huntsville

Land Use Practices and Their Effects of Ecosystem Dynamics Along the Rio Grande

Justin K. Williams, Ph.D.

Bridging the Gaps Along the Rio Grande-Investigating Attitudes Governing Use of Rio Grande Resources

Karen M. Douglas, Ph.D.

Groundwater Aquifer Recharge Assessment in the Trans-Pecos Region

Mark R. Leipnik, Ph.D.



Lamar University, Beaumont

Assessment of the Impact of Airborne Particulate Pollutants on the Rio Grande Basin Watershed

Thomas Ho, Ph.D., Jerry Lin, Ph.D., Hsing-wei Chu, Ph.D.

Field Testing for Arsenic and Electrocoagulation Remediation Diagnostic Testing in the Rio Grande Basin in the Rio Grande Basin

David L. Cocke, Ph.D., Kuyen Li, Ph.D., Helen Lou

Field Sampling and Identification of Atrazine/Pathogen-Contaminated Water in the Rio Grande Basin

Daniel Chen, Ph.D., H. Randall Yoder, Ph.D.

Study of Inorganic Fouling and Calcium Recovery from the Application of Membrane Technology in the Rio Grande Basin

Thomas Ho, Ph.D., Jerry Lin, Ph.D., Hsing-wei Chu, Ph.D.

Texas State University - San Marcos

Groundwater Isotope Geochemistry and Aquifer Testing in the Rio Grande Basin

Matthew Uliana, Ph.D., P.G.

River-based Tourism in the Rio Grande Basin

James Kimmel, Ph.D.

Status and Trends Analysis of Estuarine/Riparian Wetlands in the Southern most Rio Grande Basin

Warren Pulich Jr., Ph.D.

Assessment, Monitoring, and Prediction of the Spatial Invasion of Saltcedar in the Lower Rio Grande using Multi-resolution and Multi-temporal Remotely Sensed Imagery

Le Wang, Ph.D.

Transboundary Diagnostic Analysis Framework for the Rio Grande Basin

Walter Rast, Ph.D, PI

Sources and Pathways of Energy and Nutrients Support the Rio Grande Biotic Community

Weston Nowlin, Ph.D, Timothy Bonner, Ph.D

Rio Grande Basin Database and Clearinghouse

Emily Armitano, M.A., M.S.

Understanding, Predicting, and Development of a Management Scheme for Salinity in the Rio Grande River Basin at International Lake Amistad Reservoir

Al Groeger, Ph.D

Environmental Monitoring of the Trans-Pecos Springs

Glenn Longley, Ph.D.

San Angelo State University, San Angelo,

Small Mammal Survey

Loren Ammerman, Ph.D., Robert Dowler, Ph.D.

Videography Study

Rod Reed, Ph.D.

2008 Projects

Award No. 2008-38869-19174

Texas State University - San Marcos

Project Management, Database and Clearinghouse

Emily R. Armitano, M.A., M.S., Andrew Sansom, B.S., Co-PI
Michael Abbott, Ph.D.

A Multi-scale Assessment of Seasonal Vegetation Patterns in the Rio Conchos Watershed

Nate Curritt, Ph.D., Víctor Reyes (CEISS), Xuelian Meng

SAWC Integration of GIS Datasets for Development of a Standardized Watershed Characterization Report Tool

Thomas B. Hardy, Ph.D., Timothy H. Bonner, Ph.D.
Yongxia Xia, Ph.D., Emily R. Armitano, M.A., M.S.

Analysis, Evaluation, and Recommendations Regarding Interpretive Programs and Facilities on the Rio Grande

Jim Kimmel, Ph.D.

Rio Grande Environmental Literacy and Capacity Building

Eric Mendelman, B.A.S.

Relationships of River Flow and Nutrient Loading to Estuarine Communities of the Lower Rio Grande

Warren Pulich Jr., Ph.D., Hudson Robert DeYoe, Ph.D. (UTPA)

Development of a Transboundary Diagnostic Analysis Framework for the Sustainable Use of the Rio Grande

Walter Rast, Ph.D.

