Temple, August 9, 2002

Re: Request for proposal - TAES Water Conservation and Soil Management

Rosemary Payton
Texas Water Resources Institute
1500 Research Parkway, Suite 240
2118 TAMU
College Station, TX 77843-2118

Dear Rosemary Payton,

Please consider the submission of the attached proposal named "Watershed hydro-geomorphology attributes and compositional metrics for the characterization of riparian corridors in Texas "

Best regards,

Mauro Di Luzio

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TAES/TWRI Water Conservation and Soil Management Research Proposal

Name of the Project: Watershed hydro-geomorphology attributes and compositional metrics for the characterization of riparian corridors in Texas.

Is This a New Project or Request for Continuation? This is a New Project.
Geographic Area of the Project: Lower Colorado River Watershed
Name of Principal Investigators and Mailing addresses:

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Amount of Funding Requested: $ 15,000

Introduction

Riparian ecosystems are declining throughout the southwestern United States. Many rivers and streams have been channelized, and their riparian zones overtaken by land development. Sedimentation and excess nutrients are the most significant causes of stream channel and water quality degradation. The principal source of sediment in these systems is often the channel banks. Aquatic functions of riparian vegetation include: 1) providing stream shading, 2) contributing large woody debris and fine organic matter, 3) regulating the flux of upland-derived sediments, nutrients, and other chemicals, and 4) stabilizing stream banks. The relationships between riparian structural and stream ecological condition are not well established. Because these relationships are likely to be scale-dependent, effective methods are necessary for addressing the effects of spatial scale on the strength of associations between riparian and watershed structural attributes and biotic, chemical, and physical indicators of stream condition. In the past, coarse resolution of remote sensing and GIS maps, limited the ability to quantitatively assess the structural, geomorphic, and ecological attributes of each watershed. More current land use/land cover analyses at appropriate scales are needed. This approach would allow multidimensional assessments of riparian condition and function that would ultimately guide management, restoration, and conservation strategies.

Objectives

The main objective of this research is to determine the effect of riparian areas extension and on the ecological condition (IBI, index of biotic integrity) of perennial streams in agricultural landscapes of Texas. The overall objective of this research is to quantify relationships between remotely-sensed riparian, watershed structural-geomorphic attributes at varying spatial scales and stream indicators of stream ecological condition.

Methods

No cost, colored infrared digital orthophoto DOQQ 1-meter resolution of the study watersheds, derived from 1:40,000 NAPP photography taken 1994-97, will be used to interpret land use/land cover classes. Streams have been already delineated directly on the digital ortophotos by TNRIS (StratMap program). These data include all features comprising perennial and intermittent flowing waters, standing water

bodies, and wetlands. In addition, centerlines for double-line rivers and streams, lakes, canals, reservoirs and other areal features. A detailed classification system will be used to interpret the orthophoto and characterize land cover/land use (LCLU) of the riparian corridor as banded area adjacent to and along each side of the stream network. Since the limited budget, the completion of the GIS coverage will partially include ground-truthing (200 ground truth locations within the case study watershed are available at the USDA-NRCS lab in Temple, for the year 1999 and 2000) to estimate classification accuracy of the interpreted LCLU within the riparian corridor. Mainly an unsupervised classification will be performed based on the experience gained at the Spatial Science Laboratory (TAMU) in occasion of several remote sensing assessments using DOQQ data in Texas. GIS functions and programs will be used to band and partition the riparian corridor into various lateral-longitudinal combinations (scale).
The lateral dimension captures the cross sectional structure of the riparian corridor, while the longitudinal dimension captures the linear structure along the riparian corridor. The composition of riparian LCLU will be characterized using GIS functions to incrementally band the riparian corridor and address the continuity of natural riparian vegetation and the number and length of gaps between forest patches calculated as function of distance from the stream. Width of the riparian buffer will be estimated from arcs aligned perpendicular to both side of the stream. Watershed hydro-geomorphology attributes will be derived using digital elevation models (DEMs), using or developing tools and algorithms based on the assessment of elementary drainage directions, a methodology we have been recently developed for BASINS version 3.0, a project of U.S. EPA Office of Water (Di Luzio *et al.*, 2002)
Stream and watershed hydro-geomorphology attributes will add insight to the analyses, whereas similar investigations are generally taking into account only the landuse/land cover patterns.
Scale issues will be addressed analyzing stream ecological condition indicators at the base of each study watershed and the relationships with the derived attributes for the stream network above the reach with different size and extent. Stream ecological condition indicators are available for the case study watershed.

