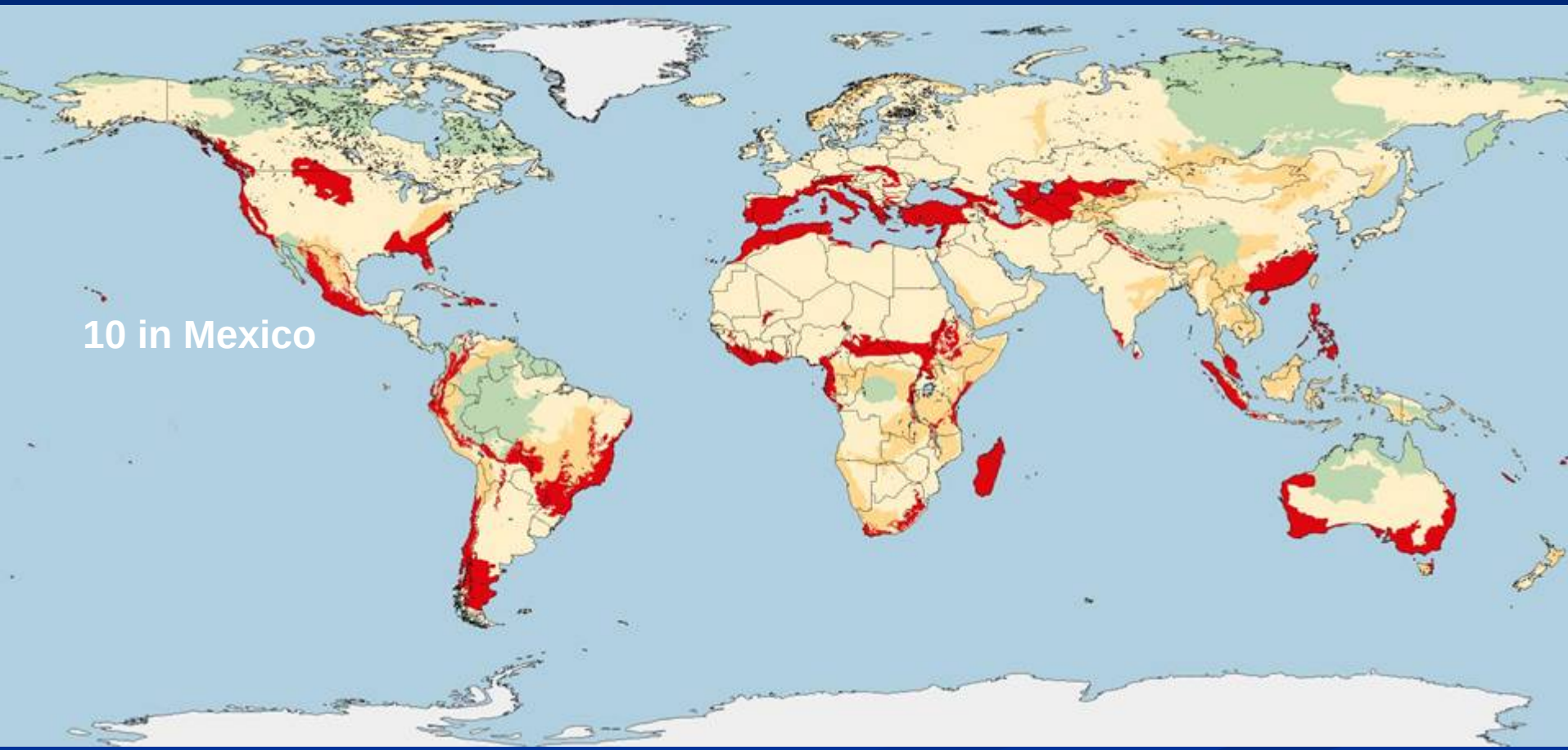
The Big Bend Reach of the Rio Grande

Addressing Ecological Decline Along a Hydrologically Altered Border River

Mark Briggs, World Wildlife Fund

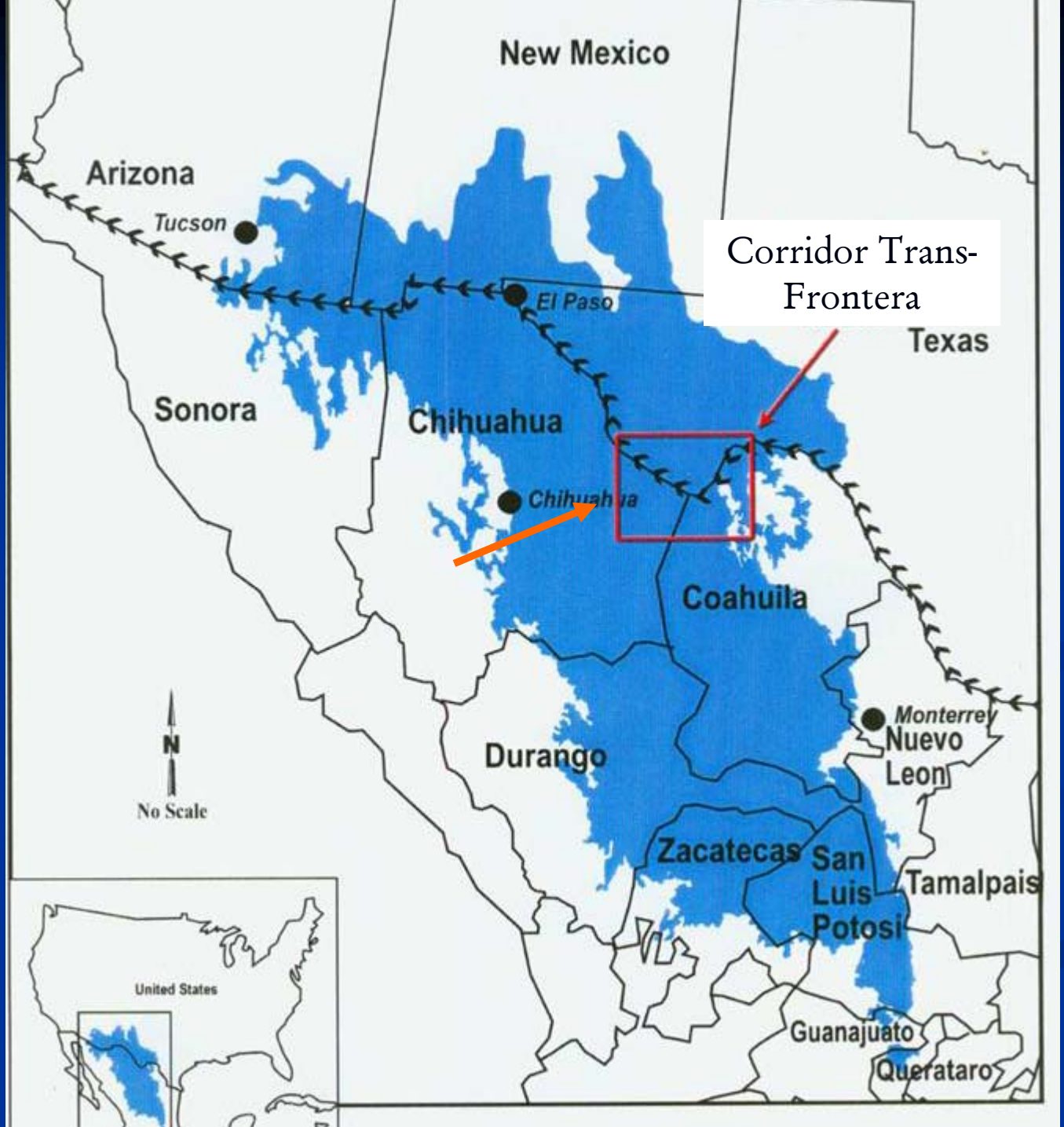
Priority Ecoregions






WWF
