



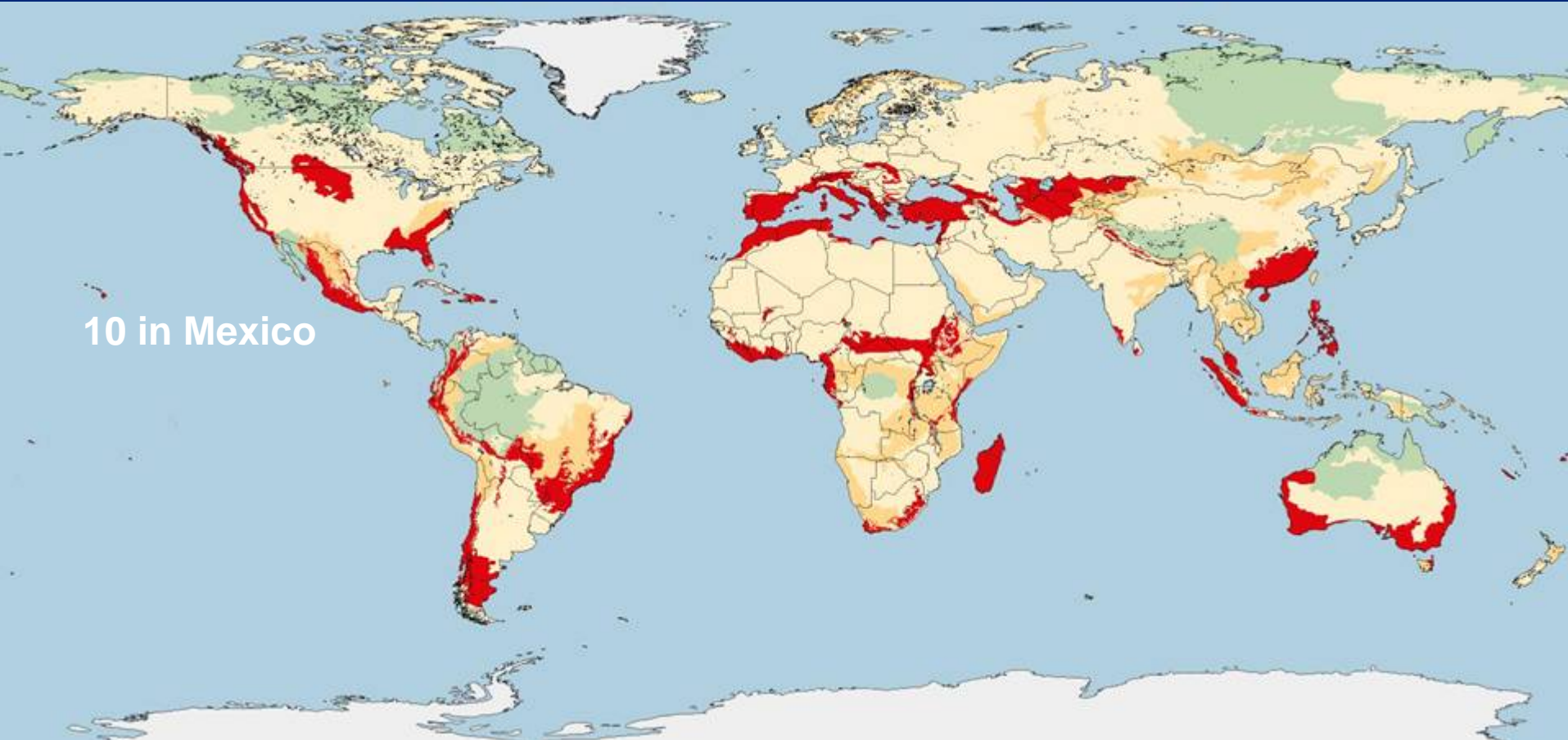
The Big Bend Reach of the Rio Grande

Addressing Ecological Decline
Along a Hydrologically Altered
Border River

Mark Briggs, World Wildlife Fund



Priority Ecoregions



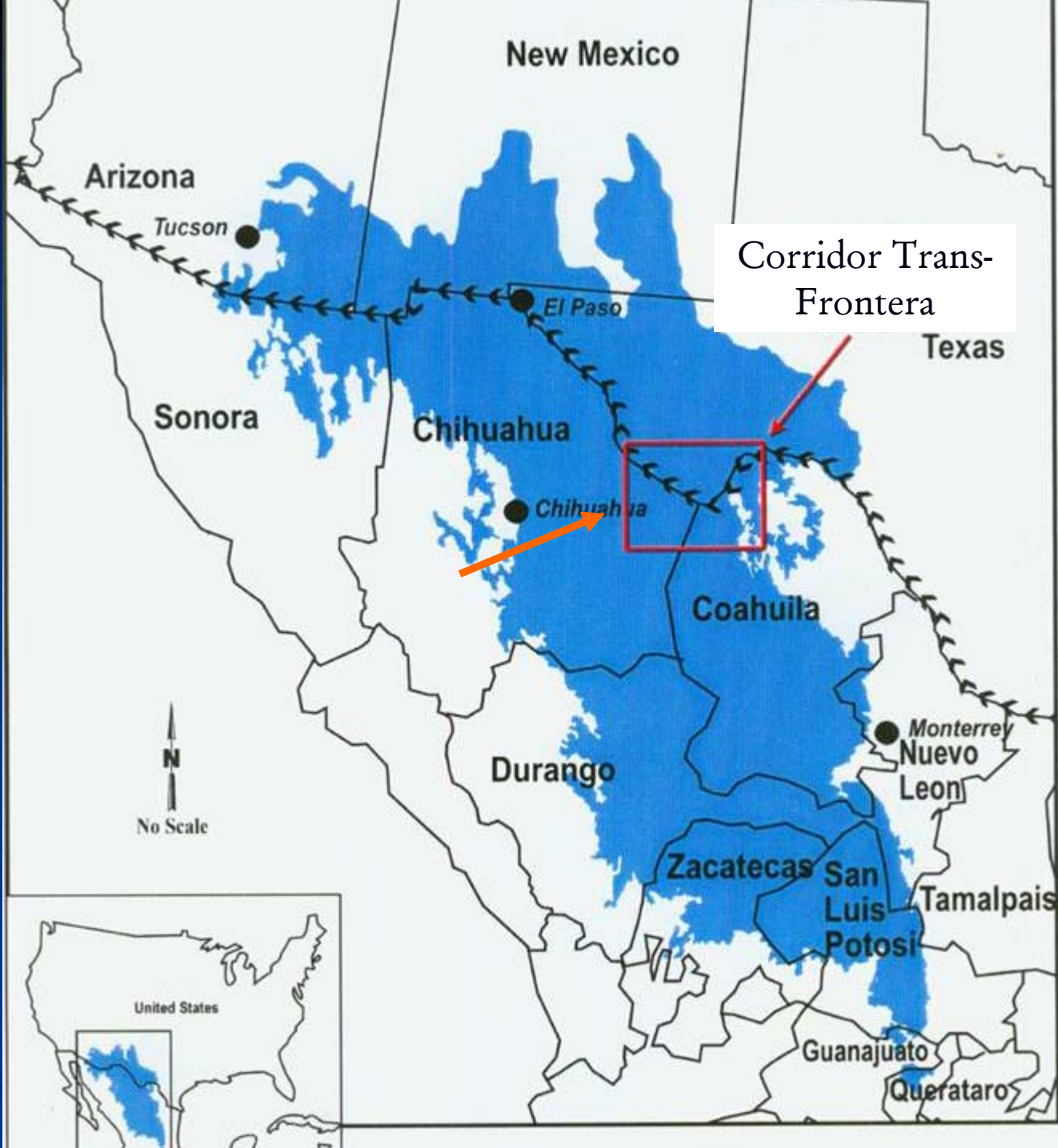
10 in Mexico



WWF

El Programa Mexicano







Big Bend/El Gran Recodo



