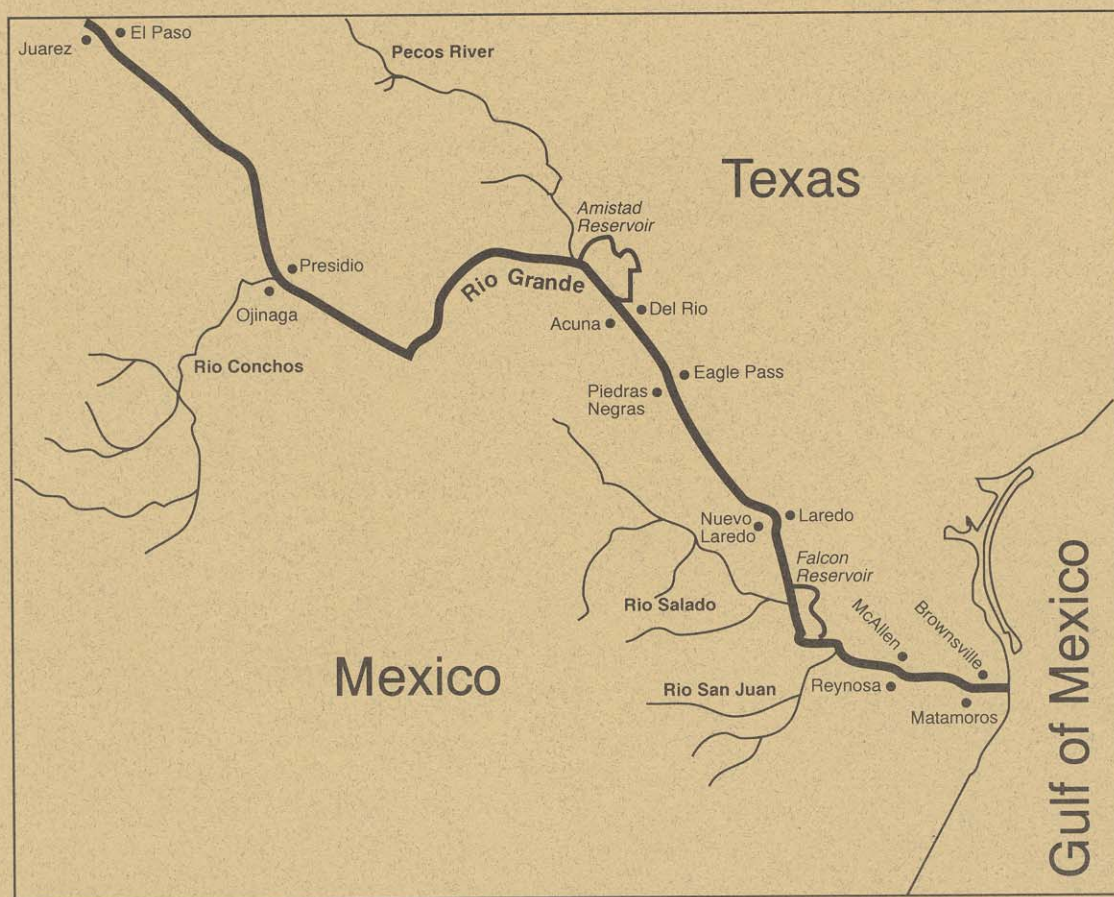


ENVIRONMENTAL ISSUES OF THE U.S.-MEXICO BORDER REGION

A Workshop Summary

Edited by
Howard L. Malstrom
Wayne R. Jordan



TEXAS WATER RESOURCES INSTITUTE

TEXAS A&M UNIVERSITY

OCTOBER 1994

Table of Contents

Foreword	i
Part A: Workshop Summary	
Introduction	1
Background	3
Pressing Issues of the Border Region	
Causal Factors	4
Resultant Effects	5
Consequences	8
Major Deficiencies in Current Programs	9
Recommended Activities	
Improve Communication and Coordination	10
Improve Management of Existing Data	12
Evolve a Comprehensive, Coordinated Research Plan	13
Part B: Appendices	
Appendix A Workshop Program	17
Appendix B Speaker Abstracts	20
Appendix C List of Participants	34

Foreword

In December, 1993, Deputy Director of the Texas Agricultural Experiment Station, Robert Merrifield, called together a group of scientists and administrators to examine the Station's programs to address a broad range of environmental issues associated with the U.S.-Mexico border region, and whether those problems would be likely to intensify with increasing trade following passage of the North American Free Trade Agreement (NAFTA). In this and subsequent meetings, the group concluded that while some locations and programs are properly positioned to address problems of rural communities and production agriculture, a broader effort by the Texas A&M University System (TAMUS) is needed to properly respond to research and educational needs of the border region. An awareness of developing activities and programs in State and Federal Agencies and at other universities led the group to conclude that an expanded TAMUS response should not be planned in isolation, but should complement activities already under way. The Workshop entitled "Environmental Issues of the U.S.-Mexico Border Region" was convened on the campus of Texas A&M University in College Station in an effort to share existing information, increase awareness of on-going activities and programs, and to assist TAMUS in planning expanded research, education and service programs for the region. Emphasis in the Workshop was placed on the Texas portion of the U.S.-Mexico border.

On the first day of the Workshop, the breadth of existing programs was portrayed by representatives of three universities, seven State agencies and two Federal agencies. On the second day, participants were formed into discussions groups and asked to address three questions: What are the most pressing environmental issues of the border region that are likely to be intensified by expanded trade?, What are the most critical deficiencies in information necessary to manage transboundary resources?, and What can be done to enhance collaborations to eliminate information gaps?. Robert Maggio, Ronald Lacewell and C. Allen Jones acted as discussion leaders for the three groups, and James Dunlap, Robert Brown and Howard Malstrom recorded the group's findings. Howard Malstrom synthesized these findings into this Workshop Summary published as part of the Texas Water Resources Institute's technical report series. We express our thanks to members of the Workshop planning committee, speakers and participants for their efforts to make the Workshop a successful planning effort.



Wayne R. Jordan
Director
Texas Water Resources Institute

Environmental Issues of the U.S.-Mexico Border Region

Part A: Workshop Summary

INTRODUCTION

A July, 1994 workshop was held in College Station to examine information available on environmental issues facing the Rio Grande River basin along the U.S.-Mexico border in Texas. The objectives of the workshop were:

- 1) to identify current university, state, and federal data bases for the region;
- 2) to inventory research and analytical capabilities; and
- 3) to determine future research plans and projects of interest.

This report summarizes the workshop, which was organized and conducted by the Texas Water Resources Institute, a unit of the Texas Agricultural Experiment Station.

Additional development of the border region may result in the degradation of many aspects of the environment and ecosystem. Factors leading to this deterioration might include: population growth and urbanization, industrial growth, shifts in agricultural practices, and international politics. The impact of changes in these factors would be felt in, among other things, water availability, water quality, air quality, land use and management, food safety, coastal resources, and information coordination. Consequences of changes in both physical and social systems could include the degradation of human health, biodiversity, and quality of life. Whether an increase in general economic well-being in the region will come about as the result of increased trade and development is not yet certain. An economic increase could help compensate for the loss and damage to natural resources caused by urbanization and industrialization. On the other hand, a lack of economic improvement or, worse yet, an economic backslide, in conjunction with resource degradation could mean irreversible problems for the region's development, economic survival and quality of life.

Border region environmental problems are being addressed by both countries, but they suffer from lack of communication and coordination; lack of organization in assembling, analyzing, and interpreting existing data; and lack of a well-defined, comprehensive, and coordinated research plan for the region. Part of the mission of the College Station Workshop was to identify and recommend ways to contribute to the resolution of border environmental problems with a binational focus to evaluate the latter. The purpose of this report is to list and discuss each of the major

suggestions, which are:

- 1) to develop an organizational structure to improve coordination between U.S. and Mexican agencies;
- 2) to provide incentives to encourage better cooperative research ventures;
and
- 3) to name an umbrella coordinating agency for the development, assessment, and distribution of existing data from the region.

This report also presents major components of a strategic research plan for the border region, including the needs and expected research outcomes. Workshop participants identified the following natural resource and environmental problems as having greatest need for research: public health, water quantity and quality, agricultural land use, environmental conservation, ecosystem management, transboundary institutions, and transportation and international commerce. It is likely that collaborative research and planning will be required to provide solutions to these and other problems. Collaborative research activities will likely be shared among U.S. and Mexican universities, and State, Federal, and local agencies.