El Programa Mexicano



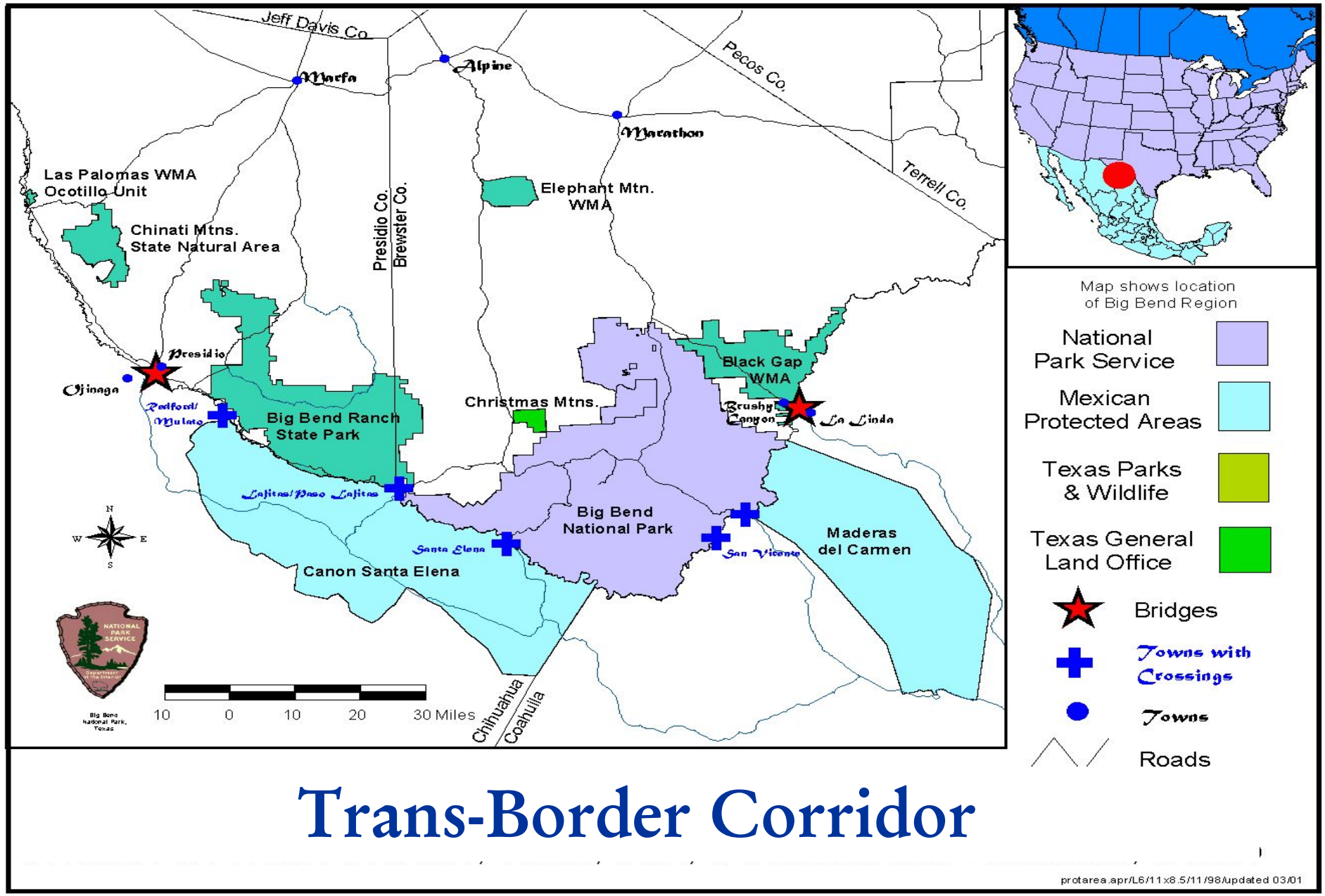


New Mexico
Arizona
Tucson
El Paso
Texas
Corridor Trans-Frontera
Sonora
Chihuahua
Chihuahua
Coahuila
Monterrey
Nuevo Leon
Durango
N
No Scale
Zacatecas
San Luis Potosi
Tamalpais
United States
Guanajuato
Queretaro