Río Grande (and its tributaries and springs) Support High Biodiversity



♣ 333 native bird species



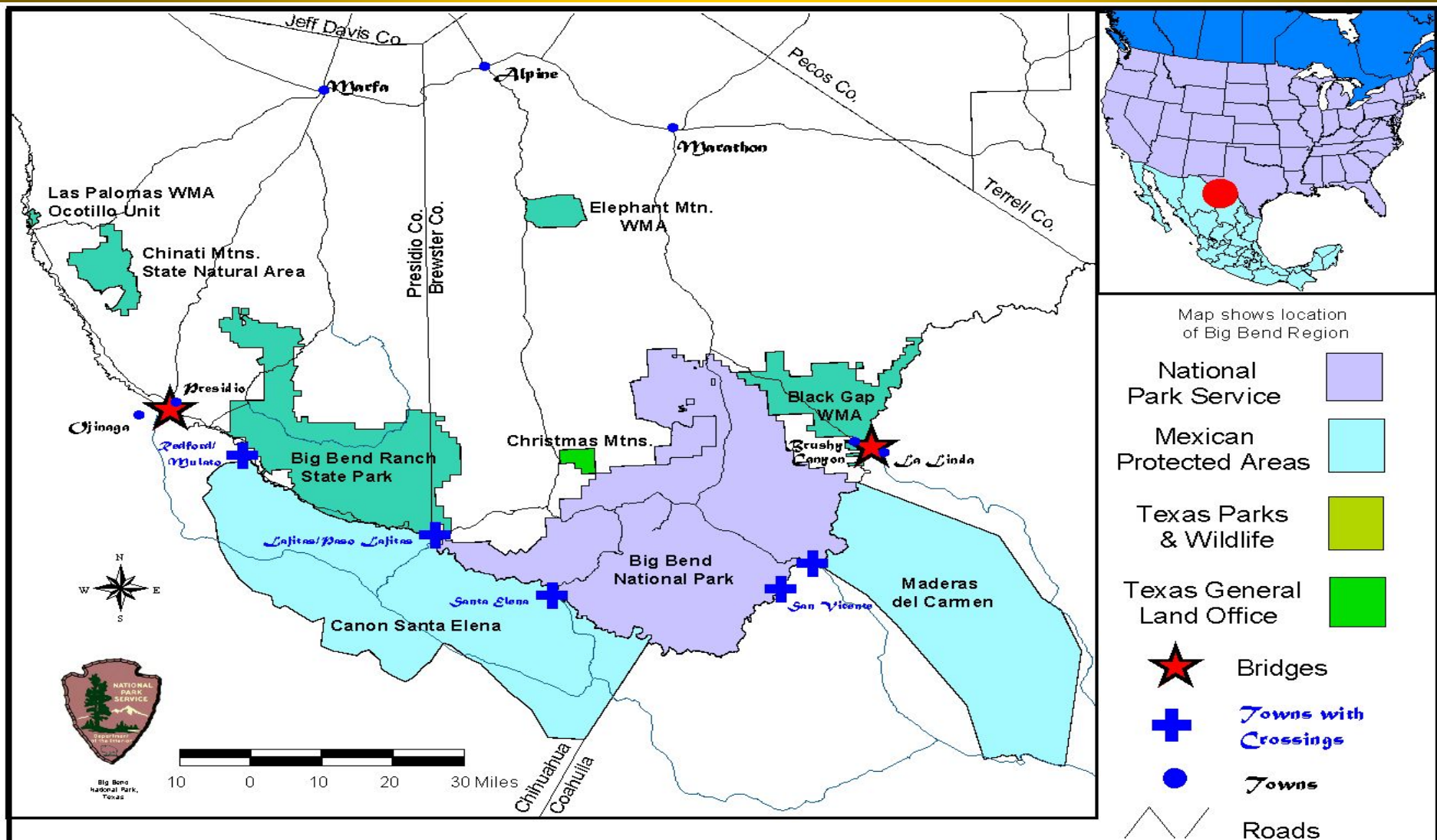
♣ 23 native fish species



♣ 76 native amphibians and reptiles



Five Protected Areas




Trans-Border Corridor

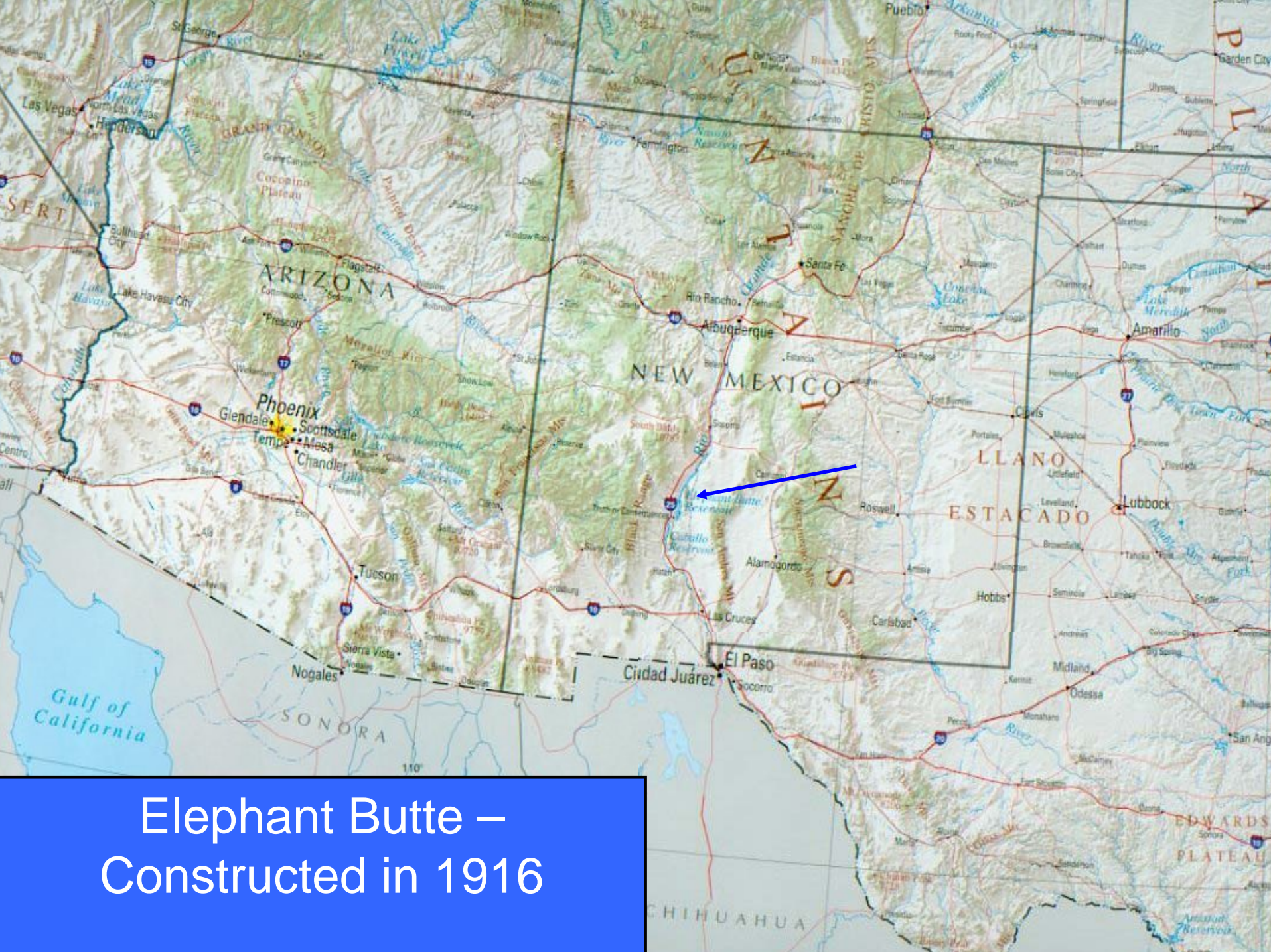
What is the problem?



