Assessment of Impacts and Stresses on the Edwards-Trinity Springs Ecosystem in Hays County, Texas

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Issue

The Edwards aquifer and the Trinity aquifer are the primary sources of water for more than 1.5 million people along the Interstate 35 (IH-35) urban corridor from San Antonio, Texas to San Marcos, Texas. The Edwards and Trinity aquifers provide a majority of the water used for industrial, military, irrigation, and public supplies. These aquifers also contribute baseflow to the rivers in the Guadalupe River Basin, and discharge to major springs to sustain critical habitat for Federally-listed endangered and threatened species. The water-supply needs of the human population are perceived by many to compete directly with the needs of endangered species and downstream users that rely on baseflow from the major springs. Furthermore, increased withdrawals from the IH-35 metropolitan areas to meet the growing needs of general populace and increasing urbanization (Fig. 1) threaten the continuation of flows at these springs.

Figure 1: Travis County, Texas urban growth south of Lake Travis spreading into the northern portion of Hays County.

Geographic Area of Interest

Ground-water withdrawals to meet land use development needs in the IH-35 urban corridor in Hays County currently are a threat to the continuation of spring flows, especially during times of drought.

The region of Hays County, Texas (Fig. 2) is unique in that it contains major springs that discharge both from the Edwards aquifer and from the Trinity aquifer. The geographic area of interest for the study includes San Marcos Spring and Jacob's Well Spring in the Guadalupe River Basin.

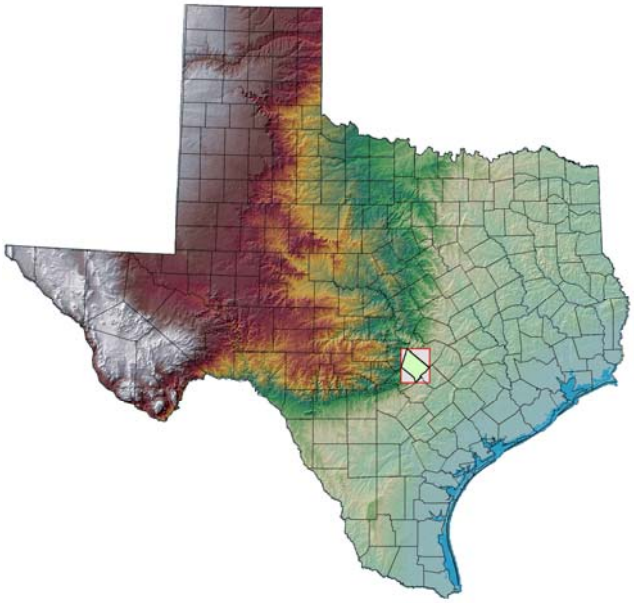

Figure 2: Hays County, Texas: Edwards-Trinity CRISP study area

To assess the impacts and stresses on the San Marcos Spring and Jacob's Well Spring within the Edwards-Trinity (ET) ecosystem, the Hays County boundary was rasterized using a 30-meter cellsize resolution to define an array of 1888 columns and 2226 rows for geographic analysis and modeling. The minimum geographic area of interest for Hays County does not include any additional buffer distance or overedge pixels.

FY05 Funding

For Fiscal Year 2005, the Central Region Integrated Science Partnership (CRISP) awarded the project $25,000. The consensus among USGS ET CRISP

principal investigators was that due to the FY05 Geographic Analysis & Monitoring (GAM) Program budgetary shortfall, the entire $25,000 would be allocated to the Geography Discipline.

Geography Discipline Staffing

Rocky Mountain Geographic Science Center (RMGSC) received the $25,000 CRISP funding in April 2005 (3rd Quarter FY05). Upon receipt of the funds, RMGSC used the CRISP funding to cover 310 FTE-hours that had been overcharged in FY05 to the BASIS+ project number 8815BIY, that is the Edwards-Trinity Aquifer Project (ETAP) investigation.