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

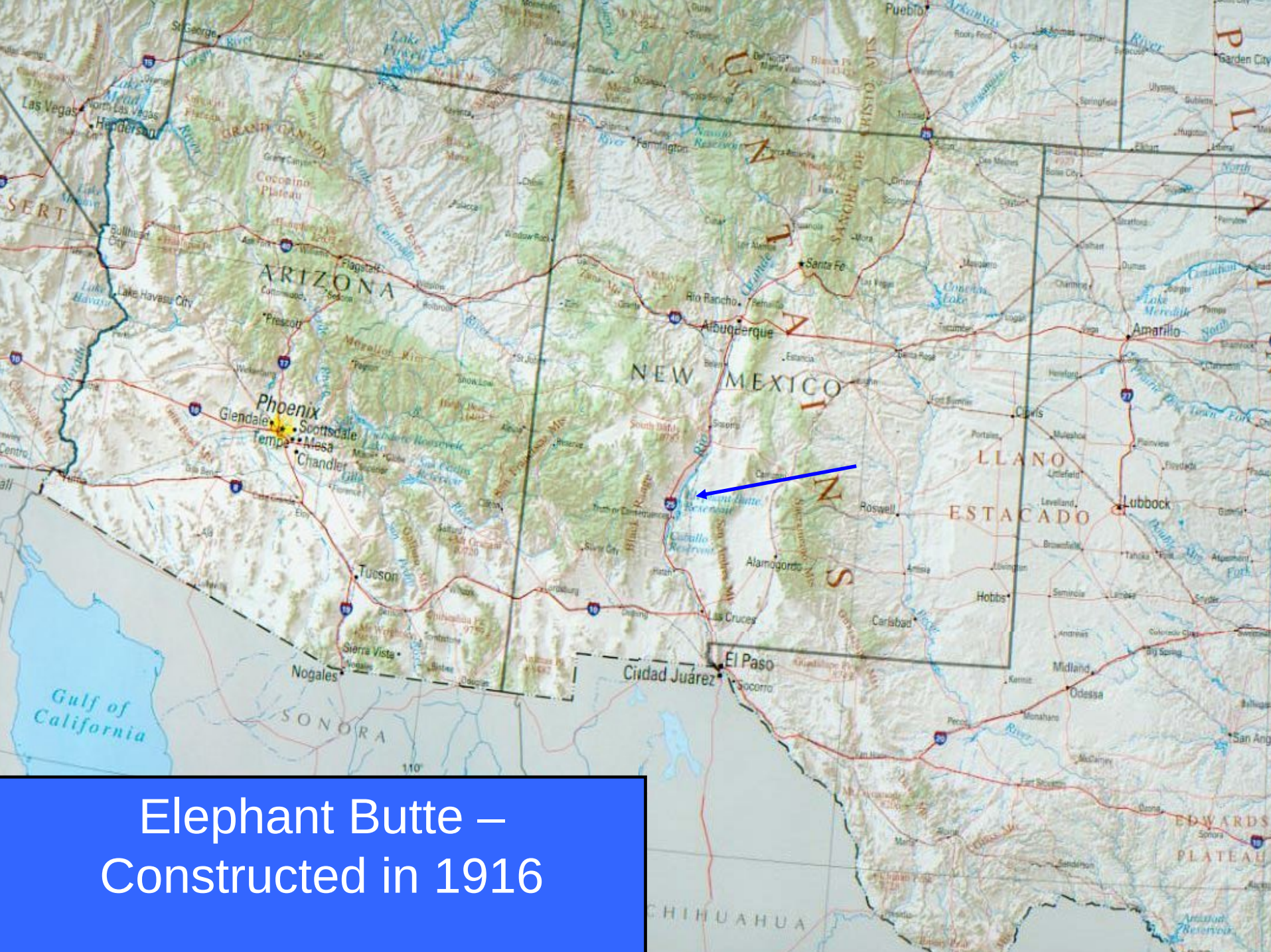
protarea.apr/L6/11x8.5/11/98/updated 03/01