BACKGROUND

The Rio Grande corridor separating Texas and Mexico is more than 900 miles long and has a combined population of 3.4 million within 60 miles on either side of the international boundary. There are many pockets of population and agricultural activity within the two most prominent regions, the Upper Rio Grande Valley (URGV), and the Lower Rio Grande Valley (LRGV). The Upper Rio Grande Valley is dominated by the cities of El Paso and Ciudad Juarez, which have a combined population of 1.5 million (600,000 in Texas) and a surrounding crop and orchard agriculture of about 100,000 acres. Both surface and groundwater are used, but agriculture is irrigated exclusively from waters of the Rio Grande. The URGV is significant for its population density, industry, and for its location as a transportation corridor between the U.S. and Mexico.

The Lower Rio Grande valley consists of four Texas counties extending from McAllen in Zapata County to Brownsville in Cameron County, and the counterpart area in Mexico. This region has a combined population of about 1.35 million (675,000 in Texas) and a combined crop and citrus agricultural acreage of about 2 million. It is a significant cotton, vegetable and sugar cane production center. Approximately one-third of the total acreage is irrigated. This region is also a major transportation route (though less so than El Paso-Ciudad Juarez) between the two countries.

Both regions have seen rapidly increasing population and industrialization over the past 30 years. The development of the maquiladora industries resulting from the 1965 Border Industrialization Program provided badly needed jobs and improved economic conditions in Mexico, but also may have exacerbated environmental problems along the border. Untreated or poorly treated domestic sewage and industrial effluents have impacted water quality; population demands have strained the finite limits of water availability and infrastructure; and increased international road traffic has adversely affected air quality. Increasing urbanization and industrialization have heightened concerns over potential resource use and abuse.

Agriculture, due to its extensive acreage and intensive character, is having an impact on the environment. Some agricultural lands are becoming salinized, contamination of ground and surface water by pesticides and fertilizers may be significant, burning of crop residue may impact air quality, and the health and habitat for wildlife may be degraded. Agriculture has traditionally been the largest consumer of water and now faces strong competition from growing municipal, industrial, and environmental users.

Efforts to protect environmental and ecological systems along the international boundary are influenced by cultural, political, technical, and economic conditions in each country. Proper planning for additional border development is essential if additional environmental problems are to be avoided. However, the ultimate solution to natural resource problems will also involve a long-term investment in

monitoring the environment and remediation of impacted regions through transboundary institutions. The relative lack of coordination among institutions, agencies, and the two nations is a significant impediment to effective environmental protection. The overall objectives of this report are to delineate the critical environmental issues facing the U.S.-Mexico border region in Texas, and to recommend actions for addressing these problems.

PRESSING ISSUES IN THE BORDER REGION

Workshop participants identified many issues involving a wide range of topics that are believed to be important environmental problems in the border region. For convenience, this report divides the issues into the following categories which will be discussed in turn: causal factors, the resultant effects on physical resources, and the possible consequences.

Causal Factors

Population Expansion and Industrial Growth

A significant portion of the environmental degradation can be ascribed to the recent population explosion along the border. The high rate of the population expansion, (a 100% increase in the past 20 years), in a region with a high poverty rate and a low tax base, does not permit a proportional expansion of infrastructure. The rapid increase (as high as 19% annually) in maquiladora development (there are about 650 along the Texas border, employing about 250,000 people) has contributed significantly to the population growth. The industries draw people, who in turn deplete natural resources and overextend limited municipal facilities while generating industrial wastes and smoke which directly degrade water and air quality. The lack of infrastructure expansion can be cited as one of the most important reasons for environmental degradation along the border.

Shifts in Agriculture

The industrialization of the border region and changing demographics have significantly affected the predominant agriculture of the region. Urban encroachment, economics and competition in production, and soil salinity have been major causes for reductions and changes in crop pattern. Reductions in planted acreage is sometimes coupled with increased use of pesticides due to labor shortage.

Passage of the recent NAFTA may have dramatic effects on some agricultural trends in both countries. Much of the labor intensive vegetable production may move to Mexico (probably to the interior) and this will change the crop mix and land use patterns of agriculture in south Texas (LRGV). These changes will heighten concerns about destruction of wildlife habitats, shifts in water use, location and

quality of waste water discharges, food quality and safety, and the interface between agriculture and urban sectors.

Trade Agreements

Beginning in the mid 1980's, many of the barriers to trade between the U.S. and Mexico were phased out. Furthermore, basic reforms in Mexico regarding less governmental interference, privatization, protection of foreign capital, and governmental reform led to marked increases in commerce between the two countries. Beginning with development of the maquila industry, there were dramatic increases in population and industry along the border. Continued expansion of free trade may result in a shift of maquilas into the interior of Mexico, but population and industrial growth along the border corridor continues at a rate greater than the average for either country as a whole. The population and industrial growth is occurring in a region of significant biodiversity where the historical habitat supports a myriad of animal, bird and plant species, but intrusions of man have been minimal.

International Differences

In addressing issues impacting an international border of two sovereign countries, perceptions of problems and solutions are exacerbated. Differences in culture, language, economic development, regulations and enforcement, political structure and function, technical capabilities, and potential to change, are serious impediments to addressing transboundary resource problems. Since the environment and many natural resources transcend the political boundary, activities on one side of the border directly impact the neighboring country and its people and resources.

Resultant Effects

Water Availability

There are concerns about the increasing consumption of water and future reservoir development in Mexico, which could have a significant impact on water availability in the LRGV. With increasing demand on a fully appropriated supply, there will likely be a shift away from agriculture and toward urban requirements. Changes within an industry, such as more efficient delivery and field application systems for agricultural irrigation, can alter the needs/uses scenarios. This raises questions regarding institutions to facilitate these changes in use and the impact of such changes on river flow and quality of water draining to the Laguna Madre from both the river and the Arroyo Colorado. The struggle between current agricultural interests and urban needs are important considerations from an international standpoint.

In both the URGV and LRGV, agriculture depends exclusively on surface water,

whereas the municipalities in the URGV use a combination of ground and surface waters for potable needs. In the URGV, recharge into aquifers is insufficient to replace usage and ultimately there will be more dependence on surface water. Practically all water needs, agricultural and municipal, in the LRGV are satisfied from the Rio Grande river. High dependence on surface water places great emphasis on climatic conditions and upstream water developments and uses.

With the intensification of population, industry, and agriculture on both sides of the border region, there is an inevitable competition for all resources, but especially water. Water is limited and is a shared resource between the U.S. and Mexico. The sharing of surface and groundwaters has been at the center of dispute between the two nations in the past, often to a point of contention in the U.S.- Mexico relations. The future growth and sustainability of the region will largely depend on effective and efficient management of limited water supplies.

Water Quality

Infrastructure, such as centralized waste water treatment systems, has not kept pace with growth in population and industry. With more uses and limited or no treatment, there is a natural deterioration of quality over time. Serious issues face agriculture, which in addition to contributing to non-point source pollution of water supplies, may also be damaging soils and crops by applying water of impaired quality. Thus, agriculture is not only impacted by water quality but also impacts water quality.

Agricultural activity, especially irrigation practices in the URGV, can be cited as responsible for increased salinization since drainage from irrigated land and runoff ultimately returns to the river. In contrast, the agricultural drain water for the LRGV moves through a canal drainage system into the Arroyo Colorado and eventually to the Laguna Madre, an estuary adjacent to the Gulf of Mexico. In the latter situation, contaminants from agriculture and municipal waste water or runoff may have a significant effect on aquatic and terrestrial wildlife. This means poor drainage results in salinization of soils while adequate agricultural drainage may impact coastal resources.

Air Quality

Air quality is impacted by agriculture, transportation, industry and the general public. Emissions from trucks and autos impact the entire region. Impacts from the pace of development along the border are unpaved roads (promote dust) and more truck traffic at already overcrowded border crossings. The indiscriminate burning of tires or other smoke promoting materials for domestic heating purposes and brick manufacturing also add to particulate emissions. The burning of sugar cane before harvest, though not considered a serious health problem, has become a 'nuisance' factor for the urban population and can impact ambient air quality. Southerly winds blow airborne contamination from Mexican factories and cities into Texas' sister

cities and adjacent areas.

Land Use and Management

The commercial and industrial development occurring along the border has both direct and indirect effects on the land. In addition to directly utilizing prime agricultural and wildlife habitat land in many cases, the waste by-products from industry and municipalities must usually be disposed of on land. In an intensifying urban development, the competition for land as a resource can be as intense as for other resources. It has both short-term and long-range effects on biodiversity from loss of habitats and on farming from loss of highly productive land. Also, availability of relatively unspoiled natural areas for recreation is viewed as a quality of life factor of increasing importance.