Consequently, the RMGSC FTE resource that was originally envisioned to work on the ET CRISP investigation could not be funded and was reallocated to work on Cooperative Topographic Mapping activities.

As a result, the ET CRISP Geography Principal Investigator has identified an alternate FTE resource to help support geographic research. Since Hays County is part of the Austin-Round Rock Metropolitan Statistical Area which is being used as a prototype site for the GAM National Urban Landscape Change Monitoring (NULCM) project, RMGSC commenced leveraging ongoing NULCM research in July 2005 to support the ET CRISP investigation.

Research Objectives and Approach

The Edwards aquifer and the Trinity aquifer are both dynamic karst systems that respond rapidly to climate variability and land use/land cover (LULC) change. Overall research objective is to better understand the complex processes and synergistic interactions that impact the ecosystem of the Edwards and Trinity aquifers in Hays County.

A major goal for the Interstate-35 urban corridor from San Antonio to San Marcos is that the availability, quality, and limits of natural resources sustaining urbanization can be defined and assessed using biologic, geologic, hydrologic, and land-use change models.

To support the overall ET CRISP goals and objectives, the Geography Discipline is constructing a temporal land surface characterization database for analyzing, modeling, and visualizing Hays County landscape change.

FY05 Geographic Research Accomplished

During Fiscal Year 2005, RMGSC began characterizing Hays County land surface using existing digital geospatial data sources. USGS National Elevation Data (NED) was used as the primary data source for deriving the percent slope and shaded-relief (Fig. 3) thematic inputs required for the SLEUTH land use model.

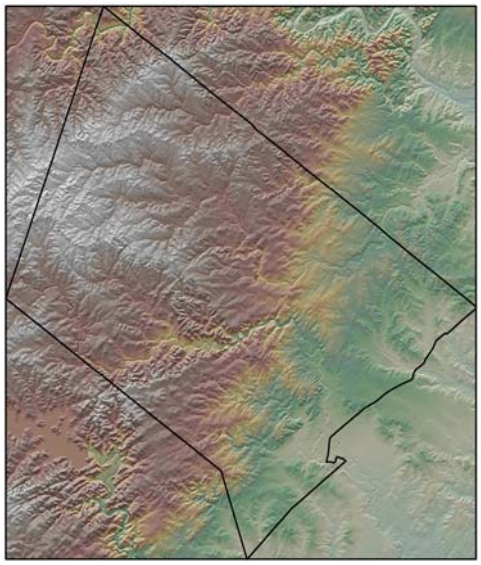

Figure 3: Color shaded-relief data for Hays County, Texas

Historical land use and land cover composition is being characterized using USGS National Land Cover Data (NLCD 1992) and GAP (2003) LULC datasets. In order to standardize the NLCD and GAP LULC classification schemes, RMGSC is aggregating the LULC categories into a quasi-Anderson Level I scheme with 10 LULC categories.

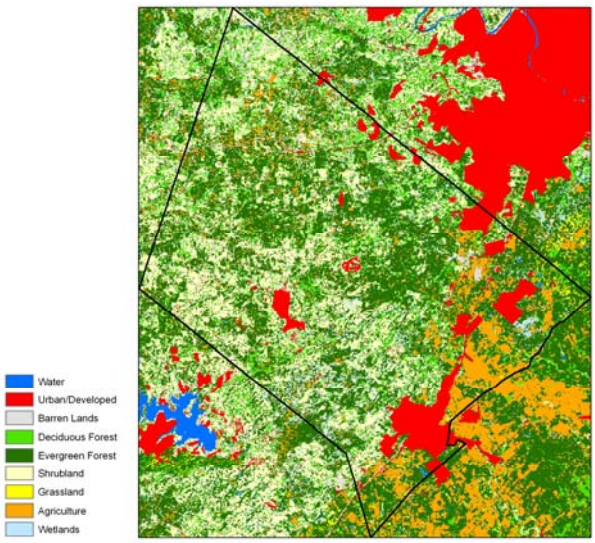

Figure 4: 2003 USGS GAP LULC data aggregated to a quasi-Anderson Level I scheme for Hays County, Texas

Temporal urbanized areas for Hays County have been extracted from the USGS GIRAS (1974), USGS NLCD (1992), Bureau of the Census (2000), and USGS GAP (2003) geospatial data as the baseline for assessing impacts on the Edwards and Trinity aquifers ecosystem as well as providing the drivers or urbanization seeds to simulate future ecosystem impacts based on predictive LULC development.