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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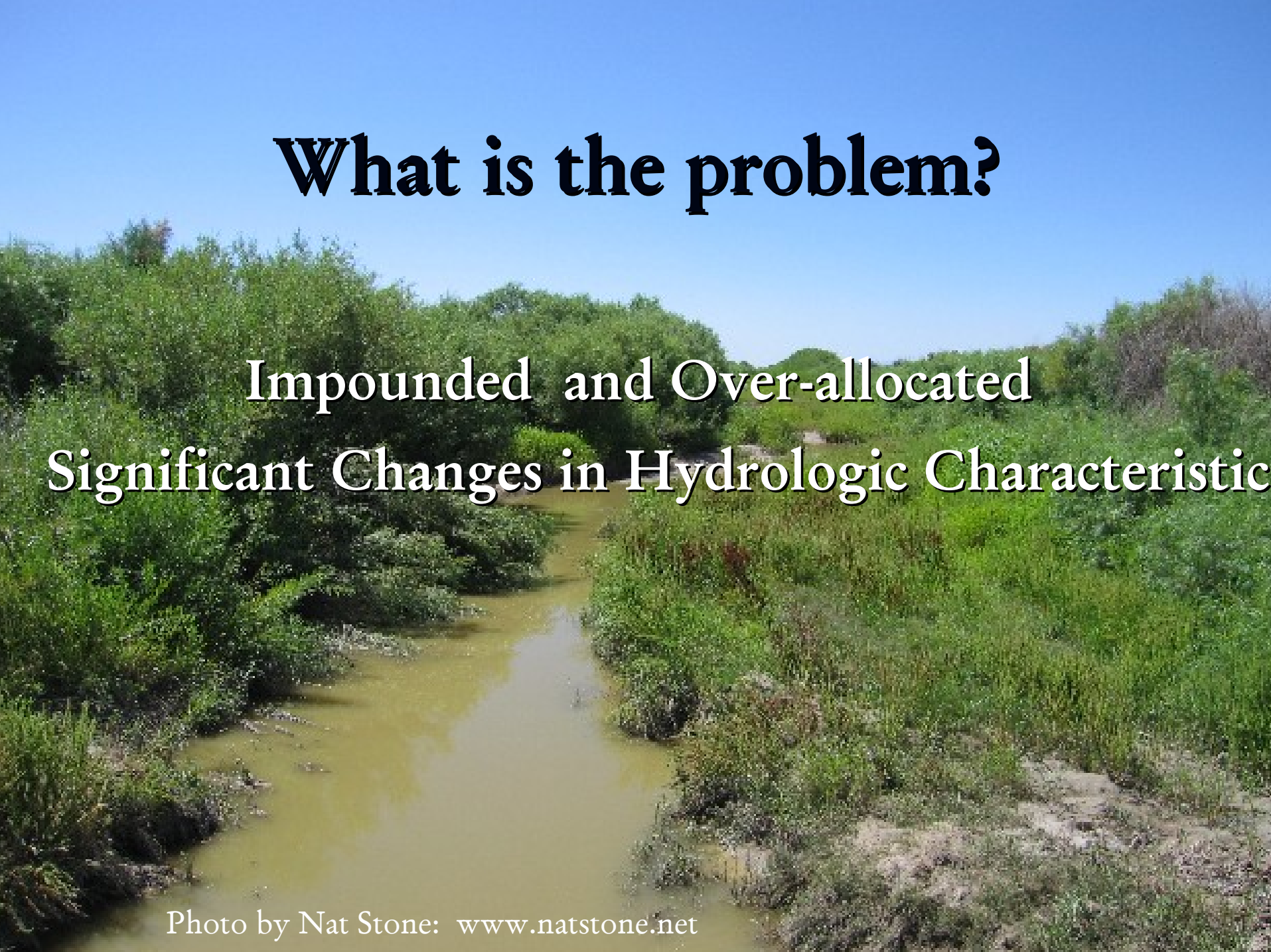
