To support this effort, the Tennessee GAP data are being provided to the Fayette County Office of Planning and Development by the Tennessee Wildlife Resources Agency for planning purposes. Assistance from the National GAP Program is being provided to the county in the appropriate use of the data and in facilitating citizen input in the conservation planning process. Central to the success of this pilot is the demonstrated enthusiasm of the county government and the cooperation of NGOs. In the meantime, the immediate challenge is to educate residents and generate support for conservation planning in this county, which is undergoing a significant transition.

First International Gap Analysis Project

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Background

Approximately half of the United States-Mexico border is defined by the Rio Grande (named the Rio Bravo in Mexico and here referred to as the RG/RB). The river is an important ecological component of the ecosystems it transverses, and the Texas-Mexico border region represents an area of great biological diversity. The Texas Gap Analysis Project (TX-GAP) has been making considerable strides toward completing Gap Analysis for the state, but successful completion of the project would have left a partial picture of the habitats encompassing the RG/RB. Coordinators of the USGS Lower Rio Grande Ecosystem Initiative (LRGEI) (U.S./Mexico Field Coordinating Committee 1996) proposed that Gap Analysis should be extended to include areas in Mexico adjacent to the Lower Rio Grande. The LRGEI's mission is to assist Department of the Interior agencies with transborder inventory, monitoring, and research activities in the Lower Rio Grande basin. During 1996, NBS Director Pulliam provided funding to begin an international Gap Analysis project that extends about 180 km into Mexico. The first meeting between CONABIO (Comision Nacional para el Conocimiento y Uso de la

Biodiversidad) and USGS personnel to plan the project took place in early '97, and CONABIO subsequently provided matching funds.

The Lower RG/RB region along the United States-Mexico border forms a basin that is about 222,000 sq. km in size (61% in the U.S. and 39% in Mexico) (Woodward and Durall 1996), and the region contains a wide variety of rare plant and animal species (Inglis 1996, Diamond *et al.* unpublished report). Since recent economic agreements (e.g., North American Free Trade Agreement) have the potential to promote high rates of economic and population growth on a short-term basis, there has been increased interest in this border region among state and federal agencies in both countries. The environmental impact from the anticipated development may be severe and will require careful binational planning. The viability of many species and natural communities of the RG/RB region will ultimately depend on cooperative efforts of both countries.

Cooperators in the RG/RB Gap Analysis Project include CONABIO, the USGS Environmental and Contaminants Research Center, Texas Cooperative Fish and Wildlife Research Unit, and the U.S. GAP. Additional support and participation is being sought from diverse sectors of both countries (e.g., federal and state governmental agencies, universities, research institutions and nongovernmental organizations) as the project develops. The project is the first international Gap Analysis project supported by the U.S. GAP and is one of the first joint activities undertaken since BRD and CONABIO signed (on January 19, 1995) a Memorandum of Understanding for cooperative participation in the assessment and conservation of biodiversity between both countries.

Project Description and Challenges

RG/RB-GAP will use standard GAP methods (i.e. GAP 1997). Current analyses performed for TX-GAP will be extended to Mexican lands adjacent to the Lower Rio Grande (Gonzalez-Rebeles *et al.* in press). A map of land cover is being produced from satellite imagery and ancillary information. Vertebrate distributions are being predicted and mapped based on knowledge of their habitat associations and the spatial representation of those preferred habitats. Land stewardship, categorized by level of management relative to conservation potential, are also being mapped. This information will be combined as digital layers and analyzed in a GIS to evaluate how the different communities, the sites of maximum species overlap (richness), or individual species distributions are represented in existing managed areas,

and to identify potential "gaps" in conservation. In addition, both TX-GAP and RG/RB-GAP biological and geographic data sets will be combined for the integrated analysis and planning of land use and management of this important border region.

The study area proposed involves a region covered by fourteen Landsat satellite scene areas that span the river plus six adjacent scene areas wholly in Mexico, covering northern portions of the states of Chihuahua, Coahuila, Nuevo Leon, and Tamaulipas in Mexico (Fig. 1). *Editor's note: Because of its detail and color we were unable to reproduce this figure. Readers are encouraged to view it on the Web http://www.gap.uidaho.edu/gap/Bulletins/6/).*

Implementing RG/RB-GAP is challenging and exciting. For example, planning and organizing a program of cooperative participation and data-sharing among the states of both countries will not be easy. As in the U.S., different agencies and institutions within the Mexican states differ in their policies and procedures. In addition, as encountered by GAP in the U.S., the availability of biological information in Mexico and its level of detail and quality varies considerably among states. Fortunately, in recent years biodiversity data have been collected, organized, and further developed by CONABIO in coordination with major museums and universities. However, it will still be a challenge to integrate data sets among states within and between the countries into standard formats appropriate for an international gap analysis.

Linking geographic data sets will be particularly problematic. Maps from each country differ in scale and format. A regional analysis across both sides of the RG/RB will require the development of standardized versions of several map themes to complement those few maps having common characteristics. For example, the most frequently used vegetation classification schemes are fairly general (e.g., Miranda and Hernandez-X 1963, Rzedowski 1988), and vegetation studies are localized and large scale. New descriptions of vegetation formations and alliances are needed.

An advantage for RG/RB-GAP is that it was developed as a regional project from the outset. This is forcing an up-front development of strategies for standardization and merging data sets. Similar to other regional GAP projects in the U.S., this project is creating new opportunities for research and providing options for solving many of the problems facing the region. The project will also provide a better understanding about the applicability of the gap analysis approach when extended across the

international boundaries.

Conclusion

RG/RB-GAP in combination with TX-GAP will generate valuable geographical and biological data sets and analyses to support conservation and land use planning of the Lower RG/RB ecosystems. Both projects will provide opportunities for data sharing and standardization of procedures for the assessment and monitoring of this important international region and the shared ecological and economical interests. The adaptation and refinement of techniques and procedures will help CONABIO evaluate approaches needed to apply gap analysis to the rest of Mexico. In general, the associated research and experiences derived from this project will set a benchmark for coordination of gap analysis across North America.

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In Pursuit of the Aquatic Component of Gap Analysis

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While GAP has made huge strides in developing information on the biogeography of terrestrial environments for conservation assessments, much less has been accomplished for aquatic environments. The program's initial focus on terrestrial vertebrates and vegetation types was a choice based on what was achievable at that early time in our history. The issue is not which components of biodiversity we might specialize in, rather, how to pragmatically implement gap analysis. In principle, GAP is committed to developing biogeographic information for all species and habitats. How else could we claim to be in the business of assessing the conservation status of biodiversity?

The need to apply the GAP methodology to aquatic environments is now, more than ever, crucial to the survival of many aquatic species. The Nature Conservancy (TNC 1966) estimates that 68 percent of all freshwater mussel species, 51 percent of crayfish species, 40 percent of amphibian species, and 39 percent of freshwater fish species are either vulnerable, imperiled, critically imperiled, or presumed extinct. These numbers of endangerment for aquatic organisms eclipse comparable figures for