Case Study

Since 2000, the Lower Colorado River Authority is monitoring 11 sections of the river. See Table 1 and Figure 1 (Attached).

Table 1 - Monitoring locations in the Lower Colorado River Watershed

TNRCC ID	General Location
12290	Colorado River at Bus Hwy 71 in Columbus, TX
12249	Cummins Creek at FM 109 near Columbus, TX
17362	Colorado River near Glen Flora, TX
17363	Llano River approximately 2 miles downstream of US 87
95023	Pecan Bayou downstream of Steppe Creek near Brownwood, TX
12369	Pedernales River at FM 962 near Westcave Preserve
12355	Colorado River downstream of US 190
12392	San Saba River at US 16 in San Saba, TX
12293	Colorado River at Smithville, TX
17009	South Llano River at South Llano River State Park near Junction, TX
12466	Colorado River in Webberville, TX

The monitoring activities include biological assessment (benthic macroinvertebrates, fishes, and habita) for the definition of the IBI index using a methodology approved for the state of Texas by TNRCC.

Outcomes

The correlations between reach-level indicators of stream ecological condition and riparian and watershed attributes for different sizes will be derived. These watershed hydro-geomorphology attributes and the compositional metrics, such as the proportion of an individual LCLU class or a combination of LCLU classes relative to a unit area, will possibly demonstrate statistical relationships with stream condition indicators. Mapping and graphically displaying the riparian LCLU data at various lateral-longitudinal combinations as well as hydro-geomorphology indexes and soil attributes will provide the ability to identify sites for field studies, such as process-level investigations of nutrient and sediment regulations and will provide alternatives to field-based inventory in conducting riparian assessments.

Specific Issues Addressed.

The research addresses a broad range of water conservation concerns: water resources-water quality, conservation buffers, riparian management, land management related to soil and water conservation.
The knowledge gained from this research could be used to create and improve management and restoration practices necessary to comply with federal and state water quality goals, including total maximum daily loads (TMDLs) and promote the use and development of models and decision support systems necessary to describe and predict the long-term response of riparian systems and stream corridor systems. These model systems will have the flexibility to interface with larger scale watershed models (for instance SWAT model) for use in accurate global assessments of restored and constructed ecosystems. Integrated approaches to watershed and stream corridor management will both sustain modern productive agriculture and protect downstream waters, including drinking water supplies, ecological habitats, and coastal resources.

Collaboration

TAES - Blackland Research **Mauro Di Luzio**: Remote Sensing data interpretation, GIS formulation and statistical assessment	**USDA-ARS - Grassland Laboratory**. **Jeff Arnold**: Hydrology validation	**NRCS - Watershed Assessment Team** **Steve Bednarz**: Remote Sensing validation using ground truth points sampled in occasion of other projects