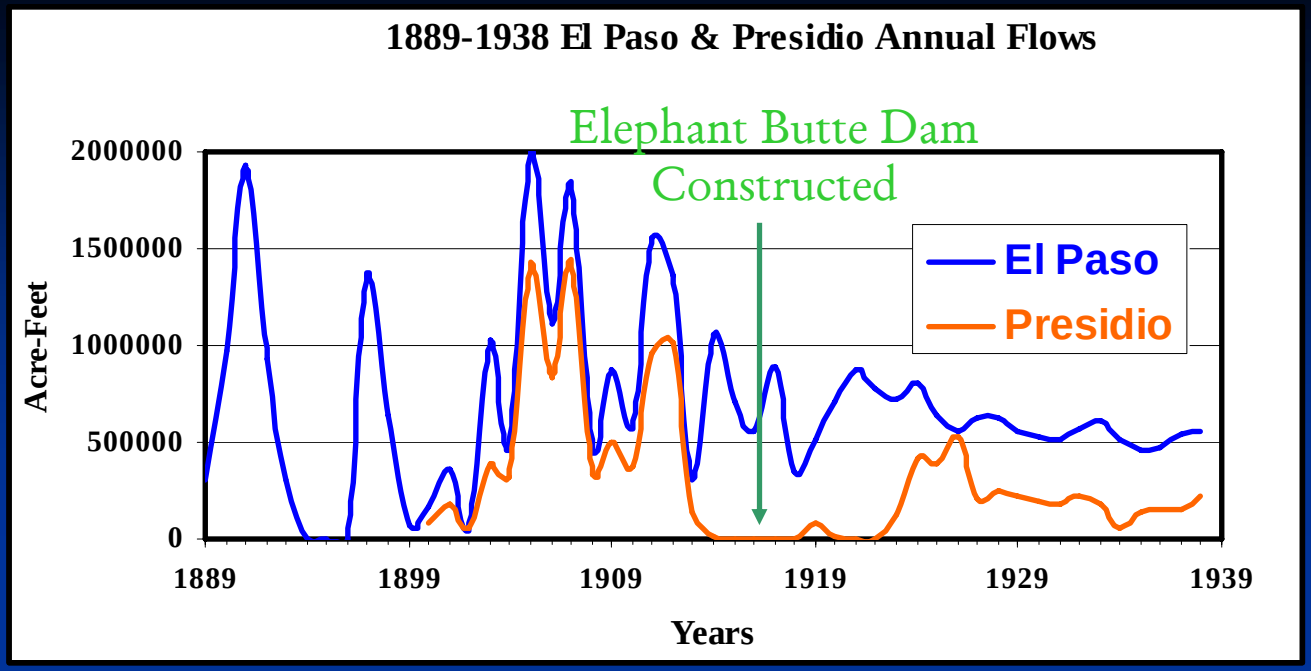
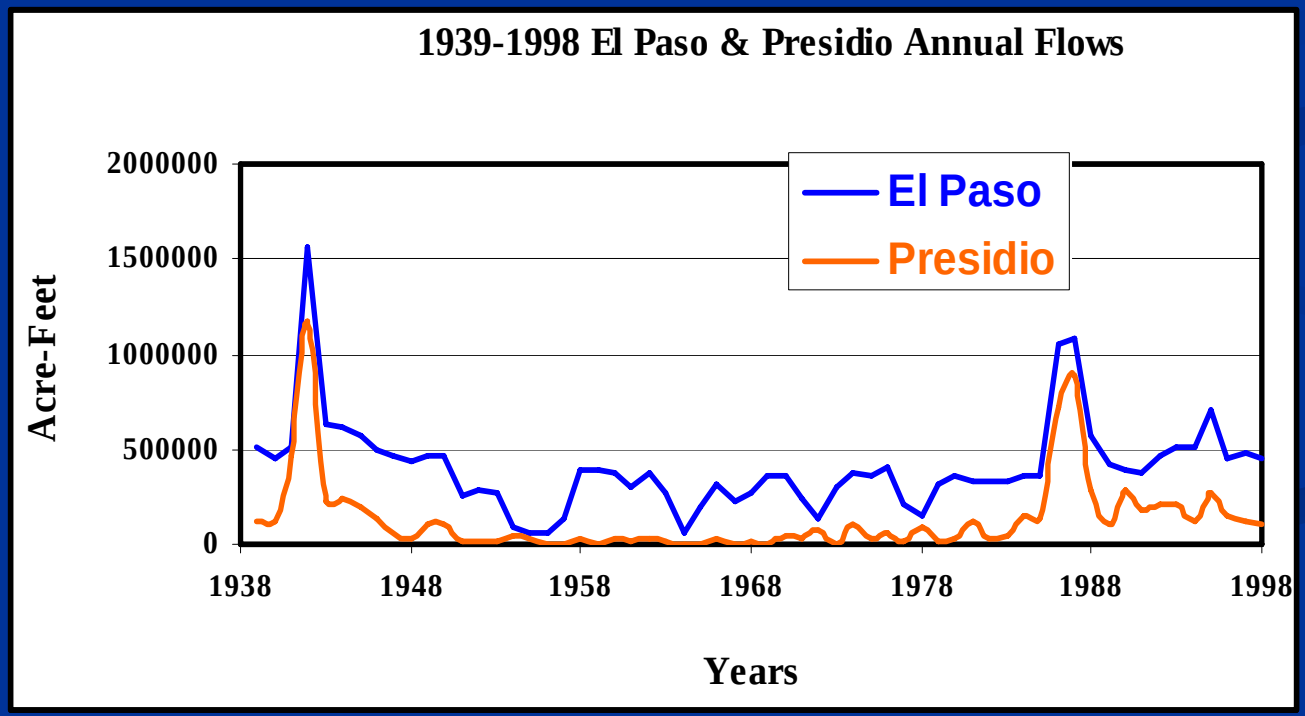
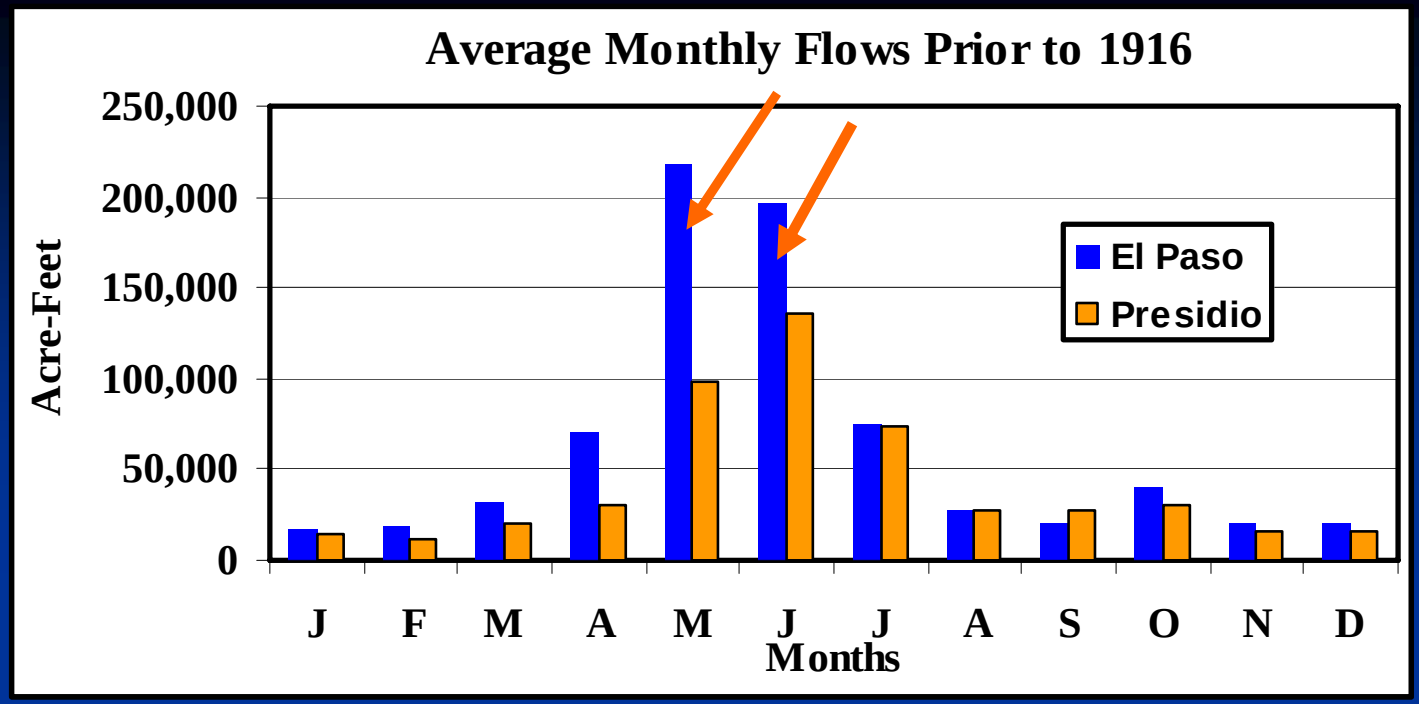
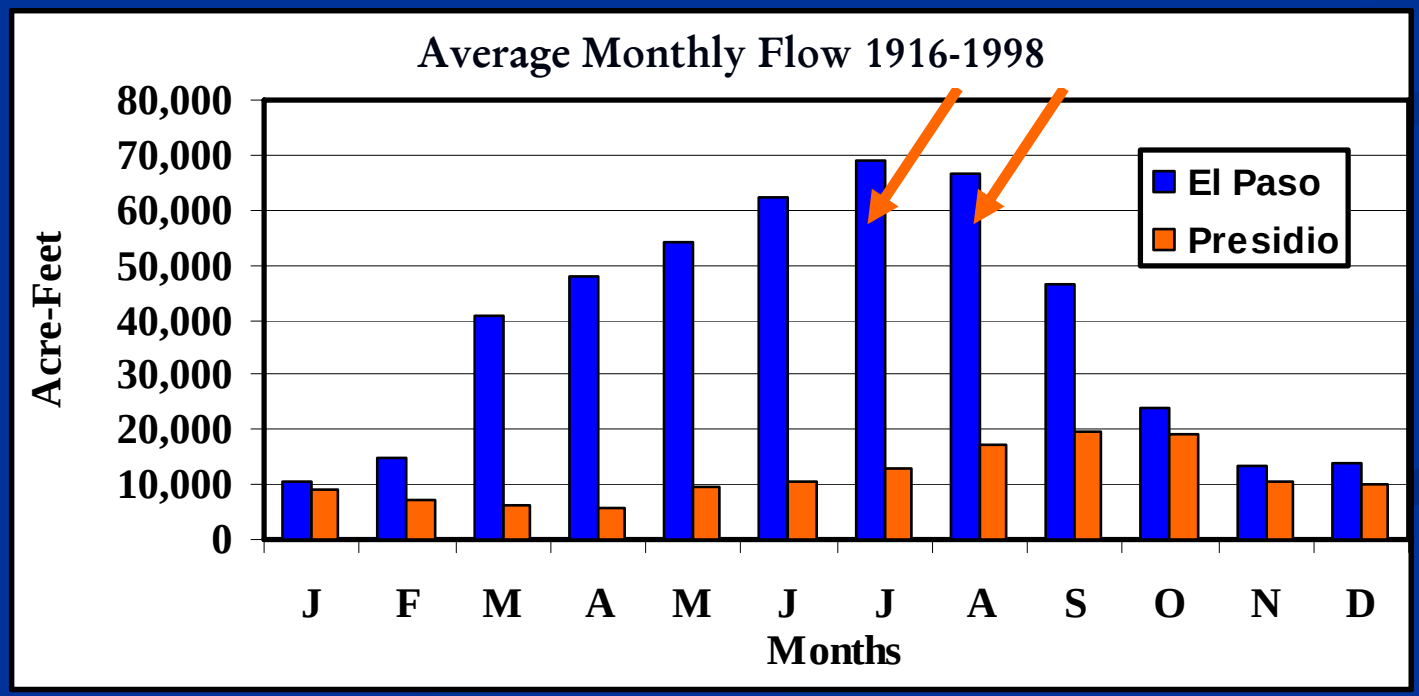