Food Safety

There are concerns regarding the quality of foods imported from Mexico. Many of the edible crops in which Mexico is expected to dominate may be produced under conditions where contaminated water and soil are employed and safety regulation enforcement is lax. Similarly, there are concerns that processed foods can also become contaminated which will necessitate extensive and costly inspections at the border. Mexico is also very concerned about the quality of food moving into their country.

Coastal Resources

Much of the Texas-Mexico border region is represented by significant diversity. A large number of distinct biotic communities have been identified, especially in the LRGV. Fishery resources in the LRGV consist primarily of the Gulf of Mexico shrimp fishery, which has been declining, and the shrimp farms located around Harlingen which have expanded. There are reports that the surface waters in the Rio Grande and the near coastal regions of the Gulf violate national fecal bacterial levels which can ultimately restrict shrimp and oyster farming. In addition, the issues of sport fishing, tourism, protected wildlife areas and endangered species are affected with deterioration of coastal resources. Elevated fecal coliform bacteria levels also present a hazard to human health making the river unfit for human contact and the water unfit for human consumption without effective treatment.

Information Coordination

Information is a less obvious physical resource but an important one that has been intensified through many aspects of the dynamics of the border corridor and recent trade agreements between the U.S. and Mexico. There is an inherent danger that competition will lead to poor coordination and a lack of pooling of resources leading to inefficient use of funds committed to addressing issues along the border corridor. Likewise, there is a plethora of survey and other information in both countries

which has not been adequately analyzed and interpreted, and is not readily available. Interpretation and analysis of the vast data sets that relate to this region are needed to quantify the magnitude of issues and identify where data gaps remain.

Consequences

Human Health

The most serious and expensive consequence of environmental degradation is the impact on human health. The public health risk from declines in water quality, air quality, land misuse, and food safety needs to be assessed in order to establish priorities for remedial action.

Problems in assessing the effects of environmental pollutants on human health include an existing database that either lacks accurate, definitive data, or data that are not readily available, or both. There is evidence that many perceptions of problems are not borne out by scientific studies. Cause and effect relationships between human health and environmental quality are not well established which greatly impedes any efforts to address the problem.

Biodiversity - Wildlife and Fisheries

The Rio Grande river system, especially the LRGV, is host to many Federal, State and private wildlife refuges. Over 100 species which inhabit this region require immediate protection and 80 species are on the endangered list (US Department of Interior). Some preliminary surveys have found pesticides and heavy metals in fish samples in the LRGV.

Dam building, agricultural development and market growth in the LRGV have had a significant impact on the region's ecological integrity and wildlife habitat. Competition between needs of wildlife and needs for further economic development is likely to be a visible and emotional environmental issue during the next few years. Water management for flood control and drainage has changed the level of the water table, sub-surface water flows, and nature of discharge into the Gulf of Mexico. Ninety-five% of the original habitat in the LRGV has been lost due to urbanization and agricultural and industrial development.

Economic Considerations

Ultimately, whether a place is desirable for habitation will depend on its resources and vitality in being able to provide those essential elements to make it desirable. The border area is plagued by an economic inability of Mexico to provide infrastructure and a limited tax base and poverty situation on the U.S. side. Until the economic picture can improve for residents along the border, perhaps as a result of trade liberalization, it will be difficult to correct many of the problems without

financial support from outside the region. Likewise, it will be critical that planning for future development of the area be done or the present situation will be perpetuated.

Quality of Life

This terminology is often a platitude to generalize a good or bad situation for the people involved in consequences of some action. Obviously, living in a region with poorly planned urban expansion and lagging infrastructure development may not provide the best quality of life. Improvement and enjoyment of all aspects of importance to a certain area include many of the issues discussed above and is the ultimate objective in establishing a desirable environment.

Major Deficiencies in Current Programs

Workshop participants were divided into three discussion groups and asked to share ideas relative to these questions: What are the most pressing environmental issues of the border region that are likely to be intensified by expanded trade?, What are the most critical deficiencies in information necessary to manage transboundary resources?, and What can be done to enhance collaborations to eliminate information gaps? For this report, these shared ideas are combined into three general topics.

Lack of Communication and Coordination

Agency, institution, and international communication has been insufficient and most involved agencies have limited awareness of current activities, available data or level of processing. Competing missions and activities among agencies is counter-productive. The external perception is that each agency has a desire to position itself to be the lead group and few, if any, wish to simply be a cooperator, or team player. This approach is costly and does not lead to coordinated, comprehensive solutions. Perhaps a major reason for competition is a lack of incentives to cooperate and collaborate. Cooperative agreements and joint funding which encourages multi-agency participation are necessary ingredients, but it is clear that a lead agency is needed to improve communication and information flow.

Lack of Organization in Assembling, Analyzing and Interpreting Existing Data

Mention was made numerous times that no organized mechanism is in place to develop existing data into a usable form supported by the appropriate analyses and interpretation. Many people and groups see the larger issues but fail to appreciate that technologies and databases are available that could have a dramatic impact on how issues are addressed. A system is needed for implementing data management technologies which might include demonstration to provide user confidence, cost-

sharing to protect natural resources, and finally a useful educational program.

There has been a lack of analysis of existing data beyond the purposes for which it was originally collected. It is incumbent on the responsible groups to accelerate the processing and analysis of existing data to avoid duplication and to conserve monetary and personnel resources. A summary of this information would be useful to quantify and begin dealing with existing problems. This also provides a mechanism to identify serious data gaps and eliminate redundancy.

It is necessary that uniform standards of format and quality control be met when collecting and organizing data from an international region. There are major concerns relating to the quality of existing data and relevance to similar data sets. A uniform standard for measure and confidence in quality assurance of data is needed and all interested groups need to participate and contribute.

There is also a lack of accurate and relevant information on cause and effect. The impact of human activities whether agricultural, industrial, municipal, political, or demographic as outlined in this report may not be well related to effects on human health and the environment. Many opinions on issues have been offered where the relationship is not well established or the concepts of cause and effect are overstated or incorrect. A comprehensive, competent risk assessment needs to be done to definitively establish cause and effect relationships among activities, environmental contaminants, and human health.

Need for Comprehensive Coordinated Strategic Research Plan

Currently, there are a number of universities, research stations and governmental agencies located in close proximity to the border. Research initiatives have been largely singular and fragmented due to competition for resources and differences in capabilities and perceptions of need. In order to address priority issues and solve the environmental concerns of the border, it is imperative that a coordinated research plan be developed to couple data collection activities with plans for implementation and education.

RECOMMENDED ACTIONS

Improve Communication and Coordination

Develop Binational Organization

An officially chartered binational organization should be developed to:

1. Coordinate activities within U.S. and Mexican institutions;
2. Develop a directory of U.S. and Mexico agency roles, activities,

capabilities, contacts, and personnel;

3. Develop and distribute a catalog of databases and research information meeting requirements for adequate Quality Assurance/Quality Control;
4. Develop and make available databases of: water, soil, biodiversity, geology, sociology, economics, demographics, topographies, commerce, climate, transportation, and air;
5. Promote inter institutional, interdisciplinary projects;
6. Organize information transfer and educational meetings; and
7. Develop inter-cultural understanding and language skills of border residents.

Promote Collaboration Within Texas Groups:

The following actions would promote greater collaboration:

1. Establish a Rio Grande collaboration task force within the Governor's office;
2. Establish a Rio Grande River watershed funding mechanism to promote interagency cooperation;
3. Encourage collaboration between universities and Federal and State agencies with targeted funding;
4. Provide a list server for existing GIS data sets; and
5. Promote communication among municipal, industrial, agricultural, and health agencies.

Promote Collaboration Among Texas and Mexican Agencies:

Greater collaboration is also necessary between Texas and Mexican agencies and universities. Several suggestions are made here:

1. Establish effective working contacts between Texas and Mexico agencies;
2. Stimulate educational exchange to build consensus on needs, capabilities, and solutions to problems;
3. Develop joint project funding to stimulate collaboration through

partnerships;

4. Establish a clearing house of contacts by location, mission, discipline, and problem involvement; and
5. Enhance bilingual communications about problems and solutions to border problems.

General Suggestions on Specific Needs

Specific needs exist and general suggestions on how to address those needs are listed here:

1. Establish a binational institution to address binational resource policy issues;
2. Provide funds for project implementation where information is adequate; and
3. Provide incentives for scientists and regulators to collaborate. Some suggestions include cooperative agreements and joint funding. A system similar to the regional project concept where several States join to address an issue of common interest could be used.

Improve Management of Existing Data

Establish Data Entity

Workshop participants suggest that establishment of a single entity to inventory, archive, manage, and distribute existing data would benefit and expedite problem-solving along the Rio Grande Corridor.