Photo by Nat Stone: www.natstone.net






Changes Along the Rio Grande: Pre-Impoundment versus Post-Impoundment

	Pre-Impoundment	Post-Impoundment
 Number of major dams	0	6
Population: Las Cruces/El Paso/Juarez	2 million (current)	6 million (projected 2025)
Irrigated Land (Colorado and New Mexico)	35,000 acres (pre-impoundment)	700,000 acres (2002)
Channelization	No channelization (pre-impoundment)	Percha Dam to Ft. Quitman (reduced channel length by 70 miles)
River Flow @ El Presidio	573,700 acre-ft (annual average before 1915)	131,800 acre-ft (annual average after 1915)



Elephant Butte –
Constructed in 1916

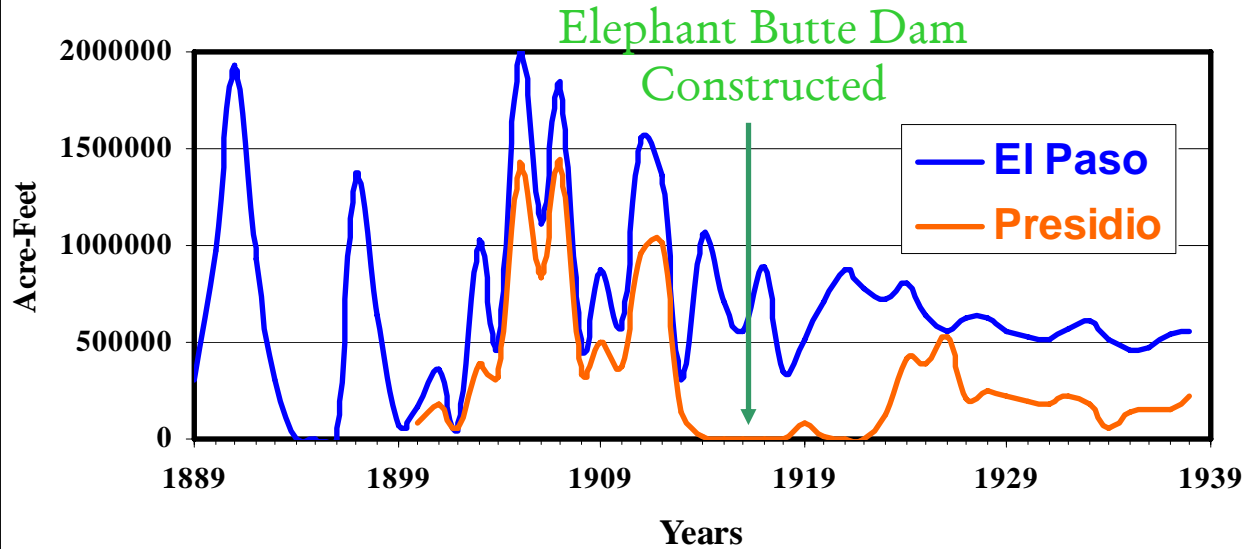
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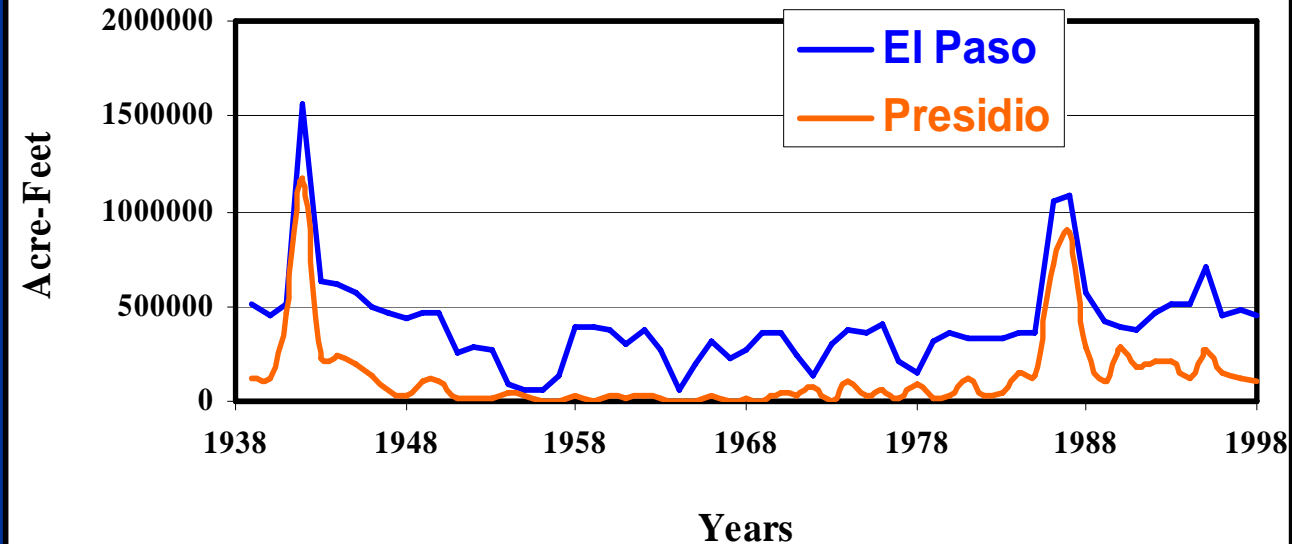
What is the problem?

Impounded and Over-allocated
Significant Changes in Hydrologic Characteristic

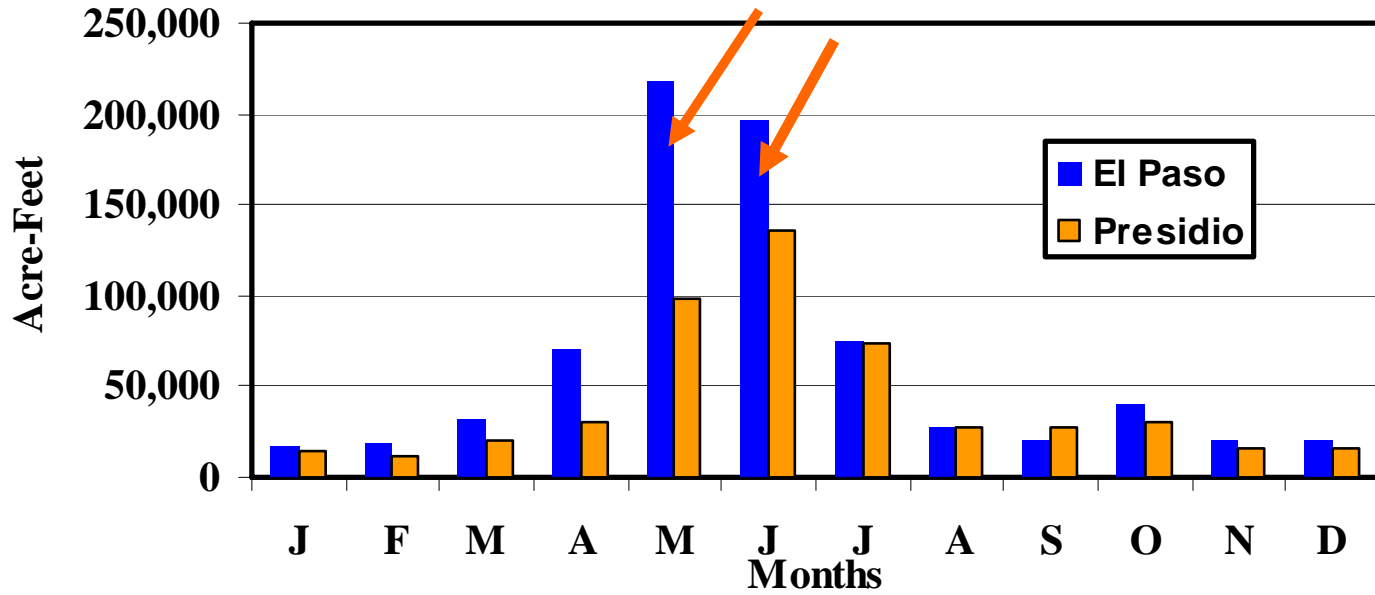
1889-1938 El Paso & Presidio Annual Flows



