Policy Research Project Syllabus

US-Mexico Salinity Negotiations in the Rio Grande/Rio Bravo

 **Course Number** PA680PGA (unique #: 60105) (graduate section)

PA 325 (unique # 60025) (undergraduate section)

 Texas Global project code number (for student application for scholarship funds): 350401

 **Day & Time** ***Tuesdays, 6 to 9 pm, room SRH 3.350***

 [Initial class meeting: Tuesday, August 26]

 [Optional second class: Joining US-Mexico salinity negotiations in Mercedes, Texas on Wednesday, August 28. Travel and expenses covered.]

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**Course Description**

The Lower Rio Grande/Rio Bravo (LRG/RB) is experiencing increasing salinity, which affects millions of people living in the Texas/Tamaulipas region who rely on the LRG/RB for domestic, commercial and industrial water use, as well as irrigation. Increasing salinity in the LRG/RB harms agricultural production, which is the major source of income on both the Mexican and the U.S. sides of the river.The purpose of this Fall 2024 PRP class to to assist the US and Mexican governments in negotiations regarding how to prevent salts from entering the lower Rio Grande/Rio Bravo (LRG/RB) river between the Falcon Reservoir and the Gulf Coast and controlling the salinity of the LRG/RB. The class will evaluate options for water management, existing facility operational improvements, and construction of new infrastructure to prevent salinization and remove salts. Class members will participate in the negotiations between the Mexican and US governments, including an initial negotiation session (participation is voluntary on the part of students) on Wednesday, August 28, 2024 in Mercedes, Texas at the IBWC/CILA offices at 325 Gold Course Road, Mercedes, right on the US/Mexico border (956-585-1657). [Transportation and expenses provided].

**This is a joint class between The University of Texas at Austin (UT-Austin) and Mexico’s National Autonomous Univerisyt of Mexico (UNAM). This project has six client agencies of the Mexican and United States (US) governments:**

**\* International agencies:** International Boundary and Water Commission (IBWC) and the Comisión Internacional de Limits y Aguas **(CILA)**

**\* Federal agencies:** US. Environmental Protection Agency (EPS) and Mexico’s Comisión Nacional del Agua (CONAGUA)

\* State and regional agencies:Texas Commission on Environmental Quality (TCEQ) and Tamaulipas’ state water agency, Comisión Estatal del Agua de Tamaulipas.

During 2023-2024 academic year, a LBJ School class developed methods to identify the sources and consequences of salinization of the LRG/RB. These methods include geographical information systems (ARC-INFO), water quality mass balance assessments (using OASIS software), modelling of groundwater flows, rainfall, evapo-transpiration, and economic assessment of the impacts of salinity on domestic users and irrigators in the LRG/RB. The 2023-34 analyses identified a variety of policy options including infrastructure construction, water/wastewater treatment, facility operation improvements, and pollution prevention. Both Mexico and the US Governments wish to move forward to recommend policy options for action. The two governments have funded the LBJ School and UNAM to help them understand the reasons for the increased salinity in the LRG/RB and to provide methods to evaluate policy options. Members of this class will have an opportunity facilitate negotiations by provding technical support to the six participating agencies. Members of the staff of Texas’ Commission on Environmental Quality (TCEQ) assist the class members in these efforts. TCEQ is located at 12100 Park 35 Circle in [Austin](https://en.wikipedia.org/wiki/Austin%2C_Texas). TCEQ is the fourth largest environmental agency in the United States and employs approximately 2,780 employees, has 69 regional offices, and a $378 million operating budget for the 2021 fiscal year. Two key scientists also assist the class, Dan Sheer, Ph.D., retired President of Hydrologics and Miguel Pavon, who directs the Borderlands Information Center (BIC), an administrative section of the Texas Water Development Board's Texas Natural Resources Information System (TNRIS).

One of the most productive elements of US-Mexican relations in 2024 is trans-boundary environmental quality, particularly between Texas and its four bordering Mexican states: Tamaulipas, Nuevo Leon, Coahuila, and Chihuahua. The two nations have worked together effectively for decades since the North American Free Trade Agreement to reduce air, water, solid and hazardous waste pollution, improve the border air and water quality, and address (but by no means resolve) water quantity and access conflicts. One of the reasons for the success in reducing pollution and improving ambient environmental quality along the Texas-Mexico border is the close cooperation between Texas and its Mexican border states through initiatives such as Border 2000, Border 2012, Border 2020 and now Border 2025. Texas has taken an institutional lead for two regional cooperative groups, the so-called four-state process (Texas, Tamaulipas, Nuevo Leon and Coahuila) and three-state process (Texas, New Mexico and Chihuahua).