1889-1938 El Paso & Presidio Annual Flows
Elephant Butte Dam
Constructed
2000000
1500000
1000000
500000
0
Acre-Feet
El Paso
Presidio
1889
1899
1909
1919
1929
1939
Years


1939-1998 El Paso & Presidio Annual Flows
2000000
1500000
1000000
500000
0
Acre-Feet
El Paso
Presidio
1938
1948
1958
1968
1978
1988
1998
Years


Average Monthly Flows Prior to 1916
250,000
200,000
150,000
100,000
50,000
0
Acre-Feet
El Paso
Presidio
J F M A M J J A S O N D
Months

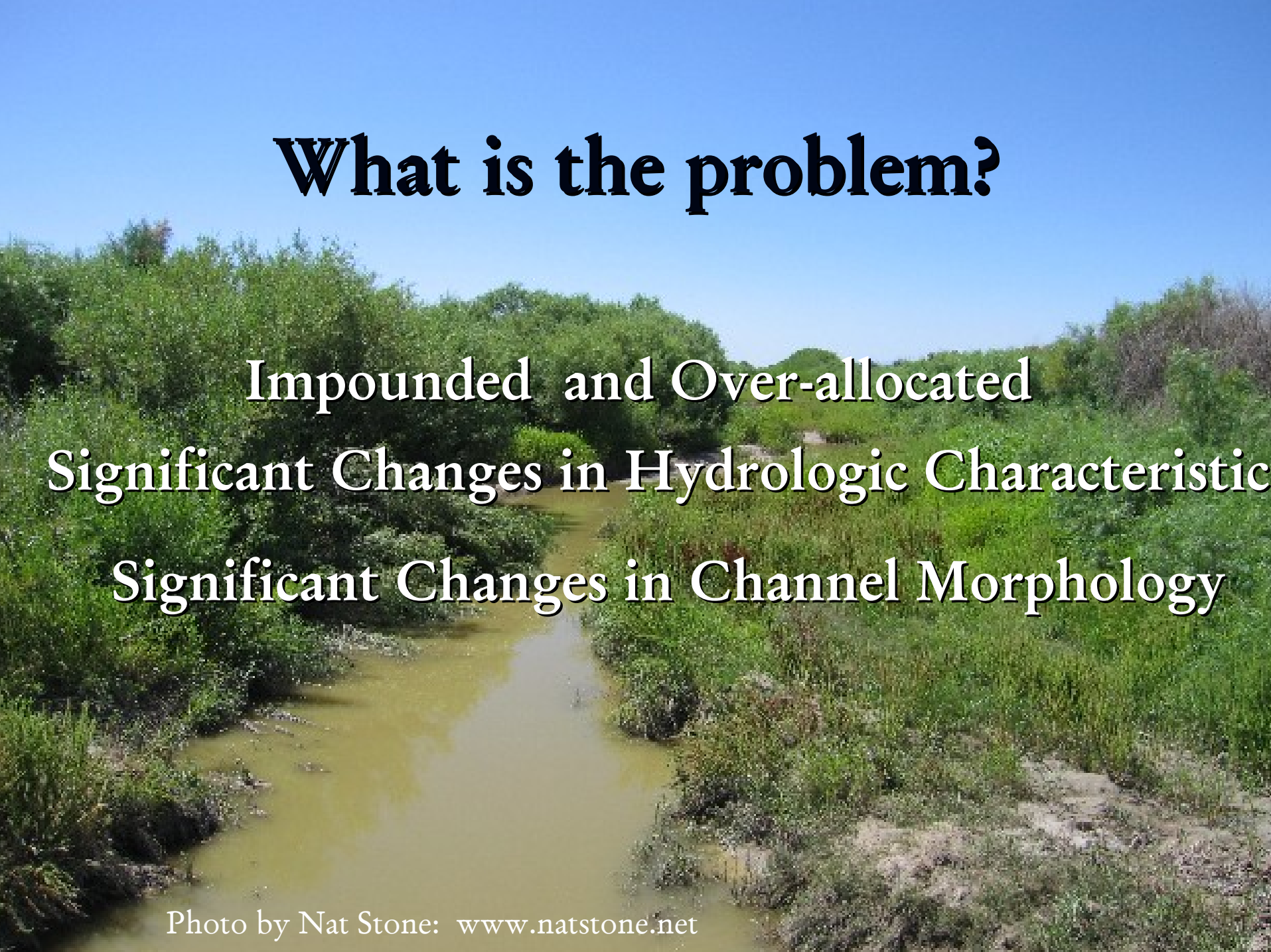

Average Monthly Flow 1916-1998
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Acre-Feet
El Paso
Presidio
J F M A M J J A S O N D
Months

ALTERED HYDROLOGIC CHARACTERISTICS

PRE-IMPOUNDMENT/POST-IMPOUNDMENT

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

What is the problem?



Impounded and Over-allocated

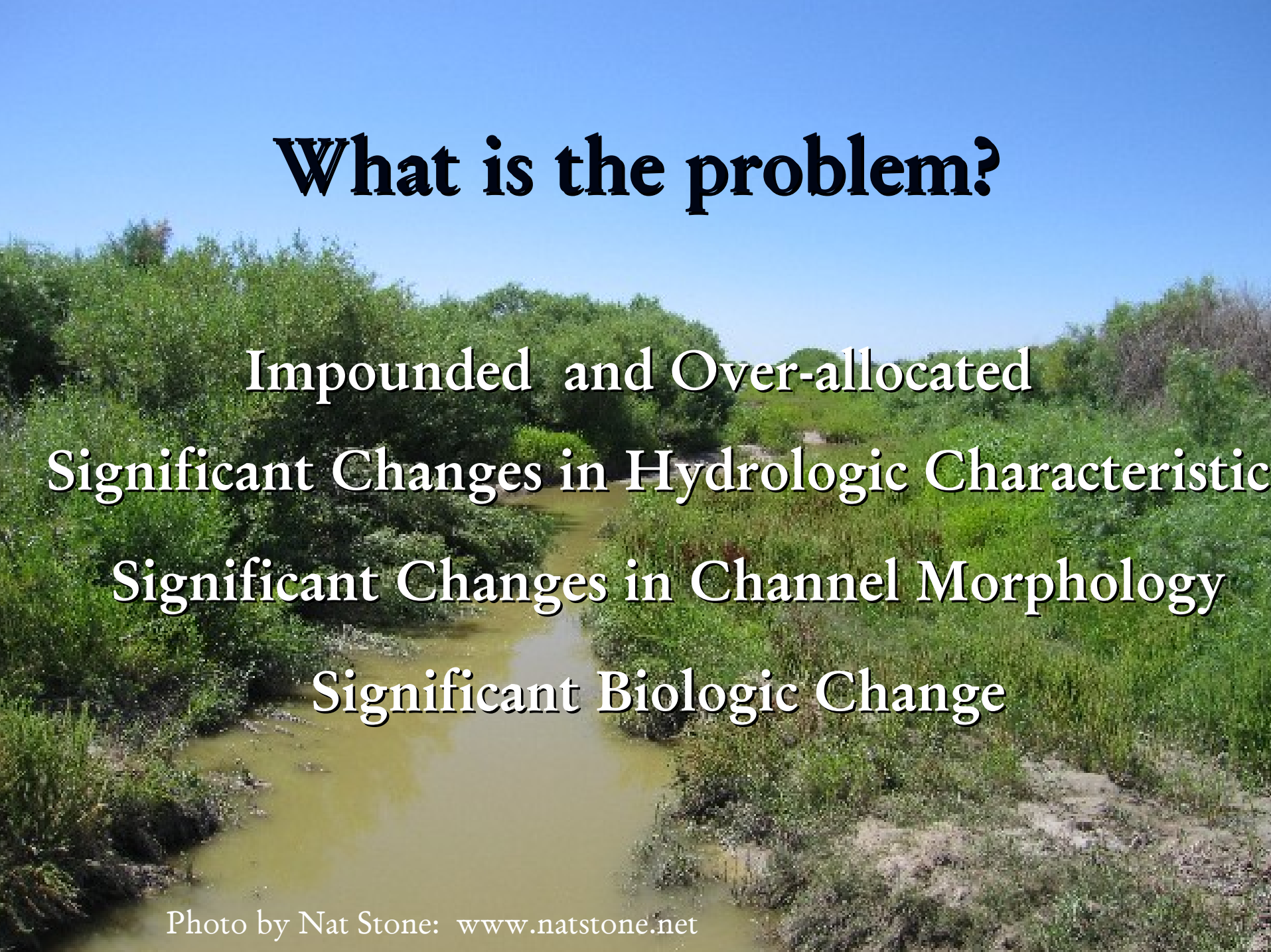
Significant Changes in Hydrologic Characteristic