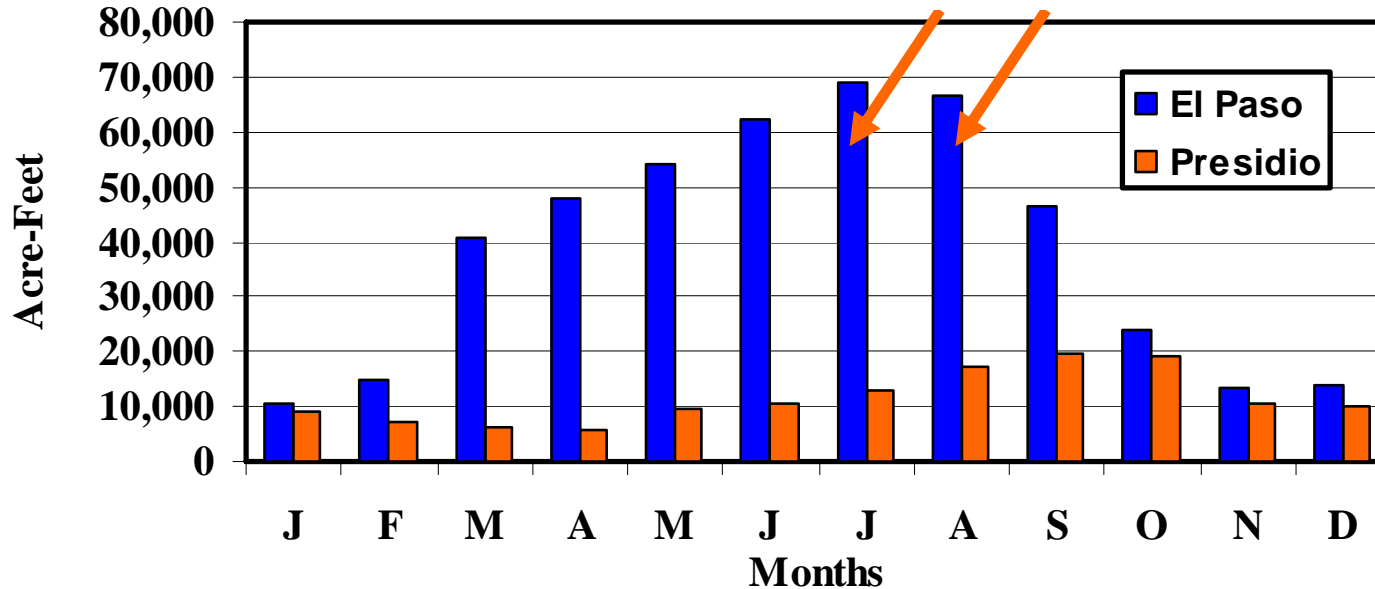
1939-1998 El Paso & Presidio Annual Flows



Average Monthly Flows Prior to 1916



Average Monthly Flow 1916-1998



ALTERED HYDROLOGIC CHARACTERISTICS

PRE-IMPOUNDMENT/POST-IMPOUNDMENT

- v Overall decrease in water quantity
- v Decrease in peak flows
- v Peak flows are of shorter duration
- v Low flow events last longer
- v Deterioration in water quality
- v Seasonal high flows have shifted from May-June to July-August

What is the problem?

Impounded and Over-allocated

Significant Changes in Hydrologic Characteristics

Significant Changes in Channel Morphology



quasi abandoned floodplain surfaces

steep channel banks

minimal floodplain surfaces

Increased Elevation Difference Between Floodplain and Channel Bed



What is the problem?

Impounded and Over-allocated

Significant Changes in Hydrologic Characteristic

Significant Changes in Channel Morphology

Significant Biologic Change

Summary of Selected Biologic Change

- v Seven native fish extirpated;
- v Of the remaining native fish, one is listed as federally endangered and two others are listed as species of concern;
- v Five Rio Grande mussel species have not been documented since the 1970s;
- v Significant decline in the extent and distribution of native bottomland plants;
- v Significant increase in the extent and distribution in non-native, invasive plants.

Dense monotypic stands of saltcedar are a manifestation of altered hydrologic conditions







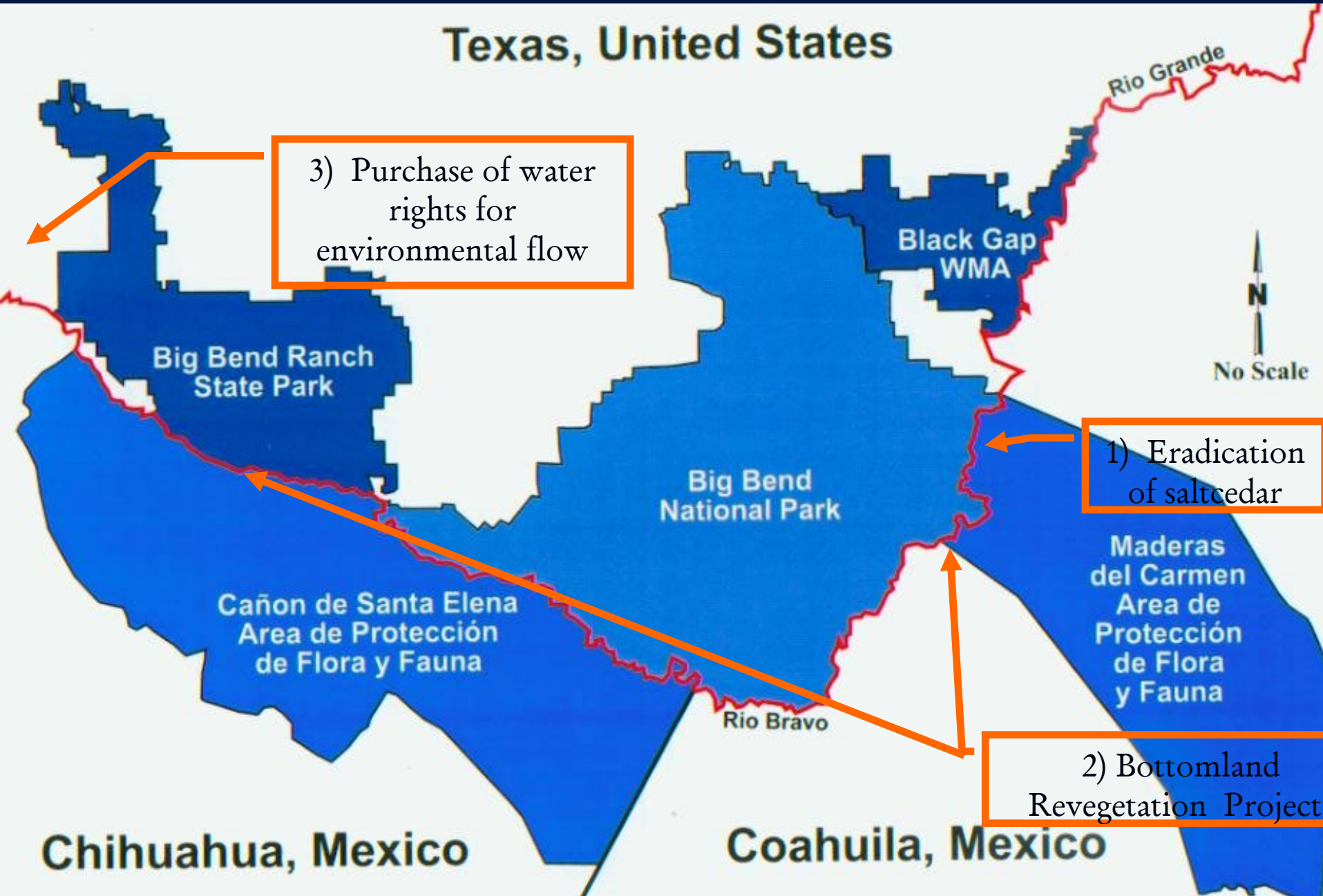
Arundo donax (Giant Reed)