Students enrolled in the class are eligible to travel to Mexico during the academic year. Funding also is available for Summer 2025 for any class member who wishes to be embedded in one of Mexico’s environmental agencies for an internship through the Global Career Launch-Mexico program of Texas Global. Funds from the Teresa Lozano Long Institute for Latin American Studies re also available to support students who wish to provide research and consulting services to Mexican governmental agencies along the border and in Mexico City. Supplemental funding sources include research contracts at UT, International Student Fee Scholarships, Curtis W. Meadows, Jr. Social Enterprise Fellows, Crook Fellowships, LBJ School-based support for internships, or from other sources, including scholarships and fellowships. Attachment 1 lists some useful websites.

**Course Objectives and Initial Working Groups**

The course has five objectives:

1. To familiarize students with methods for evaluating salinity sources and sinks in a river basin and that can be used to assess policy alternatives to prevent and control salts.
2. To develop a set of policy options that Mexico and the US can use to reduce salinity in the LRG/RB basin.
3. To use analytical tools to assess/quantify the costs, benefits, risks and opportunities for preventing or control salinity in the LRG/RB.
4. To apply those tools to assess/quantify policy alternatives and work with the federal and state governbments in Mexico and the US to identify polict options that the two nations wish to adopt and implement.
5. To help the Mexican and US governments work on bi-national agreements on management of salinity in the LRG/RB and facilitate their implementation.

Over the course of the year members of the class will accomplish tasks that align with the above objectives. Students participating in this class will be able to document the following signature policy skills from this PRP experience:

\* Preparing a narrative overview for the outcomes from a project;

\* Participating in binational negotiations and facilitating discussions among the six parties responsible for policy decisions and investment implementation;

\* Acquiring experience in working with diverse environmental professionals from six agencies of Mexico and the US and providing information to senior decision makers;

\* Conducting qualitative analysis to integrate opinions of stakeholders in recommendations for action;

\* Integrating data and quantitative analysis into a discussion of policy options and providing results as evidence to support policy actions;

\* Drafting professional-quality research reports following standard formats with thorough references;

\* Developing and presenting oral advocacy for project outcomes, based on qualitative and quantitative evidence;

\* Understanding how to prevent and respond to disagreements to enable consensus outcomes;

\* Skills working in groups to accomplish common outcomes;

\* Capacity for working as an individual with limited supervision;

\* Undertstanding how to work with professionals from multiple nations, using two languages, from different cultures ;

\* Demonstrated skills in working with diverse common software (Word, Powerpoint, Excel, etc.);

\* Operating from remote locations with other professionals using diverse contact software (Slack, Discord, Teams, Zoom, Skype, etc.);

\* Managing very large data sets and interpreting the stregnths and limitations of data sources and acquisition methods;

\* Capacity to model and evaluate natural processes with simulation and statistical methods;

\* Preparation and delivery of papers in a professional conference msetting;

\* Skills in report writing, copy-editing, and pre-publication quality assurance.

**Working Groups-First Months**

The course will initially be organized into four working groups, tasked with making use of different analytical tools for quantifying co-benefits in relation to Austin’s Climate Equity Plan.

**Working Group #1: Data Supplement Group**

Previous students have compiled a very large data base for the salinity project. At the in-person meeting on August 28, 2024 in Mercedes, Texas, the two governments will discuss any supplemental data that ought to be collected and from whom it should be collected. One working group will work with the agencies to collect and document those supplemental data. This task should be for a relatively short portion of the year; estimate: six weeks.

**Working Group #2: Non-Point Flows Group**

One challenge of seeking to identify all sources and sinks of water and salts within the LRG/RG is the topic of ‘non-point flows,’ or flows that do not come from identified sources but rather from unregulated and often unknown sources, including rainfall runoff, irrigation return flows, and unregulated/unrecorded flows. There are some estimates that have been made. This working group will seek to improve the estimates, in cooperation with both Mexican and US professionals. This task should be a relatively short portion of the year; estimate: six weeks.

**Working Group #3: OASIS Mass Balance Group**

A key element in this study is developing and improving the mass balance of water and salt that has been developed initially in the OASIS software. This working group will work for much of the semester to improve the mass balance and assess statistical patterns regading basin inflows and outflows. This group will continue through the semester.

**Working Group #4: Identification of Policy Options**

A key element in the Mexico/US negotiations will be the identification if policy options that the two governments can adopt to prevent, control, treat or remove salinity. These options include: water management strategies; operational infrastructural improvements; new infrastructure investments; mitigation options, public education options; and cross-border cooperation options. This working group will continue through the semester.