1. The Texas Natural Resource Information System (TNRIS) has initiated this activity, but its mission should be broadened to seek, request, collect, summarize and distribute information already collected. Additional funding should be provided to archive and distribute databases from Mexico.
2. There is a need for high-quality digital, standardized, base map data for hydrology, transportation networks, Texas State land surveys, and other physical and natural resource components.
3. Gaps in data sets need to be identified, legal issues of data sharing should be resolved, and data should be analyzed to establish assessments based on effects of environmental changes on human health.

General Recommendations

Other general recommendations regarding data management include:

1. developing a Gopher system for accessing databases through Internet; and
2. establishing a database contact person in each State and Federal agency.

Evolve a Comprehensive, Coordinated Research Plan

Public Health Issues

The impact of the types and amounts of organic and inorganic contaminants in the Rio Grande River and its tributaries warrants a research program in risk assessment. The sources of contamination need to be precisely identified and their fate determined. There is also a need to develop cooperative programs with the Texas Department of Health, the Center for Disease Control, regional research hospitals, local health agencies and university researchers.

To fully investigate a complex problem such as this would require investigative expertise in soil science, chemistry, hydrology, biology, biostatistics, epidemiology, and the medical community

The outcome of such a program would give us a clear understanding on how to limit any future pollution inputs, an assessment of the consequences of past practices, and how to mitigate the adverse effects of any present exposure.

Water Issues

Public policy determinations on the sharing of transboundary water resources is critically needed. A detailed investigation is needed of the aquifers, movement of water, potential future needs and withdrawals. Studies of watersheds and potential for further development of surface water resources should also be considered. For water reallocation, effective and efficient mechanisms are needed such as water marketing within a region and across international boundaries.

Expertise would be needed in geohydrology, engineering, sociology, economics, and public policy/law. A coordinated approach in this area is essential in establishing international treaties in common natural resources management for sharing both surface and groundwater resources in the context of expanding population, industrial and agricultural requirements.

Agricultural and Land Use Issues

The impact of agricultural activities as well as urban encroachment on wildlife and fish populations and habitats and human health is not fully known. We need to explore new methods on how to reduce the impact of agriculture on water quality and to assess more management options for agriculture to utilize water of impaired quality. Planning to provide a buffer zone between agricultural production and the expanding population should be developed to minimize the impact of one sector on the other.

There is an immediate need to address policy options necessary to manage population growth and urbanization in relatively small regions. Although not popular in Texas or the U.S., the magnitude of problems may call for significant land use planning and management. It is implicit that such an approach will also be employed in Mexico where problems are more severe and economic opportunities more limited.

Expertise required to address these topics includes soil science, biology, range management, agricultural engineering, economics, political scientists, and geography (rural and urban land use planning).

Expected outcomes from such investigations would include a precise, quantitative assessment of the effect of selected agricultural practices on fish and wildlife sanctuaries in LRGV, such as the Laguna Madre and Laguna Atascosa, and guidelines for methods to prevent and correct any adverse impact. Better and more complete management options for the use of low quality water and land in the agricultural setting may lead to a sustainable agriculture for the region. These investigations would also provide vital information as to how agricultural and urban communities could co-exist in close proximity to each other.

Environmental Conservation

A basic understanding of the impact of population, industry and agriculture on the ecology of the region is necessary if we intend to manage means to change or the impacts of these changes. Information is needed on how to protect and increase the biodiversity of species in concert with economic development.

Outcomes to be realized would include a clear understanding of the driving forces which are unique to the border regions and are highly correlated with the species and genetic richness. Definitive information would be gained relative to the steps which need to be taken now and in the future to avoid loss of habitat and species diversity and promote natural ecosystem sustainability.

Transportation and International Commerce

Outdated roads and transportation systems due to the rapid growth in international

trade as well as municipal and industrial expansion has contributed to many of the problems along the border. Development of new transport containers, or methods for transport of hazardous materials, and emergency preparedness are important for the protection of the border environment. In addition, development and designation of truck routes can reduce traffic congestion. Efficient procedures for crossing the international boundary can eliminate a bottleneck that leads to emissions of noxious fumes.

Outcomes expected would include better planning in routing of traffic between and through border points and a minimization of the hazards involved in transport of certain materials which might pose high risk.

The natural resource and environmental issues facing the lower Rio Grande basin region will require coordination across nations and among Federal, State, county, municipal, and regional governments. Current programs that perpetuate redundancy because of their limited scope and competing missions must be replaced by efforts that promote efficient and effective use of limited resources to address the border problems. This report is designed to identify needs and provide suggestions.

Part B

Appendix A

Workshop Program

ENVIRONMENTAL ISSUES OF THE U.S.-MEXICO BORDER REGION

Program, July 7, 1994

- 8:15 Program Convenes - Wayne Jordan, Director, Texas Water Resources Institute
Welcome - Robert G. Merrifield, Deputy Director, Texas Agricultural
Experiment Station

Presentations:

- 8:20 Nancy Lowery, University of Texas at El Paso "Needs Assessment for the Transboundary
Resource Inventory"
- 8:40 Parr Rossen, Texas Agricultural Experiment Station "Economic Impacts of NAFTA in the
Border Region"
- 9:00 Rogelio Saenz, Texas Agricultural Experiment Station "The Demography of the Texas-
Mexico Border Region"
- 9:20 Dan Sisbarro, Houston Advanced Research Council "The Sustainable Development Initiative
for the Rio Grande Basin"
- 9:40 Dan Page and Roberta Ries, U.S. Bureau of Reclamation "The Bureau of Reclamation's
Future on the U.S.-Mexico Border"
- 10:00 *Refreshment Break*
- 10:20 C. Allan Jones, Texas Agricultural Experiment Station "Hydrologic Modeling of the Rio
Grande Basin"
- 10:40 Stephen Niemeyer, Texas Natural Resource Conservation Commission "Texas-Mexico
Border Programs of the TNRCC"
- 11:00 Medhi Ali, Texas Agricultural Experiment Station "The Role of the Frank Hernandez
Environmental Laboratory in Support of Environmental Science Programs"
- 11:20 Bryan "Bo" Spoons, Texas State Soil and Water Conservation Board "Senate Bill 503 and
319(h) Activities on the Border"
- 11:40 *Lunch Break*
- 1:00 Lloyd McKinney, Texas Agricultural Experiment Station "GAP Analysis: An Assessment of
Biodiversity in Texas"
- 1:20 Guy Fipps, Texas Agricultural Extension Service "Overview of Extension Water Quality
and Extension Programs in the Lower Rio Grande Valley"
- 1:40 Suresh Pillai, Texas Agricultural Experiment Station "Microbiological Research on the
Transboundary Water Quality Problems at El Paso"
- 2:00 Larry Ditto, U. S. Fish and Wildlife Service "Overview of Fish and Wildlife Service Land
Management Program in the Lower Rio Grande Valley, Texas"

- 2:20 Ismael "Smiley" Nava, Texas Parks and Wildlife Department "Texas Parks and Wildlife Department Programs to Identify and Minimize Impacts to Natural Resources Along the Texas-Mexico Corridor"
- 2:40 *Refreshment Break*
- 3:00 Robert Maggio, Texas Agricultural Experiment Station "The Mapping Sciences Laboratory - Its Purpose and Capabilities"
- 3:20 Charles Palmer, Texas Water Development Board "Texas-Mexico Borderlands Data and Information Center"
- 3:40 Mehrdad Moosavi, Texas General Land Office "Transboundary Resource Inventory of the U.S.-Mexico Border Region"
- 4:00 Angela Miller, Texas Natural Resource Conservation Commission "Rio Grande/Rio Bravo GIS Consortium Activities"
- 4:20 Instructions for second day's activities - Wayne Jordan

Program, July 8, 1994

Workshop participants should report to their assigned breakout rooms by 8:15 a.m. Each breakout group will consider and discuss identical questions, but group assignments are made to diversify the disciplinary interests of the participants. Please remain in your assigned group which is indicated by the colored dot on your name tag.