Addressing the Problem

The Formation of a Bi-National Team

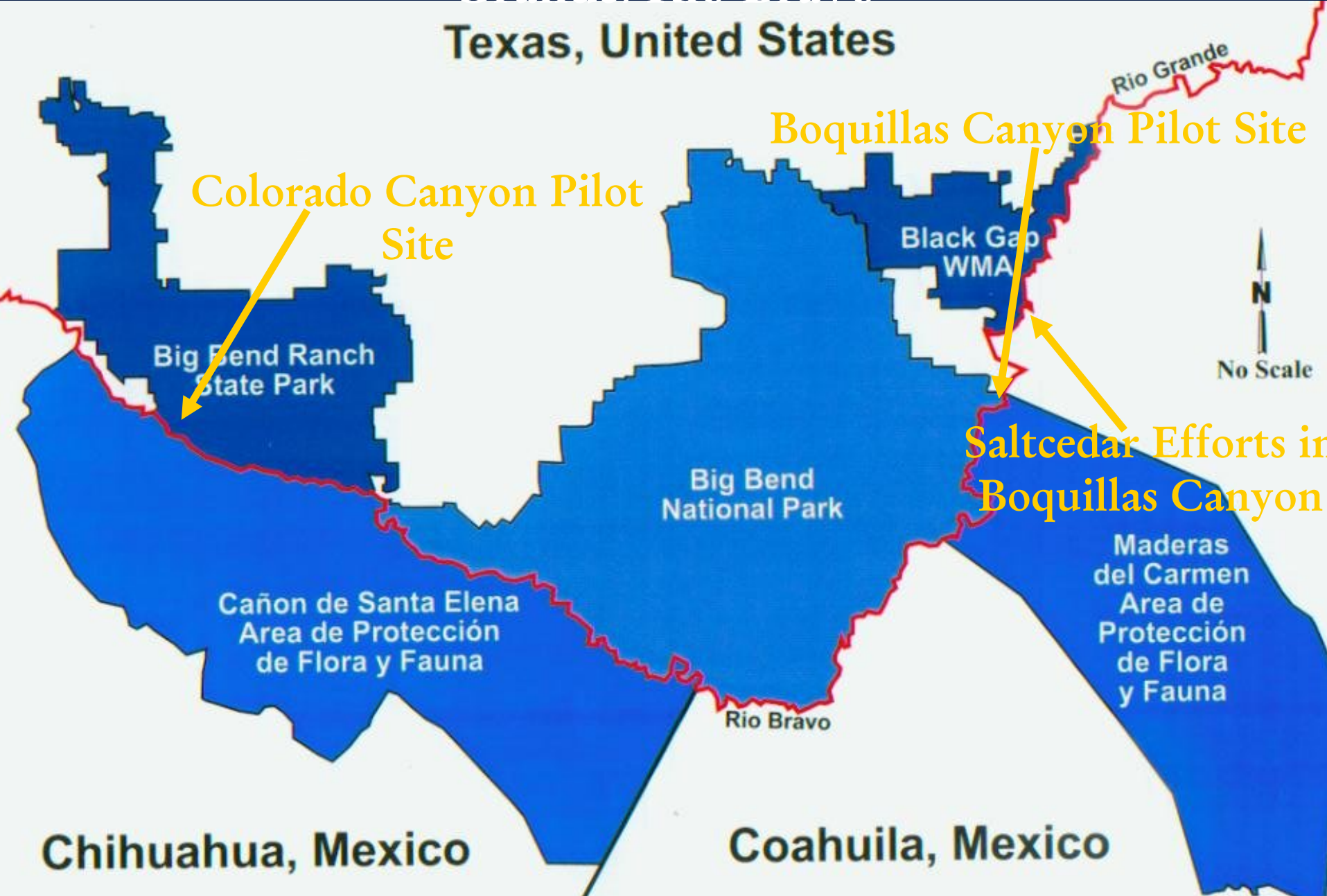


Three Major Efforts Underway



Saltcedar Removal Efforts in the Big Bend Reach of Rio Grande/Rio Bravo

Texas, United States



Saltcedar Removal Efforts in Boquillas Canyon

Chihuahua, Mexico

Coahuila, Mexico

Boquillas Canyon Pilot Restoration Site



Boquillas Canyon Pilot Restoration Site

Objectives

- 1) Remove exotic invasive plants (*Arundo donax* and *Tamarix ramosissima*);
- 2) Re-establish native vegetation;
- 3) Monitor and document results for benefit of future efforts.