Sul Ross State University, Alpine

Rio Grande Research Center

Kevin Urbanczyk Ph.D.

Mapping and Monitoring of Native and Exotic Vegetation in Trans-Pecos, Texas

Patricia Moody Harveson, Ph.D., Bonnie J. Warnock, Ph.D.
Louis A. Harveson, Ph.D.

Kokernot Springs Restoration

Kevin Urbanczyk, Ph.D., Jeffery Bennett (BIBE/NPS)
Patricia Moody Harveson, Ph.D., Bonnie J. Warnock, Ph.D.
Aimee Roberson (USFWS)

Evaluation of Source of Spring Flow from Cretaceous Aquifers along the Rio Grande Wild and Scenic River.

Kevin Urbanczyk Ph.D.
Jeffery Bennett (BIBE/NPS)
Benjamin Schwartz, Ph.D. (TSU-SM)

Impact of Upland Areas near Drainages on Water Quality in the Terlingua Creek Watershed, Brewster and Presidio County, Texas.

Bonnie J. Warnock, Ph.D.

Wintering Grassland Birds as Bio-indicators in the Rio Grande Drainage Basin

Arvind Panjabi, Ph.D. (RMBO), Bonnie J. Warnock, Ph.D.

Lamar University, Beaumont

Field Sampling/Identification of Pesticide/Pharmaceutical-Contaminated Water

Daniel Chen, Ph.D., Bin Wang, Ph.D.
H. Randall Yoder, Ph.D., Chris Ritzi, Ph.D. (SRSU)

Assessment of the Impact of Airborne Particulate Pollutants on the Rio Grande Basin Watershed

Thomas Ho, Ph.D., Jerry Lin, Ph.D.
Hsing-wei Chu, Ph.D., Paul Chiou

Impact of Global Climate Change on the Precipitation and Acid Deposition in the Rio Grande River Region

Jerry Lin, Ph.D., Thomas C. Ho, Ph.D.
Hsing-wei Chu, Ph.D.



Sam Houston State University, Huntsville

Vegetation Map of the Rio Grande Basin

Justin Williams, Ph.D.

Ichthyofaunal Diversity and Associated Metrics as Indicators of Water Quality and Land Use Practices along the Rio Grande

William I. Lutterschmidt, Ph.D.

Drought-Mitigation Planning and Responses to Climate Change along the Texas-Mexico Border: Interviews with Water Stakeholders

Karen M. Douglas, Ph.D.

Development of Edited Compilation of Rio Grande Research

Justin Williams, Ph.D.
Kevin Urbanczyk, Ph.D. (SRSU)
Emily Armitano, M.A., M.S. (TSU-SM)

2009 Projects

Award No. 2009-38899-20017

Texas State University - San Marcos

Large-scale Composting as a Means of Managing Invasive Aquatic Plants in the Lower Rio Grande River Valley

Michael Abbott, Ph.D., Tina Marie Cade, Ph.D.

Project Management, Transboundary Diagnostic Analysis, Database and Clearinghouse

Emily R. Armitano Warren, M.A., M.S., Andrew Sansom, B.S., Walter Rast, Ph.D.

Ecological Values and Ecosystem Services of Watersheds in the Lower Rio Grande River

Timothy H. Bonner, Ph.D., Weston Nowlin, Ph.D.
Yixin Zhang, Ph.D., Thomas B. Hardy, Ph.D.

Precipitation and Land-use Trends in the Rio Conchos Watershed

Nate Currit, Ph.D., Jiao Wang, M.S., Víctor Reyes (CEISS)

Stakeholder Dissemination and Training: Watershed Characterization Report Tool

Thomas B. Hardy, Ph.D., Yongxia Xia, Ph.D., Heidi Moltz, M.S.