		<u>Group Leaders</u>	<u>Recorders</u>
Room assignments:	Red - 601 Rudder	Bob Maggio	Jim Dunlap
	Blue - 502 Rudder	Ron Lacewell	Bob Brown
	Yellow - 504 Rudder	Allan Jones	Howard Malstrom

- 8:15 - 9:45 Topic 1 - What are the most pressing environmental issues of the border region that are likely to be intensified by expanded trade?
- 9:45 - 10:15 *Refreshment Break - 601 Rudder*
- 10:15 - 11:45 Topic 2 - What are the most critical deficiencies in information necessary to manage transboundary resources?
- 11:45 - 1:00 *Lunch Break*
- 1:00 - 2:30 Topic 3 - What can be done to enhance collaborations to eliminate information gaps?
- 2:30 - 3:15 Session leader reports and adjournment

Appendix B

Speaker Abstracts

*Economic Impacts of NAFTA in the Border Region:
Prospects for Texas Agriculture*

Parr Rossen
Department of Agricultural Economics
Texas A&M University System
College Station, Texas

Since the early 1980's, U.S./Mexico agricultural trade has more than tripled, reaching \$6.6 billion in 1993. U.S. food/fiber exports to Mexico were valued at \$3.7 billion in 1993 and included: grains, meats, poultry, livestock, dairy products, and other processed food products. Mexican agricultural exports to the U.S. were valued at \$2.7 billion, making Mexico the major supplier of fresh winter vegetables and feeder/stocker cattle, and an important source of tropical fruits, juices, and coffee.

Most analysts expect these trends to continue and even increase as NAFTA reaches full implementation and trade patterns more clearly reflect each country's natural comparative advantage. After NAFTA is fully implemented in 2008, U.S./Mexico agricultural trade is expected to exceed \$10.0 billion. While expanded trade is expected to have overall positive economic impacts on both nations, some highly protected and labor intensive sectors will experience more import competition, lower prices, and dislocation of labor.

Texas agriculture should experience net economic benefits from expanded trade, even though some sectors will face additional import competition. NAFTA will likely increase U.S. imports of Mexican products such as broccoli, cucumbers, cantaloupe, watermelons, honeydew melons, and onions which are protected by high, but declining duties (17-35% ad valorem), during transition to freer trade. As trade barriers are phased out, imports will increase, resulting in lower prices and negative impacts. Suppliers of seed, fertilizer, and other chemicals may experience minor economic losses as production declines in some regions. Lower business volume for input suppliers will likely lead to lower employment in certain areas of the state, particularly the Lower Rio Grande Valley. Specialized infrastructure, such as packing sheds, may gain as imported volume expands and capacity increases. Some may close, while others will survive only by relocating nearer production in Mexico. Most food processing plants will experience gains in employment as imports expand and capacity is more fully utilized, others may be forced to close or relocate nearer sources of raw material. The overall impact on employment is indeterminate with presently available information.

Consumers will be the primary gainers from additional imports of Mexican produce. Lower prices can be expected for traditional crops (tomatoes and onions) and for tropical products. But additional imports may lead to increased concerns about food safety and the presence of chemical residues in fresh products. Taxpayer costs to monitor and inspect greater import volume will likely increase. Concerns regarding human, animal, and plant health will likely become more important. Retail trade in the border region should anticipate lower sales as U.S.

businesses increase exports to Mexico or locate there to serve a growing market. Fewer Mexican consumers will need to visit the border to find the bargains that once existed only in the United States.

While net environmental impacts are uncertain, it does appear likely the border area will receive a boost from increased income growth and expanded funding of environmental infrastructure through multilateral donors, including the North American Development Bank. Increased trade and the associated economic growth should lead to increased demand for environmental quality and improvement of living conditions along the border. Certainly the expansion of remedial environmental efforts, such as improved sewage treatment, will be more viable as trade increases. Regulations established under the North American Commission on the Environment (NACE) should result in a more environmentally sound border region.

The Demography of the Texas-Mexico Border Region

Rogelio Saenz
Department of Rural Sociology
Texas A&M University
College Station, Texas

Over the last decade U.S. border communities have found themselves at the center of national debates regarding demographic, economic, and environmental issues. These debates have perhaps been the most evident along the Texas-Mexico border. These issues have reflected the large-scale population growth and the continued high levels of poverty found in this region. This analysis uses data from the 1980 and 1990 censuses to describe the demographic and socioeconomic trends taking place in the Texas border region, delineated as the 41 counties located closest to the Texas-Mexico border.

The results from the analysis reveal several patterns. First, while the population of the border region grew at a faster pace than that of Texas as a whole, the growth in the border region was concentrated in the larger metropolitan areas. In fact, approximately 90% of the border population growth during the 1980s took place in five counties: El Paso, Hidalgo, Cameron, Webb, and Zapata. In contrast, smaller, rural areas either grew very slowly or declined in population during the decade. Second, population growth in the Texas border region has been due primarily to the growth of the Hispanic population, which increased by 33% between 1980 and 1990 compared to a 2.1% decline in the Anglo population. The Texas border region contained close to 1.9 million people in 1990, with three-fourths being Hispanic. Third, the border region continues to be characterized by low levels of education and high rates of poverty, with this pattern being particularly evident in the smaller, rural areas of the border region.

*The Sustainable Development Initiative for
the Rio Grande/Rio Bravo Basin*

Dan Sisbarro
Center for Global Studies, HARC
Houston, Texas

The objective of the Sustainable Development Initiative is to promote constructive, problem-solving networks at the "working level" to address water, environmental and developmental concerns on local, basin-wide, and international bases--in short, to implement sustainable development as a balance of economic and ecological concerns that lead to a higher quality of life by considering the short as well as the longer term, and giving equal attention to efficiency and equity. Basin-wide networking and promoting local working groups are the means by which we advance the initiative.

The Rio Grande/Rio Bravo Basin is a vibrant, rapidly developing region. Land, water, air and bio-diversity are at risk in many places, as are traditional cultures and lifestyles. Growth has been rapid in many areas--population, industry, agriculture--placing stress on communities and infrastructure. This poses two central questions: (1) How can we build a viable future in this region which respects the needs of people as well as all parts of the environment? (2) What kind of organizations are needed to plan and implement sustainable development in the region?

We seek sustainable development that balances economic development and population growth with prudent use of natural (air, land and water) and human resources. Such development should allow the Rio Grande/Rio Bravo Basin to improve its social, economic, and environmental quality of life. The time has come for the citizens of the basin to organize so that they become partners in shaping the future of their cities and homesteads. Sustainable development needs unified action by all, both at local, regional and binational levels.

Initially, the initiative was guided by five institutions from Mexico and the United States who maintained a common commitment to a community based approach which stressed regional self-determination. These institutions are El Colegio de la Frontera Norte (COLEF), Houston Advanced Research Center (HARC), La Universidad Autónoma de Nuevo León (UNAL), the University of New Mexico (UNM) and the University of Texas at El Paso (UTEP). Major funding for the initiative was provided by the Ford Foundation in New York City and Mexico City. Additional funding came from the Big Bend National Park, the General Services Foundation, the Jamail Foundation, HARC, UN, and UTEP.

While these institutions continue to be involved, five sub-basin working groups have formed--the Upper Basin, Paso del Norte, Central Basin, Rio San Juan, and the Lower Basin. Each of the working groups is building local consensus on strategies to tackle local concerns. Some of the working groups are involved in specific projects.

As a result of the May 1994 El Paso Conference, which brought together the sub-basin working groups from throughout the basin, as well as public, private and non-profit interests, five priorities were agreed upon--to strengthen the sub-basin working groups, create a basin-wide network/coalition, address the need for basin-wide public institutions, develop and education program on sustainability in the basin, and link research to sustainable development. In the upcoming year we will be developing action plans to implement these recommendations.

*The Bureau of Reclamation's Future
on the U.S.-Mexico Border*

Dan Page and Roberta Ries
United States Department of the Interior
Bureau of Reclamation
Rio Grande Project
El Paso, Texas and Denver, Colorado

Reclamation was established in 1902 to reclaim the West. The intent was to provide an irrigation water to lands to encourage settlement. This original mission was expanded over the years to include power, municipal supplies and environmental projects. In Texas, Reclamation has been involved in the Balmorhea, Canadian River, Lower Colorado River, Rio Grande Rehabilitation, Malaga Bend, Nueces River, Palmetto Bend, Pecos River Basin Water Salvage, Rio Grande and San Angelo Projects. These projects, along with the other projects in the other 16 western states have played an important role in the development of the West. In the process of this development Reclamation became an important federal engineering and construction organization.

However, internally in Reclamation we have recognized for a number of years that the development of large water projects is a thing of the past. In recognition of this fact, the current Commissioner of Reclamation has issued a Blueprint for Reform to transform the agency from the premier water resources development agency to the premier water resources management agency in the world. Our mission is to manage, develop and protect water and related resources in an environmentally and economically sound manor in the interest of the American public.

Reclamation is currently involved in studies and activities along the border in Texas with the management of the Rio Grande Project in El Paso, a water resources study in West Texas and New Mexico and a Water Resource Study in the Lower Rio Grande. The Border offices of Reclamation are involved with a number of the groups making presentations today as well as others to identify, discuss and hopefully solve the environmental issues of the border.

Reclamation can be involved financially under its existing projects, by specific line item studies under its investigation program, technical assistance to states, or with other special authorities such as research, salinity projects or water conservation.