Step 1: Giant reed was burned



Step 2: Herbicide applied to both saltcedar and giant reed



Step 3: Irrigation system installed



**Step 4: Individual plant sites
augered**



Step 5: Plant vegetation





Step 6: Monitoring and Maintenance



Boquillas Canyon Saltcedar Eradication Effort









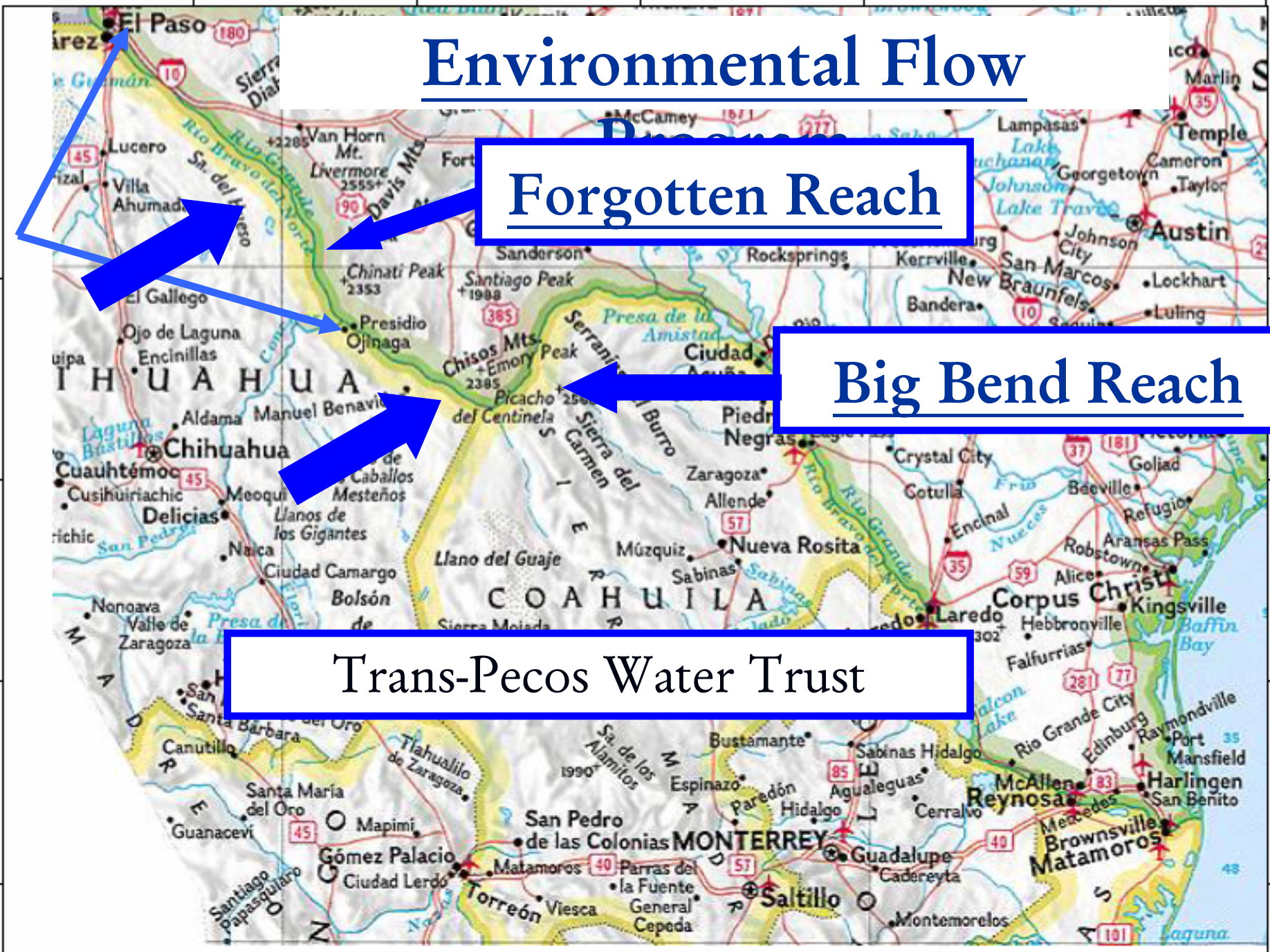


Environmental Flow

Forgotten Reach

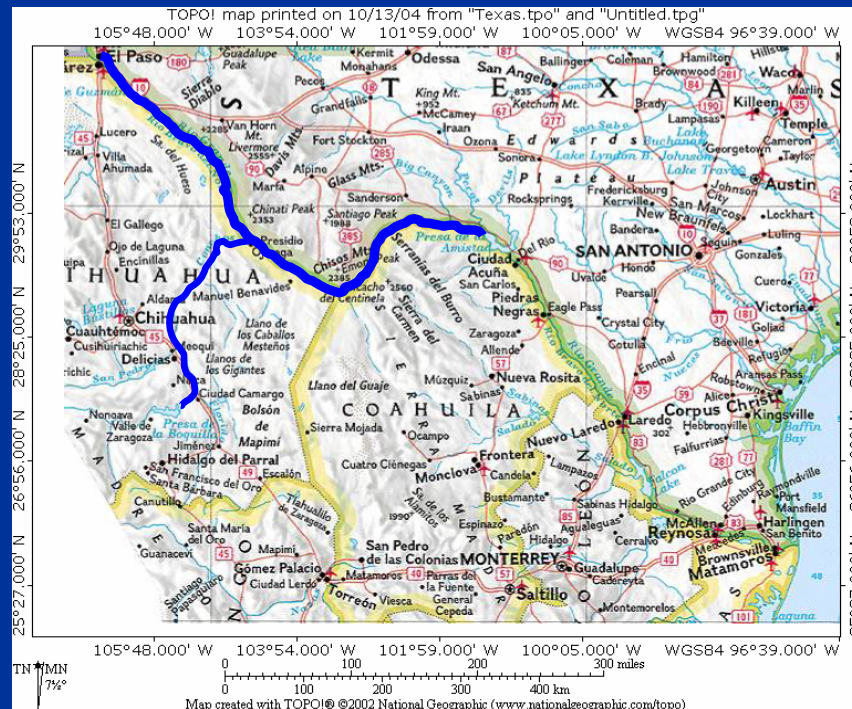
Big Bend Reach

Trans-Pecos Water Trust



Fundamental Questions for an Environmental Flow Program

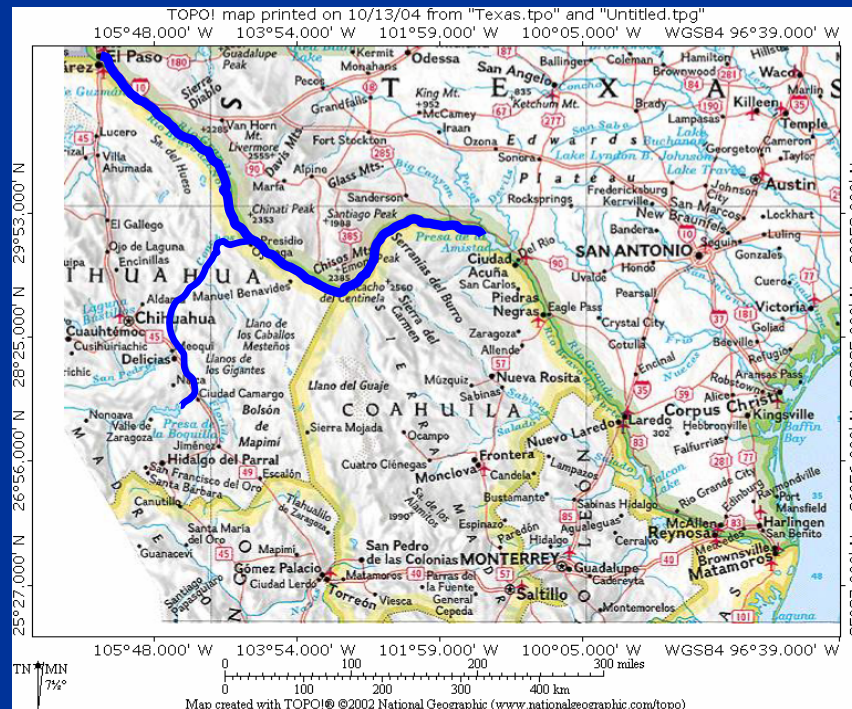
- ✓ Legal Investigations;
- ✓ Are there water rights available?
- ✓ If so, how many?
- ✓ Where are they (which part of the river)?
- ✓ How much do they cost and do they vary along the river?



Fundamental Questions for an Environmental Flow Program

Ecologic Investigations

- ✓ How much water is needed to accomplish ecologic good?
- ✓ How can river management (dam operations) be changed to best improve ecologic conditions?



Environmental Flow Program Big Bend Reach of the Rio Grande

What are our 'restoration'
objectives?