Analysis, Evaluation, and Recommendations Regarding Interpretive Programs and Facilities on the Rio Grande

Jim Kimmel, Ph.D.

Rio Grande Environmental Literacy and Capacity Building Project Phases 3 and 4

Eric Mendelman, B.A.S.

Relationships of River Flow, Salinity, and Nutrient Loading to Aquatic Plant Productivity in the Rio Grande Estuary

Warren Pulich Jr., Ph.D., Hudson Robert DeYoe, Ph.D. (UTPA)

Lamar University, Beaumont

Field Sampling and Chemical Analysis for Water/Sediment Contaminants

Daniel Chen, Ph.D., Bin Wang, Ph.D.
Kevin Urbanczyk, Ph.D. (SRSU)

Assessment of the Impact of Airborne Particulate Pollutants on the Rio Grande Basin Watershed

Thomas Ho, Ph.D., Jerry Lin, Ph.D.
Hsing-wei Chu, Ph.D., Paul Chiou, Ph.D., Qin Qian, Ph.D.

Impact of Global Climate Change on the Precipitation and Acid Deposition in the Rio Grande River Basin

Jerry Lin, Ph.D., Thomas C. Ho, Ph.D.

An Educational Application of the Field-Deployable Arsenic Electrochemical Analyzer: A Far West Texas 4-H Student Well Screening Project

Jewel Andrew Gomes, Ph.D., Kevin Urbanczyk, Ph.D.

Sul Ross State University, Alpine

Rio Grande Research Center

Kevin Urbanczyk Ph.D.

Mapping and Monitoring of Native and Exotic Vegetation in Trans-Pecos, Texas

Patricia Moody Harveson, Ph.D., Bonnie J. Warnock, Ph.D.
Louis A. Harveson, Ph.D.

Tamarisk Biological control on the Rio Grande in West Texas: Assessing and Enhancing Biodiversity to Benefit Rare Fauna in Tamarisk Invaded Riparian Areas

Chris Ritzi, Ph.D., Steven Platt, Ph.D., C. Jack DeLoach (USDA/ARS)

Effects of Invasive Species on the Biogeochemistry of Hyporheic Water from Sandbars: A Comparison of Restored and Unrestored Areas in Big Bend National Park.

Kevin Urbanczyk Ph.D., Weston Nowlin, Ph.D. (TSU-SM)
Jeffery Bennett (BIBE/NPS)

Best Management Practices for Desert Grasslands in the Trans-Pecos Region of the Rio Grande Watershed

Bonnie J. Warnock, Ph.D.

Wintering Grassland Birds as Bio-indicators in the Rio Grande Drainage Basin

Arvind Panjabi, Ph.D. (RMBO), Bonnie J. Warnock, Ph.D.

Sam Houston State University, Huntsville

Geo-referencing of Biological Collections and On Going Contributions to a Vegetation Map of the Rio Grande Basin

Justin Williams, Ph.D.

Characterizing Spatial Variation in Stream Habitats and Fish Communities across the Rio Grande Basin, Texas

Chad W. Hargrave, Ph.D.

Water Norms and Conservation Efforts: The Case of Hidalgo County, Texas

Karen M. Douglas, Ph.D., Gene L. Theodori, Ph.D.



Project Descriptions

Groundwater

Texas State University - San Marcos Project 2006

Groundwater Isotope Geochemistry and Aquifer Testing in the Rio Grande Basin

This project involved refining historical databases and setting up Geographical Information System (GIS) coverages to refine the conceptual model of the groundwater flow system in the West Texas Bolsons and Igneous Aquifer systems. Furthermore, using the ion and isotope chemistry of the groundwater and the rocks supporting the aquifers, characterization of the hydrostratigraphic units was conducted.

This project has helped better characterize the flow system and current water quality of the Presidio Bolson aquifer. In the future, data can be used to determine groundwater availability and conjunctive use strategies in the basin.