**Working Group #5: Assessment of Links Between Salinity and Water Quantity**

Water quantity allocation between Mexico and the US remains a point of significant conflict between the two nations. This working group will seek to identify the substantive and statistical connections between salinmity fluctuations and quantity of water flows in the LRG/RB basin. This group will continue through the semester.

**Working Group #6: Developing an Outreach Strategy**

The success or failure of this project depends upon the engagement of stakeholders, both within the six key Mexican/USA agencies and citizens of the LRG/RB, in developing an understanding of the reasons for the (a) increase in salinity in the LRG/RB and (b) salinity fluctuations to levels that damage crops and incur costs for water users. This working group will begin in November and will be expected to develop a strategy for engaging stakeholders that can be vetted with the six Mexican/USA agencies.

**Tentative Schedule for the LBJ School Salinity Management PRP**

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| **Dates** | **\*Data** **\*Non-Point Flows** **\*Outreach Strategy** | **\*OASIS Mass Balance****\*Links: Salinity and Water Quantity** | **\*Policy Options** |
| August | Overview:\* Orientation to the Mexico/US negotiations, including participation\* History of Mexico/US water treaties and current disputes\* Discussion of existing mass balance approach to managing salinity\* Negotiation plans for Mexico/US cooperation to prevent, control, treat and remove salinity |
| September | \*Review previous work\*Improve existing data and flow estimates\*Identify weaknesses and ambiguitities  | \*Review previous work\*Produce supplemental analyses\*Identify any remaining issues | \*Collect and define existing policy options\*Reach out to stakeholders for supplemental options\*Organize and identify priority options |
| October | \*Complete analyses\*Draft report of outcomesComponent complete | \*Conduct supplemental analyses\*Draft outcomes report | \*Organize/identify priority options for Mexico and USA separatelyDraft report of outcomes |
| November | Outreach Stategy: Develop initial ideas\*Share results with Mexico/US | \*Document/assess mass balance; address any issues\*Conduct supplemental analyses of salinity link to water quantity\*Share results with Mexico/US | \*Develop methods to evaluate policy options (multi-criteria)\*Engage stakleholders in assessment of policy options\*Share results with Mexico/US |
| December | \*Draft outreach report on strategiesComponent complete | \*Finalize OASIS mass balance and salinity links\*Identify ambiguities in mass balance and salinity link to water quantity\*Each group completes report | \*Draft report on policy options and preferencesw of Mexico and US |
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Attachment 1

Website for Supplemental Funding for Summer 2025

\* <https://global.utexas.edu/abroad/funding/scholarships>

\* https://www.scholarshiptab.com/scholarships/university-of-texas-at-austin-ut-austin-2021-international-education-fee-ief-scholarships

\* http://utdirect.utexas.edu/student/abroad/globalassist.WBX

\* https://onestop.utexas.edu/managing-costs/scholarships-financial-aid/

LBJ School students are eligible to apply for funds to support unpaid summer internships following policies promulgated for Summer 2024, as indicated in a website prepared for Summer 2020 at: \*<https://lbj.utexas.edu/sites/default/files/LBJ_School_Internship_Policies_for_Summer_2020.pdf>. Students also are eligible to raise funds through a so-called ‘HornRaiser’ process; see

\* <https://hornraiser.utexas.edu/about>

**Attachment 2**

**Annotated Bibliography**

(all items to be available on Box)

Calderon, Miriam, Chuanyu Yang, Veronica Ancona, and this link will open in a new tab Link to external site. “Assessing Fungal Plant Pathogen Presence in Irrigation Water from the Rio Grande River in South Texas, USA.” *Agriculture* 13, no. 7 (2023): 1401. https://doi.org/10.3390/agriculture13071401. The study describes fungal plants present in the area of the Rio Grande that is used to support the Lower Rio Grande Valley’s agriculture. The data concluded that there is a high diversity of fungal species in the Rio Grande, including plant pathogens.

Cough-Schulze, Chantal. “Salinity Along the Rio Grande.” *txH2O*, 2021. https://twri.tamu.edu/publications/txh2o/2021/winter-2021/salinity-along-the-rio-grande /.
The article talks about the importance of the water that comes from the Rio Grande as it is used for irrigation for many of the surrounding cities. However, it mentions El Paso county, which is not the area of focus for this project.