Significant Changes in Channel Morphology

Photo by Nat Stone: www.natstone.net


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
Photo by Nat Stone: www.natstone.net

Summary of Selected Biologic Change

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

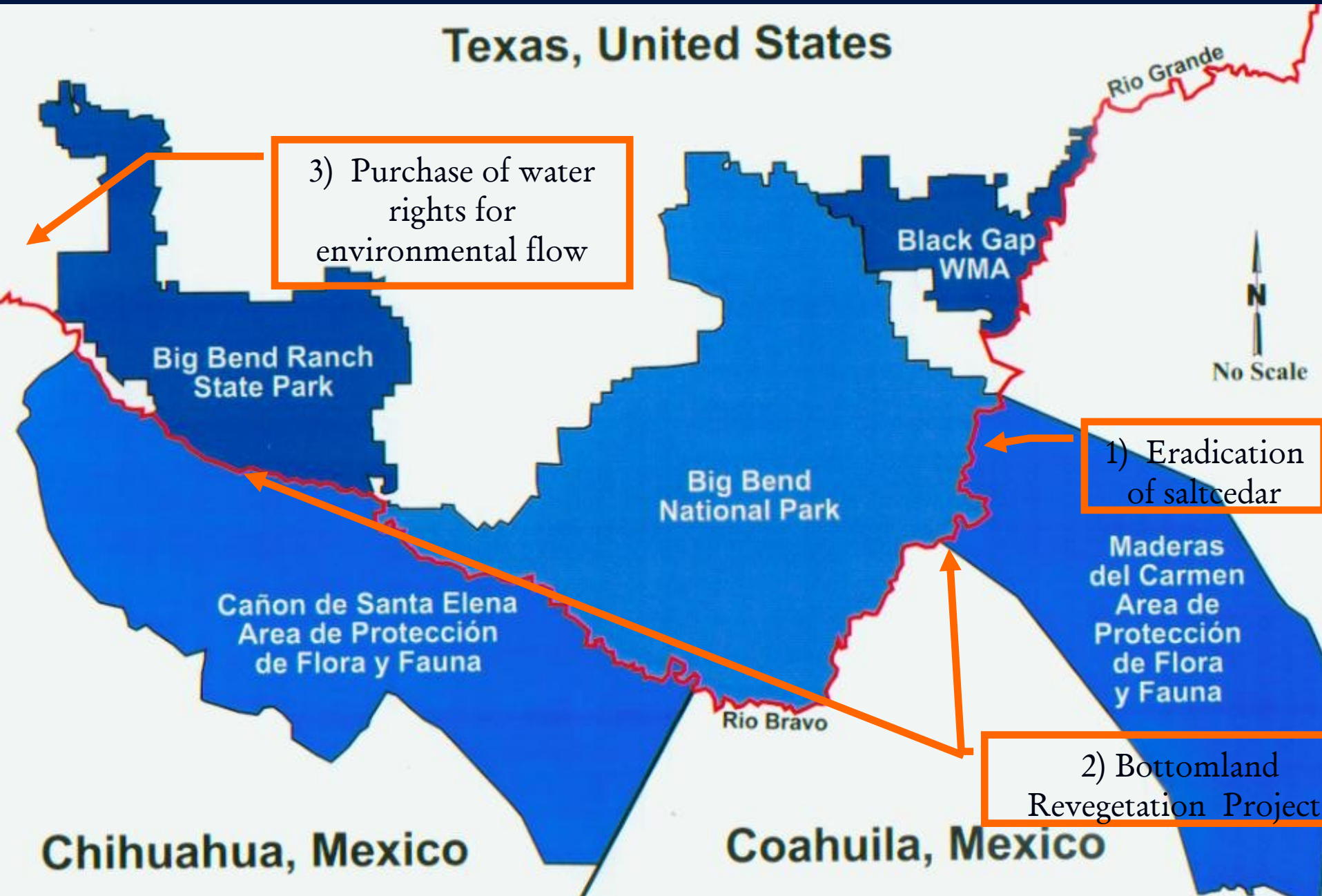
Dense monotypic stands of saltcedar are a manifestation of altered hydrologic conditions


Arundo donax (Giant Reed)