Sul Ross State University Project 2008

Evaluation of Source of Spring Flow from Cretaceous Aquifers along the Rio Grande Wild and Scenic River

This project seeks to complete a hydro-geologic evaluation of thermal springs along the Rio Grande Wild and Scenic River (RIGR). These springs are a remarkable feature of the RIGR and are potentially threatened by groundwater pumping. By working with local and regional water planning groups, staff members at Big Bend National Park (BIBE) were able to provide the information to persuade the State of Texas to list the springs as ecologically significant.



Sul Ross State University Project 2008

Kokernot Springs Restoration

The Kokernot Springs Restoration Project is a multi-phase endeavor aimed at returning the spring and the adjacent floodplain to a condition that represents a more functional and sustainable geo-hydrologic and biologic condition.

Project Descriptions

Surface Water

Lamar University 2008-2009

Impact of Global Climate Change on the Precipitation and Acid Deposition in the Rio Grande River Region

The objective of this research project is to examine the impact of global climate change on the precipitation and acid deposition in the Rio Grande River Basin region. Such assessment is necessary because of the concerns of environmental degradation and water sustainability caused by global changes. It is anticipated that global climate change will result in detectable differences in regional meteorology (temperature, precipitation, surface radiation, humidity, and winds), allowing detailed analysis of its effect on air quality under numerous meteorological and future emission scenarios, both individually and in combination. The climate forcing and its impacts on precipitation and acid deposition in the basin region between a base year (2000) and a future year (2050) will be reported as the project deliverables.

Sul Ross State University 2008

Impact of Upland Areas near drainages on water quality in the Terlingua Creek Watershed, Brewster and Presidio County, Texas

This project is intended to address the main issues surrounding the benefits and drawbacks to earthen tanks as compared with native riparian areas with and without restored upland variable source areas in the Chihuahuan

Desert, with a focus on the Terlingua Creek watershed. The main objectives include collecting baseline information about current structural and functional conditions of tanks in the Terlingua Creek watershed, current wildlife usage and vegetation/flora at a subset of the tanks and in the native riparian areas, restoration of variable source areas to determine the impact of runoff on native riparian areas, and to determine the hydrological impacts of tanks and variable source areas in the creation of a management protocol for earthen tanks in the Trans-Pecos based upon data collected in the Terlingua Creek watershed.



Texas State University - San Marcos 2006

Understanding, Predicting, and Development of a Management Scheme for Salinity in the Rio Grande River Basin at International Lake Amistad Reservoir

This project is a continuing descriptive study of the submarine springs in both arms of the Rio Grande Reservoir and in the reservoir itself. Objectives include monthly monitoring of the reservoir water quality in Lake Amistad and to analyze nutrient sediments and sediment chemical characteristics.

Project Descriptions

Biology & Ecology

Texas State University—San Marcos 2008

Relationships of River Flow and Nutrient Loading to Estuarine Communities of the Lower Rio Grande

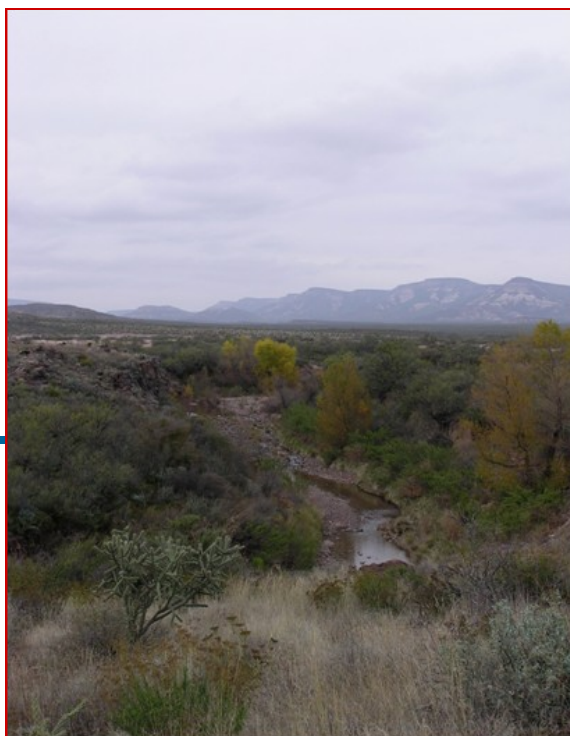
Addressing the freshwater inflow needs and ecosystem maintenance of the Rio Grande estuary, this project will document the distribution and dynamics of the biological indicators of estuarine conditions. By determining the relationships between the distribution of estuarine plants and barnacles related to salinity, river flows and nutrient loading in this area will be better understood.