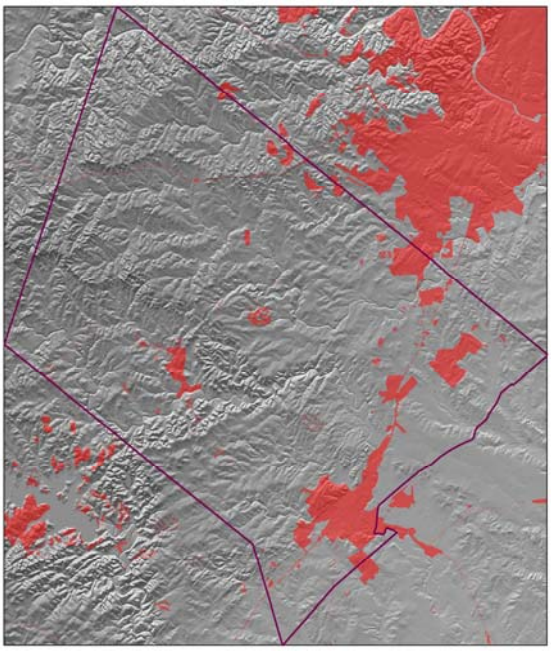

Figure 5: 2000 Bureau of the Census urbanized areas for Hays County, Texas

SLEUTH contemporary transportation network thematic requirements have been met by extracting the primary roads from the 2002 Texas Department of Transportation (TxDOT) data.

Outstanding FY06 Geographic Research

To complete the Hays County land surface characterization database in FY06, the Geography Discipline still needs to create a 1960 historical primary transportation routes dataset from the scanned Texas State Library County Highway Map. In addition, the SLEUTH land use model requires an excluded lands thematic input which RMGSC plans to derive from the USGS National Hydrography Data (NHD) and the Greater Austin-San Antonio Corridor Council's greenspace data.

Conducting land use trend analysis from the 1970s to the 2000s using the temporal LULC data to quantify the rates of urban growth, identify landscape change trends, and determine land use patterns remains to be completed in FY06.

Upon completion of the historical transportation and excluded lands datasets during FY06, the SLEUTH predictive land use model will be used to simulate future Hays County urbanized area and land use patterns for the years 2025 and 2040.

FY06 RMGSC Budget Impact Analysis

As a result of the Western Geographic Science Center and Mid-Continent Geographic Science Center Secure Facilities being closed in FY05, the RMGSC has received an additional $1M in FY06 funding to support National Civil Applications Program (NCAP) research activities.

Subsequently, GAM-funded FTE resources are being reallocated to NCAP and the potential impact to the ET CRISP project in FY06 is potentially not having FTE expertise to execute the SLEUTH land use model for Hays County.

As a result, the ET CRISP Geography Principal Investigator may need to negotiate with the RMGSC NCAP Project Chief for land use modeling FTE resources.

Research Benefits

Geographic research results from the land surface characterization will provide temporal urban growth information and historical land use patterns along the IH-35 urban corridor in Hays County as thematic inputs for the STELLA biotic impact simulation model.

The ultimate goal for the ET CRISP project is to provide scientific information that city, county and regional resource management planners in Hays County can use to optimize the use of the Edwards and Trinity aquifers for the present and future population, while ensuring that an ecologically sustainable water supply is maintained for endangered species and downstream users.