To obtain further information on Reclamation programs contact should be made to the local offices in Austin and El Paso.

The Denver Office of Reclamation (which is reorganizing into the Technical Service Center) has developed and worked with a number of programs which may be of interest to this group.

Hydrologic Modeling of the Rio Grande Basin

C. Allan Jones
Blackland Research Center
Texas Agricultural Experiment Station
Temple, Texas

A prototype hydrologic modeling system of the Texas portion of the Rio Grande Basin has been developed. Basic components include the Soil and Water Assessment Tool (SWAT); tabular and spatial input databases including topography, soils, land use, weather, stream networks, drainage basins, and related hydrologic information. The system is being developed as a proof of concept with the final objective of a complete, integrated hydrologic and water quality for the North American Free Trade Agreement region (Mexico, United States and Canada).

Anticipated enhancements within the Rio Grande Basin include simulation of Mexico, New Mexico, and Colorado watersheds; irrigation, municipal and industrial withdrawals and return flows; diversions outside the Rio Grande drainage (e.g., the Arroyo Colorado); reservoir management; and salinity and other water quality parameters.

The completed system will permit rapid, cost-effective, and biophysically realistic assessments of alternative water resource management policies, including their effects on agriculture, wildlife, and municipal/industrial interests.

Border Programs of the Texas Natural Resources Conservation Commission (TNRCC)

Steve Niemeyer
Texas Natural Resources Conservation Commission
Austin, Texas

The TNRCC has more than 87 programs and activities specific to the border or that are statewide and have a border component. A brief overview of some of the specific programs follows.

Office of Air Quality

The Office of Air Quality has several ongoing air programs, including: continued air quality monitoring and emissions inventory data gathering activities, particularly in El Paso/Juárez area; and continued support of the Paso Del Norte Air Quality Task Force, which has initiated several projects aimed at improving regional air quality on a bi-monthly basis, among which are the development plans for an International Air Quality Management District in the Paso Del Norte Region.

Office of Legal and Regulatory Services

The TNRCC has four regional offices, in El Paso, Odessa, San Antonio and in Weslaco and Harlingen in the Lower Rio Grande Valley, which perform inspections, monitoring and enforcement. They also respond to citizen complaints.

Office of Pollution Prevention and Reduction (OPPR)

OPPR has a border initiative which includes training, technical assistance and voluntary source reduction programs targeted to border industries. Projects include: pollution prevention site assistance at industrial facilities; development of a public education campaign to promote pollution prevention in the region; technical training and workshops for pollution prevention projects; and establishment of voluntary pollution reduction programs primarily for the maquiladora industry, modeled on the TNRCC's Clean Industries 2000 program.

Office of Waste Management

The Maquiladora and International Waste Program regulates transboundary shipments of hazardous and industrial non-hazardous waste into or through Texas. TNRCC implemented a new tracking system for maquilaodras which is site-specific and will provide increased visibility from data collected on waste generated in Mexico.

Office of Waste Resource Management

The TNRCC border programs related to water include: ensuring the TNRCC does its part in the delivery and provision of wastewater and water services to colonias; managing the surface water resources of the region in the most efficient way; continuing and expanding programs related to protection of groundwater and safe drinking water; and the ongoing Rio Grande/Rio Bravo Regional Assessment of Water Quality and the continuing surface water quality monitoring program.

The Role of the Frank Hernandez Environmental Laboratory in Support of Environmental Science Programs

A. Mehdi Ali
Agricultural Research and Extension Center
Texas A&M University
El Paso, Texas

The Frank Hernandez Environmental Laboratory was established in 1992 primarily to support the newly-developed environmental science program at the El Paso Research Center. The high capability of the laboratory, through the use of computer controlled instrumental chemical analysis, would increase sample through-put. Therefore, there will be increased opportunity for involvement in cooperative projects with other locations and institutes. Some of the specific environmental projects the laboratory is supporting include:

- Use of laboratory as a training facility for students and technicians (especially from Mexico).
- Research Enhancement Program (REP) "Spatial Variability Effects on Solute Retention and Leaching in Irrigated Fields."
- Biosolids application and use of effluent sewage water in agricultural land.
- C:N ratio in composting soilless material.
- RNR (nutrients and salts in forest soil) and CFC studies.

The laboratory is in the process of certification and accreditation under EPA Performance Evaluation Studies for both water pollution and drinking water. The laboratory is fully equipped for inorganic and some organic chemical analysis.

Senate Bill 503 and 319(h) Activities on the Border

Bryan "Bo" Spoons
Texas State Soil and Water Conservation Board
Temple, Texas

The recent Texas legislation concerning agricultural/silvicultural nonpoint source pollution abatement has generated much interest. There are activities which are beginning to occur state-wide as well as plans to expand to agricultural areas in the border region. The producers on the local level should contact their local SWCD for information concerning availability of SB 503 funding for nonpoint source abatement in their area. A recent ruling by the Texas State Soil and Water Conservation Board limited the allocation to \$10,000 per person per year.

Clean Water Act 319(h) activities are continuing in the state as well as on the border region. The legislation in FY93, Senate Bill 502, set forth the Texas State Soil and Water Conservation Board as the lead agency for Agricultural/Silvicultural Nonpoint Source pollution. This has allowed the Board to apply directly for grant funding to the Environmental Protection Agency. Our program is closely coordinated with the existing program at the Texas Natural Resource Conservation Commission. A project is to begin in July 1994 to study and demonstrate Best Management Practices to abate nonpoint source pollution in the Arroyo Colorado region of the Rio Grand Valley. This project should have a positive impact on the border region.

Gap Analysis: An Assessment of Biodiversity in Texas

Lloyd B. McKinney
Department of Forest Science-Mapping Sciences Division
Texas A&M University
College Station, Texas

In Cooperation with

Nancy Mathews
TX Cooperative Fish and Wildlife
Research Unit
National Biological Survey
Texas Tech University

and

Joy Winckel
Department of Range and Wildlife
Management
Texas Tech University

The U.S. Fish and Wildlife Service initiated the Gap Analysis program in 1989 to establish a protocol to identify geographic areas with high levels of biodiversity (wildlife species richness) and important habitat attributes, relative to land-use and land ownership. Using geographic information technology, a nation-wide database is under development that includes layers representing vegetation communities, terrestrial vertebrate distributions, and boundaries of state, federally, or other types of protected land. A nation-wide analysis will be conducted to assess the level of protection afforded to areas of high biodiversity.

Texas formally joined the Gap Analysis program in late 1993. Construction of a state-wide vegetation map has begun. Vegetation communities have been determined based on the framework provided by the UNESCO classification system. Thematic Mapper (TM) imagery will be used to identify these classes using an unsupervised classification. Each vegetation class will then be refined using a supervised process relying on ancillary data and airborne videography. The minimum mapping unit selected for the state map will be 40 hectares. Map accuracy will be 80% or greater, conforming to national map accuracy standards, and will rely on the use of ancillary and aerial videography data sets. The creation of the data layers representing terrestrial vertebrate range maps and protected area boundaries will commence during the second and third year of the project. Anticipated completion data for the entire database is 1999.

Under the direction of the newly created National Biological Survey, Gap Analysis will become one of several tools used to assess the status of the nation's natural resources. Texas joins 34 states which have completed or have on-going Gap programs. Upon the completion of the entire lower 48 states in 1999, resources managers at the state, regional and national levels will have one of the most advanced and comprehensive tools with which to prioritize land use and conservation decisions.

*Overview of Extension Water Quality and Conservation Programs
in the Lower Rio Grande Valley*

Guy Fipps
Department of Agricultural Engineering
Texas A&M University
College Station, Texas

Texas Agricultural Extension Service is composed of Specialists from various departments at Texas A&M University, and county Extension agents. Extension programming priorities are determined in each county by locally organized committees. The local county committees in the Lower Rio Grande Valley have identified **Water Quality and Conservation** as one of their most important programming needs.

An overview of the issues faced by the Valley are discussed, along with examples of targeted Extension demonstration projects. One example is the irrigation water quality drainage demonstrations where total nutrient and salinity discharges and soil leaching are analyzed as related to irrigation water and nutrient management practices. Other projects include evaluation of improved irrigation technologies and management practices, environmental consequences of sludge application to farmland, and the development of an irrigation district simulation model combining G.I.S. with canal routing and crop growth models.

Last year a new program was initiated to evaluate the design and operation of alternative on-site wastewater treatment systems suitable for individual households, small communities and colonias.