Using four water quality monitoring stations in the tidal portion of the Rio Grande, mid-stream surveys will be conducted and water samples will be collected to test for analysis of various suspended soils, metals, minerals and particles. Also, boat surveys will be conducted to establish the distribution of indicator plants such as mangrove, hyacinth and giant cane for delineating between estuarine and riverine habitat. At the conclusion of this project, an integrated analysis of the ecological and physio-chemical data will be available in the form of a project report and peer-reviewed scientific publications.

Texas State University—San Marcos 2006

Sources and Pathways of Energy and Nutrients Supporting the Rio Grande Biotic Community

This in-depth study of the Rio Grande, from Big Bend to Brownsville, will assess the fish and invertebrate species, and analyze the nutrient sources and food webs of the river. Additionally, patterns in energy and nutrient sources for the fish of this region will be compared with areas above Brownsville and below Amistad Reservoir, Texas. A final sampling will be conducted at each of the established field sites and the relative abundance and diversity of each fish and invertebrate species will be collected.



Project Descriptions

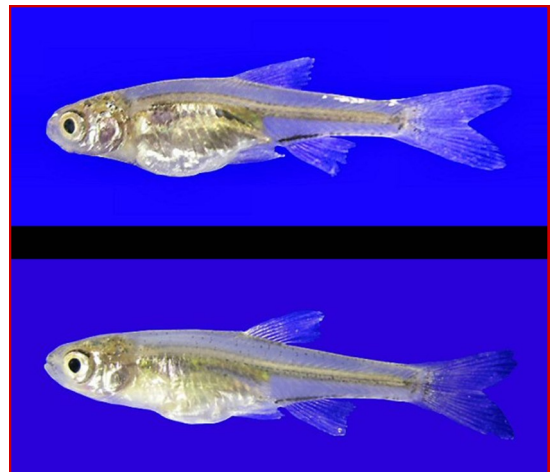
Biology & Ecology

Texas State University—San Marcos 2004-2005

Ecological Characterization of Fish Assemblages

This ecological characterization of fish assemblages will provide detailed and comprehensive data for the Big Bend reach of the Rio Grande. Final results will help guide progressive management programs for sustaining and improving fish assemblages of the region. In order to analyze current fish assemblages along the Rio Grande river basin, the researchers have incorporated historical changes in fish collections through taxa and functional guilds to help determine spatial and seasonal trends.

Research also includes quantifying spatial and temporal habitat associations of the fish assemblage, in addition to investigating reproduction and food habits for riverine fishes. This study provides critical information regarding reintroduction initiatives for the Rio Grande silvery minnow (*Hybognathus amarus*) and important findings on the early life history of the threatened blue sucker (*Cycleptus elongates*).



Sul Ross State University 2008-2009

Wintering Grassland Birds as Bio-indicators in the Rio Grande Drainage Basin

The purpose of this project is to fill important gaps in current knowledge of wintering North American grassland bird populations in the Rio Grande drainage basin. Wintering grassland bird abundance, distribution, habitat use, community structure and inter-annual movements will be investigated in Marfa's grasslands as well as in grasslands along the Rio Conchos basin.

Furthermore, this project will address the socioeconomic values of grasslands by developing indices of ecosystem integrity that consider grassland bird abundance, habitat features and condition and geographic location. These indices can later be used to evaluate grassland ecosystem health and inform sustainable management across the region.