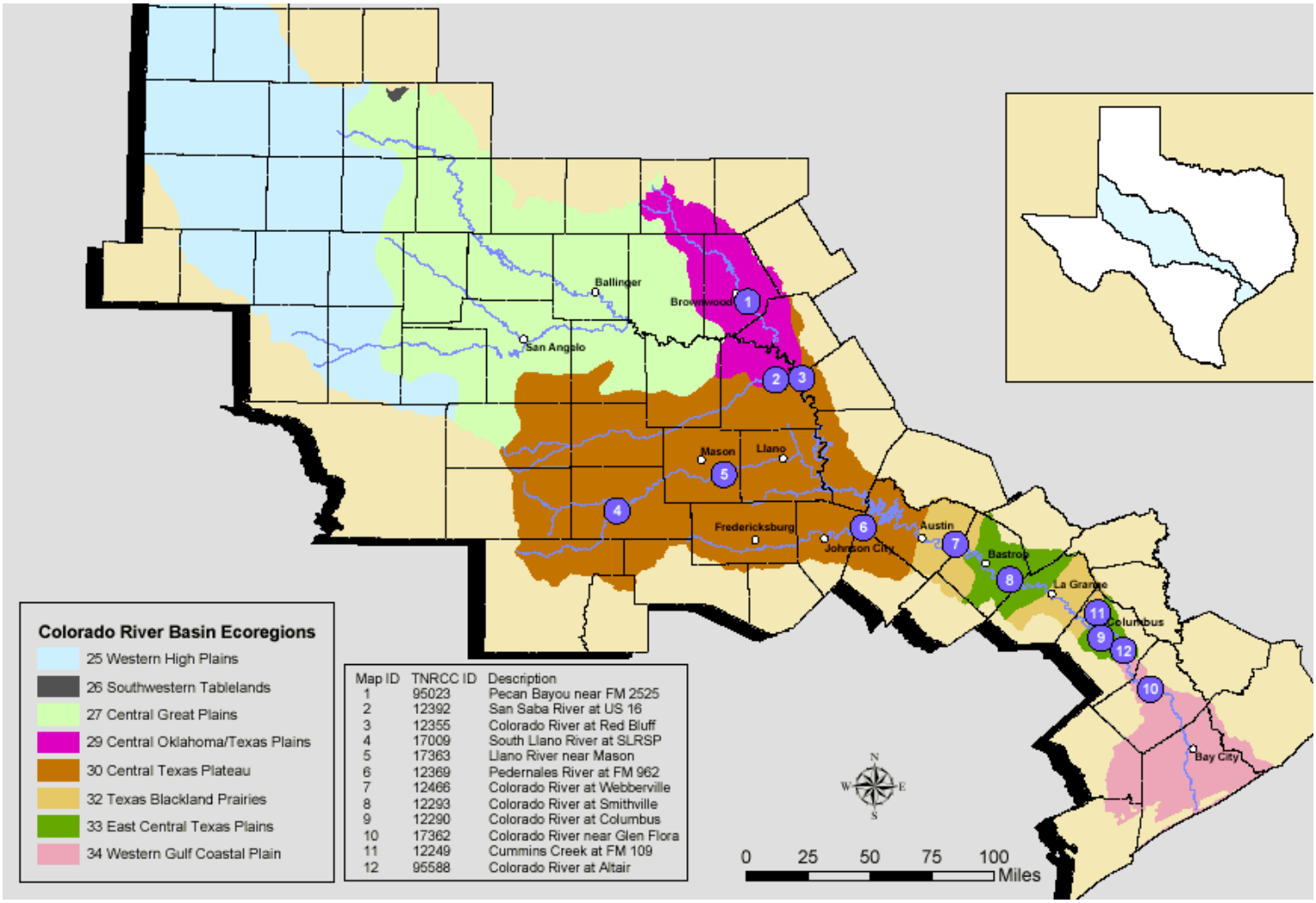
Other Collaborators
TAMU - Spatial Science Lab.
Raghavan Srinivasan:
GIS and Remote Sensing method validation.

Submitted by:
Mauro Di Luzio

Approved for submission
Prof. William Dugas

ATTACHMENT

Figure 1 - Location of Monitorin Station in the Lower Colorado River Watershed



Bibliography

Di Luzio M, R. Srinivasan, and J. G. Arnold (2002). Integration of Watershed Tools and SWAT Model into BASINS. J. American Water Resource Association. Scheduled August 2002 issue.