*Microbiological Research on Transboundary Water
Quality Problems at El Paso*

Suresh D. Pillai
Texas Agricultural Research and Extension Center
El Paso, Texas

The El Paso-Ciudad Juarez sector of the U.S.-Mexico border is one of the most populous regions of the border with a combined population of more than 2 million people. Ciudad Juarez with a population of over 1.5 million people does not have any waste water treatment plant. On

the U.S. side of the border, many *colonias* have developed without adequate drinking water and waste water treatment systems. Consequently, the potential for widespread contamination of surface and groundwater resources exists. Though there have been reports on the extent of microbial contamination of border water resources, a majority of these studies have used traditional parameters such as fecal coliforms and total coliforms. The use of such bacterial indicators to estimate microbial contamination is fraught with limitations. The Environmental Microbiology research program at the Texas A&M University Research Center at El Paso is aimed at identifying the sources and extent of microbial contamination, estimating the public health risks and developing strategies to reduce the impact of microbial pathogens. The research program utilizes specialized molecular biology/biochemical techniques.

One of the larger on-going projects is the evaluation of bacterial, viral and parasitic protozoan contamination of surface and groundwater resources on the El Paso-Cuidad Juarez border. The bacterial component of this collaborative study focuses on the extent of contamination and the genetic relatedness of the various groundwater bacterial isolates. We are in the process of determining the genetic diversity of *Enterobacter* spp. isolates using a combination of plasmid profile analyses and genomic amplifications. The virus studies focus on determining the presence of enteric viruses in groundwater, while the protozoan component involves identifying the potential sources of *Cryptosporidium* spp. and *Giardia* spp. contamination. A related project is aimed at determining the metabolic status of microbial pathogens in canals and river sediments. Another ongoing project involves developing methodologies to identify the sources of contamination based on genetic/biochemical fingerprints of the contaminating organisms, and the changes they may induce among the indigenous microbial population structure. Being able to specifically differentiate animal, industrial and domestic wastes will be of significant importance in determining the sources of contamination and developing preventive measures. We are currently in the process of isolating bacterial isolates from human and animal waste streams and characterizing them using specific gene probes and antibiotic profiles.

Some of the other border related projects slated for the future include determining the role of environmental factors on the spread of bovine tuberculosis among U.S.-Mexico cattle herds, and attempting to correlate microbiological markers with chemical pollutant levels on the border.

*An Overview of the U.S. Fish and Wildlife Service
Land Management Program in the Lower Rio Grande Valley, Texas*

Larry R. Ditto
Project Leader
Lower Rio Grande Valley National Wildlife Refuge Complex
McAllen, Texas

The U.S. Fish and Wildlife Service has managed two national wildlife refuges in extreme south Texas since the mid-1940's. Nevertheless, 90% of the native vegetation in the lower four counties was cleared by the 1970s for agriculture and human development. A 1982 land protection plan created the Lower Rio Grande Valley National Wildlife Refuge to protect, enhance, and restore 11 biotic communities totalling 132,500 acres. Using the corridor concept, remaining large tracts of native brush will be acquired or otherwise protected and connected by habitat corridors. The area has a greater diversity of plants and animals than any place in the U.S. with the possible exception of south Florida. Land is being acquired from willing sellers with funds appropriated by Congress from the Land and Water Conservation Fund. Management includes active water management and reforestation to aid the restoration of riparian and thorn brush habitat. Water and air quality should be improved and economic improvement through recreation and eco-tourism should be realized. Mexico voices a desire to participate. Numerous issues have arisen as NAFTA and rapid development spur growth and competition for natural resources. The refuge program requires interaction and planning with virtually all agencies and political bodies in south Texas.

*Texas Parks and Wildlife Department Programs to Identify and Minimize
Impacts to Natural Resources Along the Texas Mexico Corridor*

Ismael "Smiley" Nava
Texas Parks and Wildlife Department
Resource Protection Division

The Resources Protection Division of the Texas Parks and Wildlife Department is represented by four branches: Endangered Resources, Environmental Quality, Habitat Assessment, and Aquatic Studies. Each branch is involved in projects which include one or more of the following tasks related to border issues and state natural resources: minimizing degradation or impacts, enhancing habitat or other natural resources, inventorying natural resources including endangered or threatened species, and contaminant assessment. Some tasks concerning border issues performed by each branch are summarized below; capabilities and resources provided by each are noted where applicable.

Endangered Resources Branch

1. The Branch is currently working closely with private landowners to manage several endangered and threatened plant and animal species.
2. The Branch is working on a current inventory of plants in national wildlife management areas.
3. The Branch is involved in a large scale departmental initiative to inventory habitat and species along the border, and have that data acquired and managed by Mexico and United States Conservation Data Centers (CDC's) to be strategically located along both sides of the border. CDC's will be developed to include GIS capabilities, Heritage data capabilities, and teams to conduct Rapid Bio-Assessment capabilities.

Habitat Assessment

1. The group is currently involved with hearings at the Texas Railroad Commission regarding mining activities of DOS Republicas near Eagle Pass. Issues include sightings of endangered species in the mining or project site, and habitat concerns.
2. The group plans for a workshop to discuss ecological impacts regarding dredging operations in the Lower Laguna Madre are underway. Immediate concerns include levee breaks of impounded spoil material and resuspension of contaminants.
3. The branch has GIS laboratory capabilities located at the headquarters complex. Varied GIS computer assisted equipment includes the following: ARC INFO and ARC View on PC's and workstations; digitizers; large format scanner (black and white); and large format plotters.
4. The GIS lab is currently in large scale project to digitize and scan the department's state parks and wildlife management areas including those along the Texas-Mexico border. Plans to map riparian habitats, changes over time, and introduction of non-native species along the border area has been proposed by NASA; also, a proposal to merge the nation heritage data along with border on maps for the Endangered Resources Branch are being discussed.

Environmental Quality and Aquatic Studies

1. Branch staff have collaborated and participated in field collection and contaminant assessment studies on two related projects with other state, federal and Mexican government agencies during the past two years. These include an intensive survey of the Rio Grande River termed the Rio Grande Toxic Substances Study which focused on stations from El Paso to Brownsville (freshwater reaches), and the Coastal Impact Monitoring Project (CIMP) which focused on contaminants in tidally-influenced waters (saltwater reaches).

2. The Aquatics Branch has varied biological sampling, collection and environmental assessment capabilities. Staff biologist's expertise also includes Rapid Bio-Assessments (RBA's), Index of Biological Integrity, and collection of fish voucher specimens from across the state including the Rio Grande River, and other aquatic inventory capabilities.
3. The Environmental Quality Branch has on staff a Contaminant Biologist and also a functional environmental laboratory which specializes in contaminant analyses of tissue (fish) samples.

Appendix C

List of Participants

Registration List

Ali, Dr. Medhi
Texas A&M University Agricultural Research
Center
1380 A&M Circle
El Paso, Texas 79927
(915) 859-9111

Arriola, Dr. Roland
Center for Entrepreneurship
University of Texas - Pan American
1201 W. University Drive
Edinburg, Texas 78539
(210) 381-3361

Assadian, Dr. Naomi
Texas A&M University Agricultural Research
Center
1380 A&M Circle
El Paso, Texas 79927
(915) 859-9111

Brown, Dr. Bob
Professor and Head
Wildlife and Fishery Sciences Department
Texas A&M University
College Station, Texas 77843-2258
(409) 845-1261

Bryant, John
Energy Systems Laboratory
Mechanical Engineering Department
Texas A&M University
College Station, Texas 77843-3123
(409) 845-6402

Byers, Dr. Floyd
Animal Science Department
Texas A&M University
College Station, Texas 77843-2471
(409) 845-5065

Clarke, Dr. Neville
Executive Director
Southern Association of Agricultural
Experiment Station Directors
Centeq Research Plaza, Ste. 241
College Station, Texas 77843-2129
(409) 845-2855

Colwick, Mr. Allan
USDA, SCS
101 S. Main
Temple, Texas 76501-7682

Cummins, Ms. Billy
D-5930
U.S. Bureau of Reclamation
P. O. Box 25007
Denver Federal Center
Denver, Colorado 80225-0007
(303) 236-9306

Davis, Dr. Don
College of Veterinary Medicine
Veterinary Pathobiology Department
Texas A&M University
College Station, Texas 77843-4467
(409) 845-5174
(409) 845-9972

Davis, Dr. Jim
Wildlife and Fisheries Science Department
Texas A&M University
College Station, Texas 77843-2258
(409) 845-7473

Ditto, Mr. Larry
US Fish and Wildlife Services
Acquisition Office
320 North Main, Room 225
McAllen, Texas 78501
(210) 630-4636

DuBowy, Dr. Paul
Wildlife and Fisheries Science Department
Texas A&M University
College Station, Texas 77843-2258
(409) 845-5777