Project Descriptions

GIS Applications

Texas State University - San Marcos 2006

Assessment, Monitoring and Predicting the Spatial Invasion of Salt cedar in the Lower Rio Grande using Multi-resolution and Multi-temporal Remotely Sensed Imagery

This project assesses the presence of Salt cedar, an invasive, non-native plant species, in the Rio Grande river basin using high spatial resolution imagery. Researchers have combined various methods of remote sensing to map the spatial and temporal density of Salt cedar in order to understand and predict its potential spread along the river basin. Using Landsat TM imagery with a resolution of 30 meters, they have systematically derived Salt cedar fractions from spatial imagery. Recent progress includes comparing different unmixing methods for deriving Salt cedar fractions from Landsat TM imagery and comparing discrete classifiers for differentiating Salt cedar from other riparian vegetations.

Texas State University - San Marcos 2008

A Multi-scale Assessment of Seasonal Vegetation Patterns in the Rio Conchos Watershed

This project will analyze seasonal trends in vegetation greenness using MODIS Normalized Difference Vegetation Index (NDVI) 16-day composite images. By creating a series of land-cover maps indicating the onset and duration of greenness, a multi-temporal principle component analysis will be conducted to assess casual mechanisms of the vegetation greenness patterns.

The outcome will be seasonal “greenness” maps for the entire Conchos basin for 2000-2008 including charts and statistics describing the seasonal relationship between precipitation and greenness as well as spectral reflectance curves for the various vegetation types found in the Bajo Rio Conchos region of the watershed.

Sam Houston State University 2008

Vegetation Map of the Rio Grande Basin

Utilizing a new protocol developed and tested at SHSU that fuses remote sensing techniques with the National Vegetation Classification Standard (NVCS), this study will expand on an existing detailed vegetation map of the Rio Grande. Researchers have used GIS to produce vegetation maps of the Rio Grande including seven of the seventeen Texas counties bordering the river. This project will seek to map seven additional border counties and the maps will then be used for a number of ecological models including bird distribution predictions, plant distributions, and invasive species encroachment. The final goal is for all seventeen counties of the Rio Grande to be mapped and for predictive maps to be made that would anticipate invasive plant encroachment of certain species.

Project Descriptions

Education & Public Outreach

Texas State University - San Marcos 2004-2005

Understanding Water-Related Issues in the Rio Grande River Basin: K-12 Education & Curriculum Development

This study will involve developing curriculum materials that will integrate the results of the SAWC research programs with educational activities aligned with state and national education standards in all relevant subject areas. In addition an in-residence summer workshop for thirty K-12 educators from the Rio Grande River Basin region will be conducted. This will result in the development of standards-based, teacher-generated lesson plans in the fields of science, social studies, environmental science, math and other related disciplines.

Texas State University - San Marcos 2008

Rio Grande Environmental Literacy and Capacity Building

Since 1991 the Texas Stream Team Program (formerly Texas Watch) has supported a statewide network of volunteers and partners conducting water resource education and volunteer monitoring. The program has successfully implemented the Dos Laredos Project in Laredo and Nuevo Laredo and has collaborated with the International Boundary and Water Commission (IBWC) to ensure Stream Team activities support and enhance IBWC's Texas Clean Rivers Program Public Outreach objectives.

The aims of the project are to increase environmental literacy among project participants, support data collection, promote data sharing and foster watershed stewardship.



Project Descriptions Education & Public Outreach

Texas State University - San Marcos 2004-2009

A Transboundary Diagnostic Analysis Framework for Sustainable Use of the Rio Grande and its Resources

The goal of this study is to develop a comprehensive, ecosystem-based, integrated management framework for the sustainable use of the Rio Grande, consistent with elements of the Transboundary Diagnostic Analysis (TDA) of the Global Environment Facility (GEF), including refinement to incorporate recommendations arising from the PDF-A stakeholder meeting held in Ciudad Juarez, Mexico in October 2006.