De La Garza, Miranda Nicole, Jianhong Ren, and Veronica Ancona. “Spatiotemporal Variations of Hydrochemical Characteristics of Irrigation Water: A Case Study of the Lower Rio Grande Valley, USA.” *IWA Publishing* 23, no. 5 (2001). https://doi.org/10.2166/ws.2023.082. The study done here is searching to find hazards caused by salinity, sodicity, and alkalinity of the irrigation water from the Rio Grande. Specifically, they studied water from the Rio Grande within the Hidalgo and Cameron counties. The results from the project show high levels of TDS, nitrates, and salts in the irrigation water tested.

Dirrigl, Frank J., Courtney J. Huston, and Marisol Bazaldua. “Evaluating Stormwater Canals for Water Quality in the Lower Rio Grande Valley, Texas.” *Taylor & Francis Ltd.* 18, no. 1 (March 2016): 6–17. https://doi.org/10.1017/S1466046615000411.
In the article, they conducted research on the LRGV canal system in the city limits of Edinburg, Hidalgo County, Texas. Water quality data, including water temperature, electrical conductivity, dissolved oxygen, pH, total dissolved solids, and salinity, were measured. Based on the results, they found that the water in the Lower Rio Grande Valley canal system meets NPDES and Texas surface water quality standards.

Eaton, David, Miguel Pavon, and Daniel Sheer. “A Mass Balance Approach to Assessing Salinity Along the Rio Grande/Rio Bravo River - Spring 2023 Update.” University of Texas at Austin, 2023. This report is a continuation of the effort begun in 2022 with an original report, A Mass Balance Approach to Assessing Salinity Along the Rio Grande/Rio Bravo River. Eaton, David, Daniel Shear, and Miguel Pavon. “A Mass Balance Approach to Assessing Salinity Along the Rio Grande/Rio Bravo River.” University of Texas at Austin, 2022. A mass balance of salinity was completed in December 2022 at three locations in the Lower Rio Grande.

Fanning, Carl D., and Leon Lyles. “Salt Concentration of Rainfall and Shallow Groundwater across the Lower Rio Grande Valley.” *Journal of Geophysical Research (1896-1977)* 69, no. 4 (1964): 599–604. https://doi.org/10.1029/JZ069i004p00599.
The report studied the salt concentration of rainfall across the Lower Rio Grande Valley in the year 1964. However, the report does not discuss water quality in the Rio Grande.

Gandara, S. C., W. J. Gibbons, and D. L. Barbie. “Water Resources Data for Texas, Water Year 2000. Volume 5. Guadalupe River Basin, Nueces River Basin, Rio Grande Basin, and Intervening Coastal Basins.” *Water Data Report. United States Geological Survey*. United States Geological Survey, 2001. https://www.proquest.com/agricenvironm/docview/19576641/AA96AF6636F64BF6PQ /101. The report measured water quality of different rivers in Texas, including the Rio Grande Basin in the year 2000. Gaging stations reported that relate to our study include the Rio Grande below Falcon Dam, Rio Grande at Fort Ringgold, Rio Grande City, Rio Grande near Los Ebanos, Rio Grande below Anzalduas Dam, and Rio Grande near Brownsville. Stage, discharge, and water quality of streams and canals were recorded.

Gowda, Ramdas. “Assessment of Rio Grande Water Quality.” Master’s Thesis, The University of Texas at El Paso, 1993. The masters’ thesis discusses the water quality of the Rio Grande in its entirety. However, there was no sampling station located in South Texas. The southernmost sampling station was located in El Paso, Texas.

IBWC. “Active Gaging Stations.” Accessed October 10, 2023. https://ibwc.azurewebsites.net/water-data/active-gaging-stations/.
The following source shows active gaging stations in the United States and measures the discharge, precipitation, water velocity, and height of the Rio Grande. The data is split up to focus on different areas of the Rio Grande. Areas that could be of interest to this project include the dataset that is “Below Falcon Dam to the Gulf of Mexico.” There are more sections within this dataset among cities.

Interior Department Documents & Publications. “Lower Rio Grande Basin Study Shows Shortfall in Future Water Supply.” Washington, United States: Federal Information & News Dispatch, LLC, December 17, 2013. https://www.proquest.com/agricenvironm/docview/1468945536/abstract/AA96AF6636 F64BF6PQ/9. The article shows that climate change is causing a water shortage in the Rio Grande Basin from the Rio Grande. Potential solutions that were proposed include seawater and groundwater desalination.