Dunlap, Dr. James
Texas A&M University Agricultural Research
and Extension Center at Weslaco
2415 East Highway 83
Weslaco, Texas 78596
(210) 968-5585

Dyke, Dr. Paul T.
Blackland Research Center at Temple
808 E. Blackland Road
Temple, Texas 76502
(817) 770-6612
Email: dyke@iiml.tamu.edu

Fenn, Dr. Lloyd
Texas A&M University Agricultural Research
Center
1380 A&M Circle
El Paso, Texas 79927
(915) 859-9111

Fipps, Dr. Guy
Agricultural Engineering Department
Texas A&M University
College Station, Texas 77843-2117
(409) 845-7454

Gilley, Dr. James
Agricultural Engineering
Texas A&M University
College Station, Texas 77843-2117
(409) 845-3940
E-Mail: Gilley@Zeuss.TAMU.EDU

Gonzalez, Mr. Hector S., Director
Border Environmental Health Office
Texas Department of Health
1100 W. 49th St.
Austin, Texas 78756
(512) 458-7675

Goodell, Dr. Philip
Department of Geological Science
University of Texas - El Paso
El Paso, Texas 79968-0555
(915) 747-5501

Harris, Dr. Bill
Soil & Crop Sciences Department
Texas A&M University
College Station, Texas 77843-2474
(409) 845-2425

Hauck, Dr. Larry
Texas Institute of Applied Environmental
Research
Tarleton State University
Box T-258, Tarleton Station
Stephenville, Texas 76402

Helm, Mr. Virgil
USDA, SCS
101 S. Main
Temple, Texas 76501-7682

Hernandez, Salvadore M., MPH
Chief Sanitarian
Texas Department of Health,
Office of Border Environmental
and Consumer Health
4201 Medical Drive Box 127, Suite 105
San Antonio, Texas 78229
(210) 692-0562
(800) 693-6699

Hinojosa, Mr. John
Watermaster
TNRCC
811 E. Pike Blvd.
Weslaco, Texas 78596
(210) 968-5481

Jacob, Mr. John
Training Specialist
Texas Engineering Extension Service
Texas A&M University
College Station, Texas 77843-8000
(409) 845-3418
Email: jjacob@tamu.edu

Jensen, Ricard
Information Specialist
Texas Water Resources Institute
Texas A&M University
301 Scoates Hall
College Station, Texas 77843-2118
(409) 845-8571
Email: rjensen@tamu.edu

Jones, Dr. C. Allan
Blackland Research Center at Temple
808 East Blackland Road
Temple, Texas 76502
(817) 770-6600

Kaiser, Dr. Ron
Recreation, Parks and Tourism Sciences Dept.
Texas A&M University
College Station, Texas 77843-2261
(409) 845-5303

Keddy-Hector, Mr. Dean
Texas Parks and Wildlife Department
4200 Smith School Road
Austin, Texas 78744
(512) 389-4800

Kenimer, Dr. Ann
Agricultural Engineering
Texas A&M University
College Station, Texas 77843-2117
(409) 845-3677

Krupp, Mr. Steve
Texas Parks and Wildlife Department
Box 120 W Trail Drive
Austin, Texas 78737
(512) 288-3919

Lacewell, Dr. Ron
Agricultural Economics Department
Texas A&M University
College Station, Texas 77843-2124
(409) 845-2333

Legé, Dr. Ken
Soil & Crop Sciences Department
Texas A&M University
College Station, Texas 77843-2474
(409) 845-1461

Lesikar, Dr. Bruce
Agricultural Engineering Department
Texas A&M University
College Station, Texas 77843-2117
(409) 845-7453

Lowery, Ms. Nancy
Center for Environmental Resources
Management
University of Texas - El Paso
El Paso, Texas 79968-0645
(915) 747-6648

Maggio, Dr. Robert
Forest Science Department
Texas A&M University
College Station, Texas 77843-2135
(409) 845-5069

Malstrom, Dr. Howard
Texas A&M University Agricultural Research
Center
1380 A&M Circle
El Paso, Texas 79927
(915) 859-9111

McKinney, Dr. Lloyd
Forest Science Department
Texas A&M University
College Station, Texas 77843-2135
(409) 845-7201

Merrifield, Dr. Robert G.
Deputy Director
Texas Agricultural Experiment Station
College Station, Texas 77843-2147
(409) 845-8486

Miller, Ms. Angela
TNRCC
P. O. Box 13087, Capitol Station
Austin, Texas 78711-3087
(512) 463-8268

Moore, Mr. Alan
Civil Engineer
USDA-SCS
2315 Expressway 83, Room 103
San Benito, Texas 78586
(210) 399-2522

Mora, Dr. Miguel
Wildlife and Fisheries Science Department
Texas A&M University
College Station, Texas 77843-2258
(409) 845-5777

Nava, Mr. Ismael "Smiley"
Texas Parks and Wildlife Department
4200 Smith School Road
Austin, Texas 78744
(512) 389-4864

Nelson, Dr. A. Gene
Agricultural Economics Department
Texas A&M University
College Station, Texas 77843-2124
(409) 845-2116

Niemeyer, Mr. Stephen
TNRCC
Office of Border Affairs and Environmental
Equity
P. O. Box 13087, Capitol Station
Austin, Texas 78711-3087
(512) 475-2328

Nuckles, Mr. Tom
General Land Office
Resource & Asses Management/Coastal Division
1700 N. Congress Avenue, Room 730
Austin, Texas 78701
(512) 463-5054

Page, Mr. Dan
U. S. Bureau of Reclamation
700 E. San Antonio Avenue, Room 318
El Paso, Texas 79901
(915) 534-6301

Palmer, Mr. Charles
Chief, TNRIS
Texas Water Development Board
P. O. Box 13231
Austin, Texas 78711-3231
(512) 463-7847

Pillai, Dr. Suresh
Texas A&M University Agricultural Research
Center
1380 A&M Circle
El Paso, Texas 79927
(915) 859-9111

Powell, Mr. Darron
Rio Grande Compact Commission
P. O. Box 179
El Paso, Texas 79950-1719
(915) 532-0196

Ries, Ms. Roberta
D-5930
U.S. Bureau of Reclamation
P. O. Box 25007
Denver Federal Center
Denver, Colorado 80225-0007
(303) 236-9306

Rodgers, Dr. Bob
Physics and Geology Department
University of Texas - Pan American
1201 W. University Drive
Edinburg, Texas 78539
(210) 381-3521

Rodriguez, Mark, M.D., MPH
Epidemiologist/Toxicologist
Texas Department of Health,
Office of Border Environmental
and Consumer Health
4201 Medical Drive Box 127, Suite 105
San Antonio, Texas 78229
(210) 692-0562
(800) 693-6699

Rossen, Dr. Parr
Agricultural Economics Department
Texas A&M University
College Station, Texas 77843-2124
(409) 845-3070

Saenz, Dr. Rogelio
Rural Sociology Department
Texas A&M University
College Station, Texas 77843-2125
(409) 845-3521

Sisbarro, Mr. Dan
Houston Advanced Research Council
Center for Global Studies
4800 Research Forest Drive
The Woodlands, Texas 77381
(713) 363-7913

Small, Mr. Ted
U.S. Geological Survey
Water Resources Division
435 Isom Road
North Plaza, Suite 234
San Antonio, Texas 78216
(210) 229-4390

Smith, Mr. Pete
Grants Administrator
Texas Forest Service
Third floor, State Headquarters Building
College Station, Texas 77843-2136
(409) 845-2641
(409) 845-5764

Spoons, Mr. Bryan "Bo"
Texas State Soil and Water Conservation Board
P. O. Box 658
Temple, Texas 76503
(817) 773-2250

Teel, Dr. Pete
Entomology Department
Texas A&M University
College Station, Texas 77843-2475
(409) 845-3253

Underwood, Mr. G. T.
President
Intrix Associates
1 Hillcrest Ct.
Trophy Club, Texas 76262
(817) 491-1598
Email: GUNDERWO@TAMU.EDU

Wagner, Dr. Gale G.
College of Veterinary Medicine
Veterinary Pathobiology Department
Texas A&M University
College Station, Texas 77843-4467
(409) 845-4275

Wiedenfeld, Dr. Bob
Texas A&M University Agricultural Research and
Extension Center at Weslaco
2415 East Highway 83
Weslaco, Texas 78596
(210) 968-5585

Williamson, Mr. Dennis
USDA, SCS
101 S. Main
Temple, Texas 76501-7682
(817) 770-6502

Woodfin, Dr. Tom, ASLA
Landscape Architecture/Urban Planning Dept.
Texas A&M University
College Station, Texas 77843-3137
(409) 845-1079