♣ Sediment

budget

♣ Channel morphology

♣ Water quality

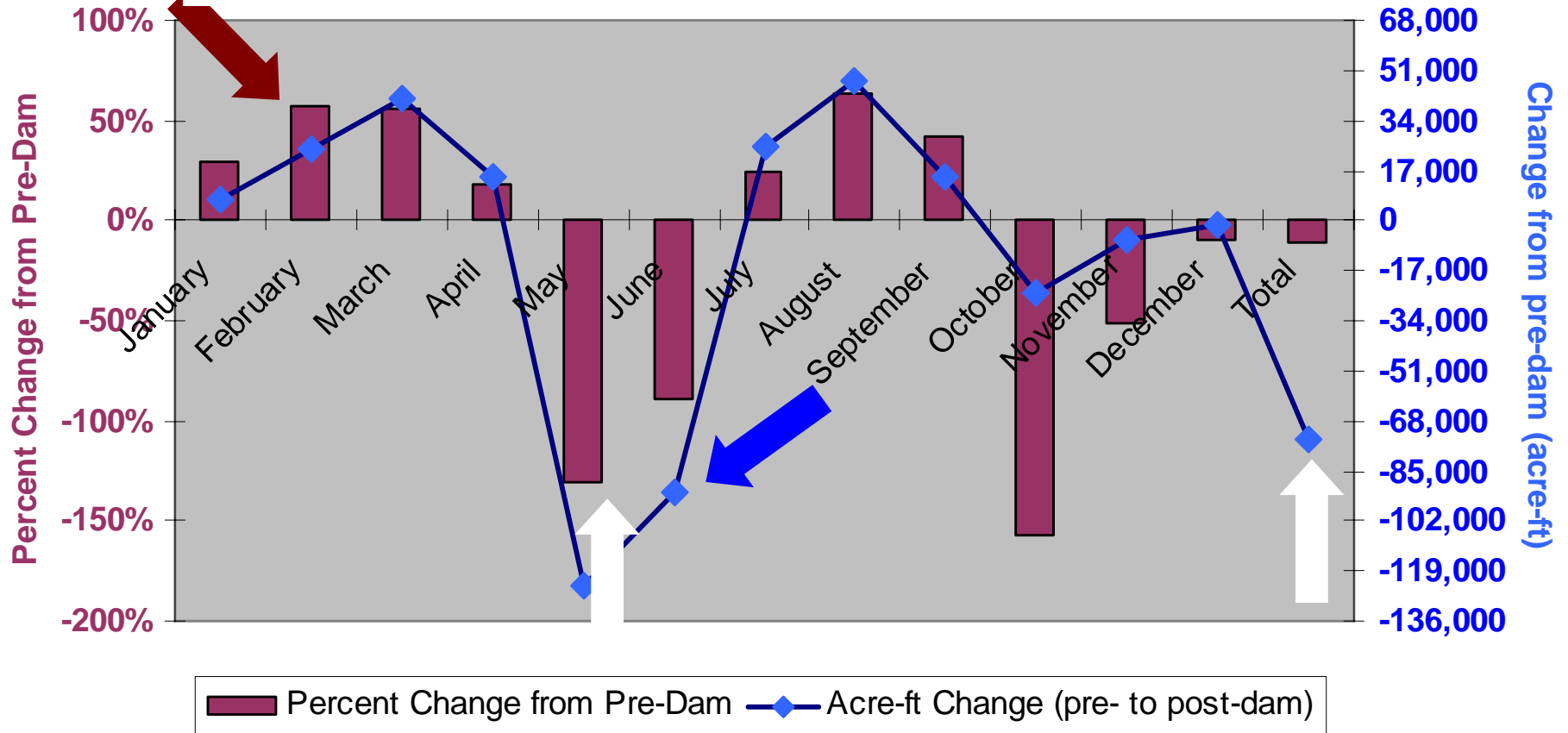
♣ Extent and distribution of

bottomland

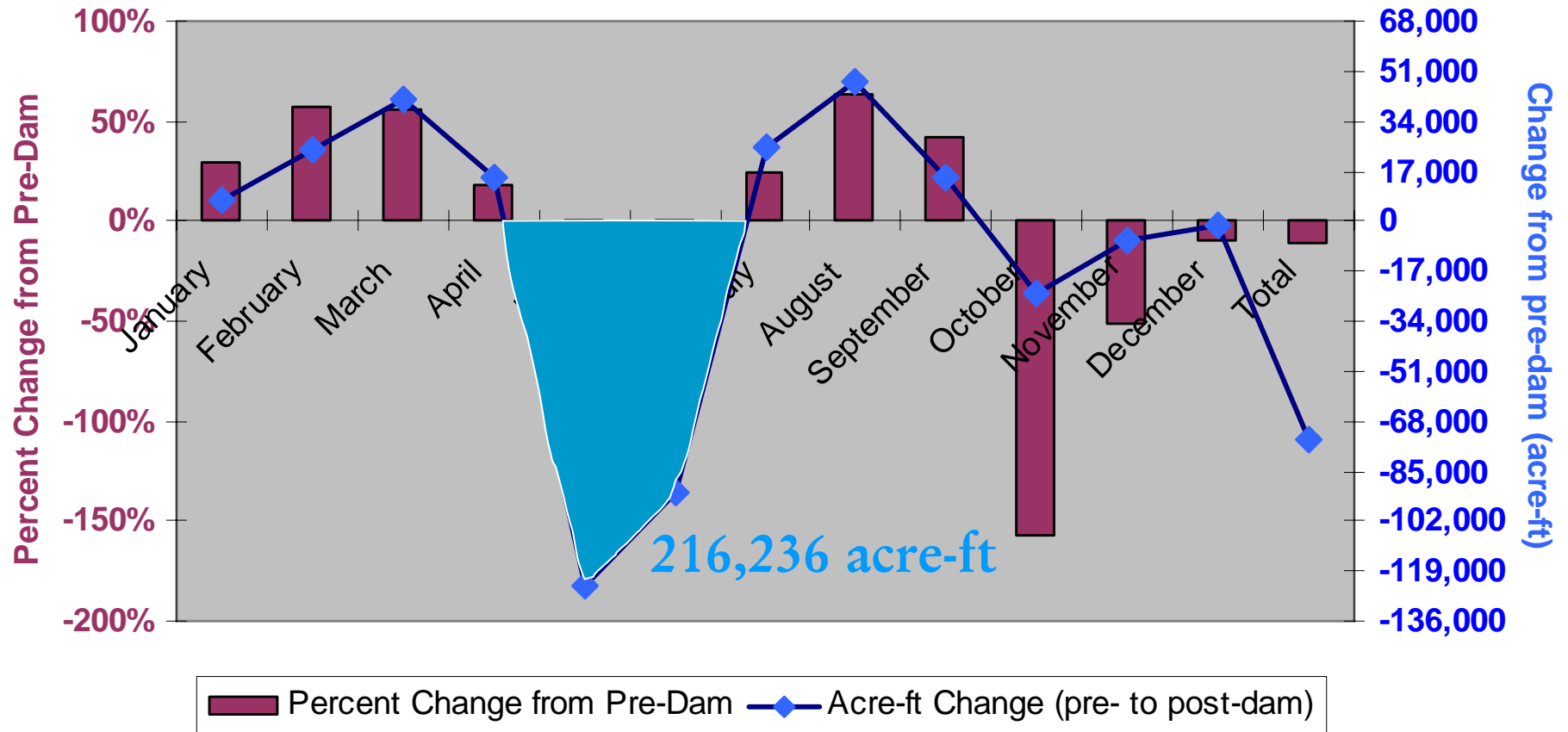
flora and fauna

Quantify the amount of environmental
water and flow pattern required to achieve
stated objectives