Sul Ross State University 2004-2009

Rio Grande Research Center

The four main objectives of the Rio Grande Research Center are to create a basin-wide perspective for the sustainable use of water resources within the bi-national Rio Grande watershed, to provide administrative support and project headquarters for the SAWC research program, and to promote intergovernmental, academic and stakeholder collaboration as well as outreach and education about the sustainable use of the natural resources of the Rio Grande.



Website: <http://www.sulross.edu/pages/4624.asp>



Project Descriptions

Human Factors

Texas State University - San Marcos 2006

Analysis and Evaluation of River-based Tourism on the Rio Grande

This research has documented the importance of river-based recreation and tourism to the regional economy and to the individuals who participate in it. It has also identified the motivations and commitments of river-tourism professionals and the potential cooperative partnerships in the upper-river that may help reduce some of the priority conflicts for the Rio Grande's water.



Texas State University - San Marcos 2008

Analysis, Evaluation, and Recommendations Regarding Interpretive Programs and Facilities on the Rio Grande

The purpose of this research is to evaluate existing interpretive programs and facilities on the entire Rio Grande and to develop recommendations that will lead to a comprehensive interpretive plan for the river. This project will not only address the issues and challenges related to the sustainable use of the water resources of the Rio Grande, but will evaluate the socioeconomic and related drainage basin characteristics relevant to its sustainable use.

Sam Houston State University 2008

Drought-Mitigation Planning and Responses to Climate Change along the Texas-Mexico Border: Interviews with Water Stakeholders

Water resource managers and policy makers, along with other water stakeholders, including agriculture, farming, and irrigation interests, will be interviewed in order to better understand the levels to which recommendations have been adopted or factored into the water resource planning agenda. Over the last decade, scientists have continued to identify the link between climate changes and environmental changes. As the Texas-Mexico region continues to grapple more intensely with projected water shortages, there is a need to better understand how climate change figures into the accounting of future water shortages and in equations for the distribution of water for the future. Our interviews with the different groups will assess whether- and if so, how- climate change has figured into the accounting of future water distributions and shortages.

Project Descriptions Information & Data Management

Texas State University - San Marcos 2004-2009

Database and Clearinghouse

Towards the goal of defining and assessing the present environmental status of the Rio Grande River Basin, this project will develop a publicly accessible web database of institutions and organizations with data and information related to the basin on the US and Mexico side of the border. A public web library of English and Spanish publications and research papers relating to the basin will also be made available. In the past, researchers have expressed a need for a centralized clearinghouse of information because it is often difficult and time consuming to access existing data and data sources.

It is envisioned that once this Database and Clearinghouse project is complete, data gaps and duplicative efforts can be identified and studies can begin to specifically address missing data throughout the basin. Moreover, a clearer picture of the root causes and barriers to sustainable use of the basin's resources will emerge and these efforts will promote better communications among organizations within the US and Mexico that live or work on the Rio Grande.

Website: <http://www.rivers.txstate.edu/rg/>

Texas State University - San Marcos 2008

SAWC Integration of GIS Datasets for Development of a Standardized Watershed Characterization Report Tool

This project proposes to utilize the existing geospatial datasets developed to date within the Rio Grande Watershed to populate the database structures used by the Watershed Characterization tool and generate summary reports for each sub-basin. This effort will also include trend analyses on the changes in the flow regimes and incorporation of related aquatic resource information on the distribution and life stage periodicities. The deliverables include populated databases, sub-basin summary reports, updated aquatic resource inventory data and the identification of missing data sets not yet available for each of the 11 resource categories.

Produced by:
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Non-Discrimination Statement

No person shall be excluded from participation in, denied the benefits of, or be subject to discrimination under any program or activity sponsored or conducted by Sul Ross State University, on any basis prohibited by applicable law, including, but not limited to, race, color, national origin, religion, sex, age, or disability.



United States Department of Agriculture
National Institute of Food and Agriculture