Khedun, C. Prakash, Ashok K. Mishra, John D. Bolten, Hiroko K. Beaudoing, Ronald A. Kaiser, J. Richard Giardino, and Vijay P. Singh. “Understanding Changes in Water Availability in the Rio Grande/Río Bravo Del Norte Basin under the Influence of Large-Scale Circulation Indices Using the Noah Land Surface Model.” *Journal of Geophysical Research: Atmospheres* 117 (March 3, 2012). https://doi.org/10.1029/2011JD016590. The study utilized precipitation stations along the Rio Grande to analyze changes in water availability. There are several stations located in the Lower Rio Grande area. The study found that climate change can affect water scarcity.

Langman, Jeff B., and Andre S. Ellis. “Geochemical Indicators of Interbasin Groundwater Flow within the Southern Rio Grande Valley, Southwestern USA.” *Environmental Earth Sciences* 68, no. 5 (July 24, 2012): 1285–1303. https://doi.org/10.1007/s12665-012-1827-4. The article investigates the connection between the Jornada del Muerto Basin and the Mesilla Basin, two adjacent aquifers in the Rio Grande Valley that are separated by a buried bedrock high from Tertiary intrusions. Unfortunately, the location that is being evaluated is in the New Mexico region of the Rio Grande.

Manz, Louis R., Dibyendu Sarkar, and Weldon W. Hammond Jr. “Water Resources and Water Quality in the Rio Grande Valley of Texas: Current Status and Future Projections.” *Environmental Geosciences* 12, no. 3 (September 1, 2005): 193–206. https://doi.org/10.1306/eg.04260404005. The article reviews the hydrogeology, water resources, and water quality of the Rio Grande Valley, a transboundary region that spans parts of New Mexico, Texas, and Mexico. The Lower Rio Grande is split into seven different segments to analyze water quality. This included salt concentration, measured either by the chloride content or by total dissolved solids.

Mukerjee, Shaibal, Douglas S Shadwick, Kirk E Dean, and Linda Y Carmichael. “Assessing Transboundary Influences in the Lower Rio Grande Valley,” n.d.
The following study analyzed air pollutants in the Lower Rio Grande. The study found that there were not high levels of air pollution, however, there was no mention of water quality.

Ramos, Irma N., Lora Baker Davis, Qiang He, Marlynn May, and Kenneth S. Ramos. “Environmental Risk Factors of Disease in the Cameron Park Colonia, a Hispanic Community Along the Texas-Mexico Border.” *Journal of Immigrant and Minority Health* 10, no. 4 (January 18, 2008): 345–51. \This report summarizes the results of a cross-sectional study in Cameron Park in 2000-2001 to identify disease prevalence and health concerns among colonia residents and to identify environmental exposures to potentially adverse environmental conditions. There is mention of the water in the Lower Rio Grande potentially affecting the health of people that live nearby. The article states,”approximately 55 million gallons of raw sewage pour daily into open canals, which cut through the colonias as they carry the sewage to the Rio Grande River”.

Robb, Kathy. “The Rio Grande/Rio Bravo Water Deliveries Under the 1944 Treaty: A Compendium of Ideas,” December 2022. https://www.ibwc.gov/wp-content/uploads/2023/04/Exec\_Rio\_Grande\_White\_Paper\_- Summary-FINAL.pdf. This executive paper proposes solutions to improve water quality. Relating to the Lower Rio Grande, the Brackish Groundwater Desalination was identified as the strategy best suited to meet the region’s long term water needs. There is another study that further analyzes the water quality of the Lower Rio Grande.

Sanchez-Martinez, Marina, and Alberto Ocaña-Luna. “Estructura y variación estacional de la comunidad ictioplanctónica en una laguna hipersalina del oeste del Golfo de México: Laguna Madre, Tamaulipas.” *Hidribiologica* 25, no. 2 (2015): 175–86.
Zooplankton samples were collected in October 1997, January, May and July 1998 and the salinity and temperature (°C) of the surface water were simultaneously measured. The study found that there was a positive correlation between the abundance of larvae of A. mitchilli with temperature and salinity.

Trock, Warren L. “Institutional Factors Affecting Land and Water Development, Lower Rio Grande Valley, Texas.” Texas A&M University, December 1969. https://onlinelibrary.wiley.com/doi/abs/10.1029/WR005i006p01364. This report analyzes factors affecting land and water quality for agricultural purposes.

A decline in water quality has made it difficult for farmers to irrigate crops properly. USGS. “Real-Time Water Quality.” Accessed October 8, 2023.

https://waterwatch.usgs.gov/wqwatch/.
The database contains water quality data such as temperature, pH, nitrate measurements, chlorophyll measurements, etc. in bodies of water across the United States. The website contains information on temperature, pH, and conductance for stations located in the Lower Rio Grande. It gets updated daily.