Mean Monthly Flow Volume of Rio Grande at El Paso Pre-Dam - Post-Dam Comparison



Monthly Runoff at El Paso: Pre-Dam - Post-Dam Comparison

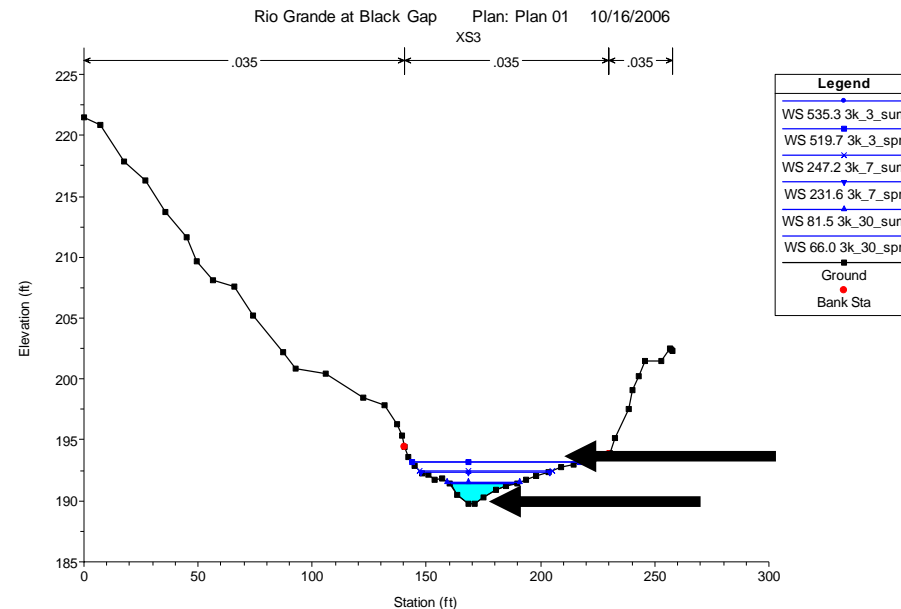


Environmental Flow Reality Check

- v Water rights potentially available for environmental flow no where near pre-impoundment deficits (216,236 acre-ft versus maybe 12,000 acre-ft)
- v Future deficits may be even more significant given climate change and increased severity in drought conditions
- v Significant legal/political hurdles
- v Water losses from point of purchase to target reach can be significant
- v Current channel morphologic and bottomland plant community conditions offer significant challenges

Good News

- Preliminary hec-ras model shows potentially significant increases in stage (from base flow) even if with only modest amounts of environmental water (e.g., 3,000 acre-ft)



Bad News



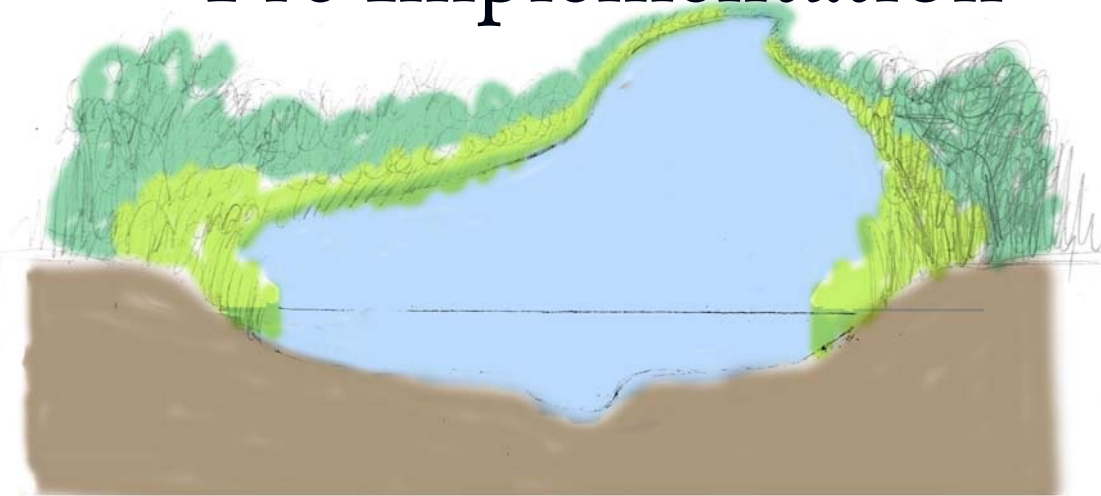
To be effective, environmental flows:

- ✓ Require additional ecologic and hydrologic investigations
- ✓ Need to be used strategically
- ✓ Purchase of environmental water rights needs to be accompanied by changes in river management;
- ✓ Be done in conjunction with on-the-ground efforts

Planned On-the-Ground Efforts

- 
- ♣ Focus on artificially removing invasive plants in selected areas;
 - ♣ Potentially involve the artificial creation of floodplain surfaces for reestablishing native bottomland plants.

Pre-Implementation

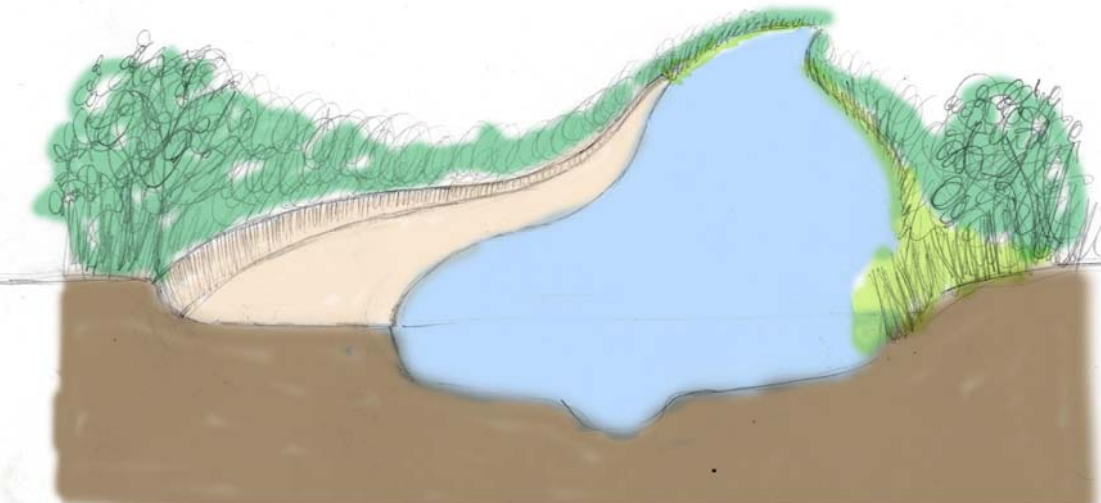


In select areas,
artificially create:

♣ floodplain surfaces
that could be inundated
by modest
environmental flows

♣ planted with native
bottomland vegetation
species

Post-Implementation



← 50' →

Efforts to secure water rights for bottomland ecological benefit

Challenges:

- 1) Expensive;
- 2) Significant legal/sociopolitical hurdles;
- 3) Quantification of required flow poses significant technical challenges;
- 4) Requires changes in river management;
- 5) Requires bi-national collaboration;
- 6) Conducted in conjunction with on-the-ground efforts.

Benefits:

- 1) Addressing hydrologic changes that have precipitated biologic decline;
- 2) Potential long-term benefit for multiple species;
- 3) Potential benefit for human stakeholders.

Priorities

- ✓ Monitor results of saltcedar eradication efforts and revegetation projects;
- ✓ Conduct additional bottomland revegetation efforts as well as pilot floodplain modification efforts
- ✓ Collect ecological / hydrological data needed to better understand the validity of using environmental flow to improve bottomland ecologic conditions
- ✓ Work with protected area managers and participating NGOs, and scientists to formulate detailed restoration objectives
- ✓ Secure funding for the Trans-Boundary Water Trust for the purchase of environmental water

See You On the River