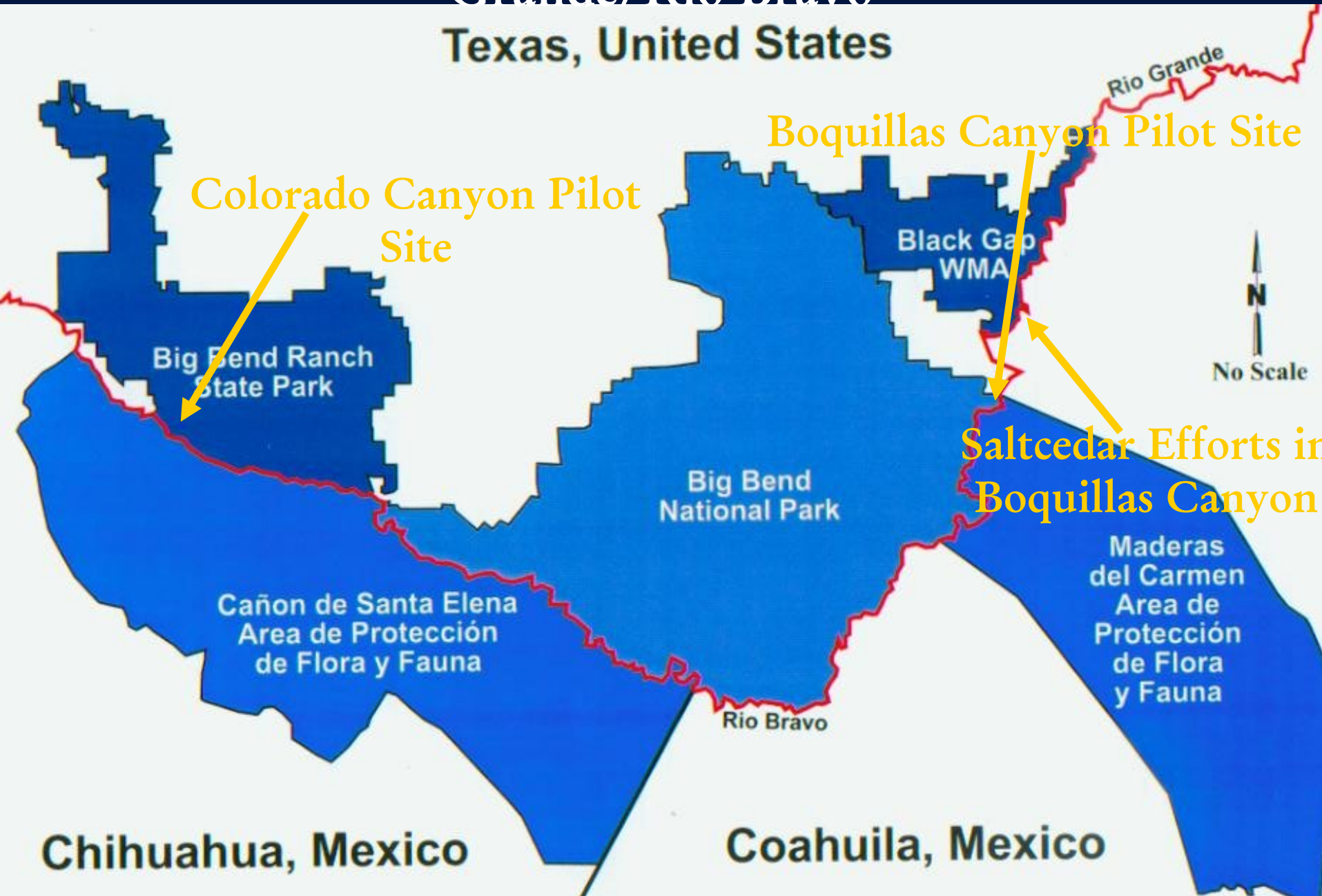
Addressing the Problem

The Formation of a Bi-National Team

Three Major Efforts Underway



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



Boquillas Canyon Pilot Restoration Site

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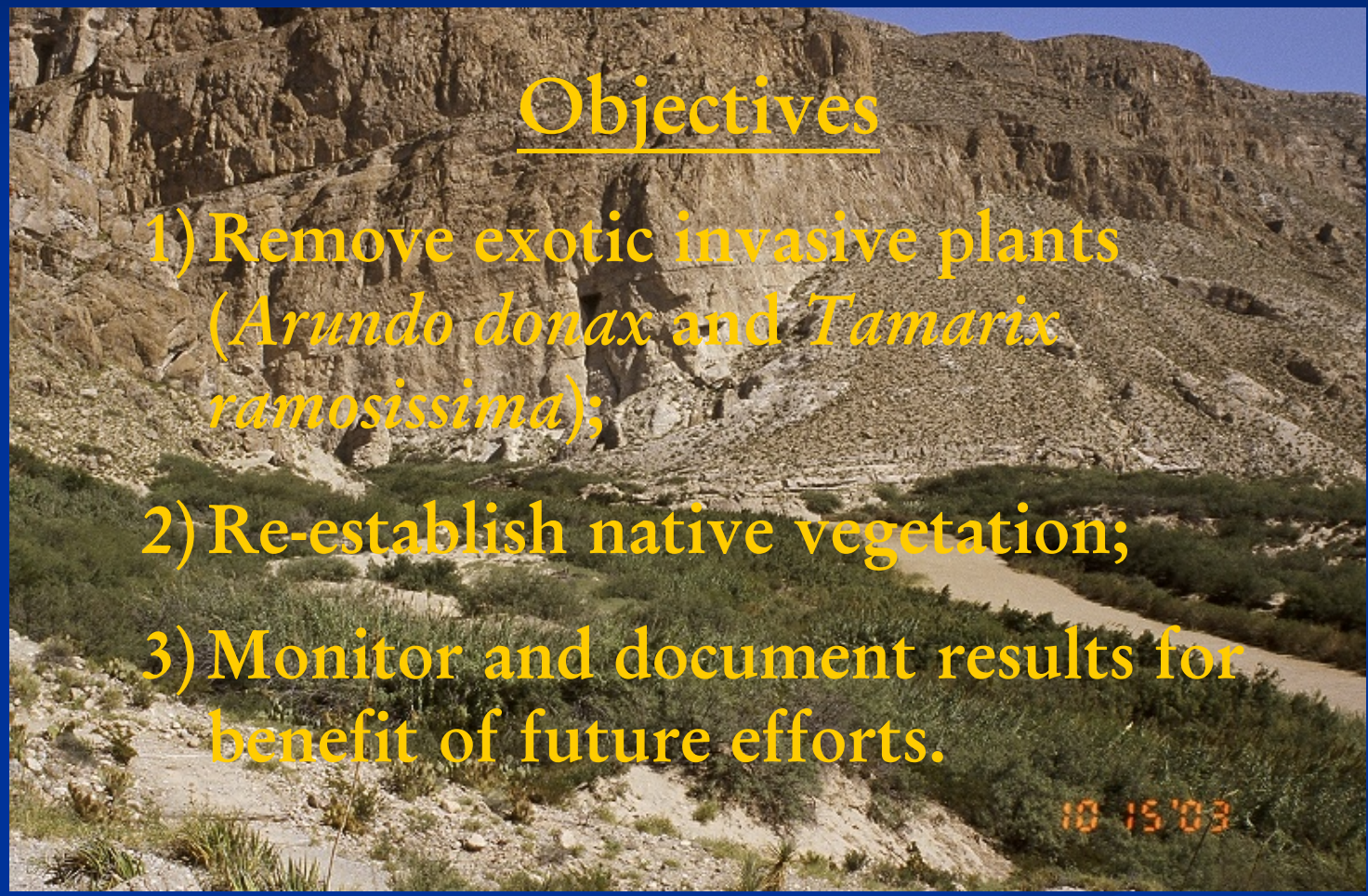


Step 1: Giant reed was burned

Step 2: Herbicide applied to both saltcedar and giant reed

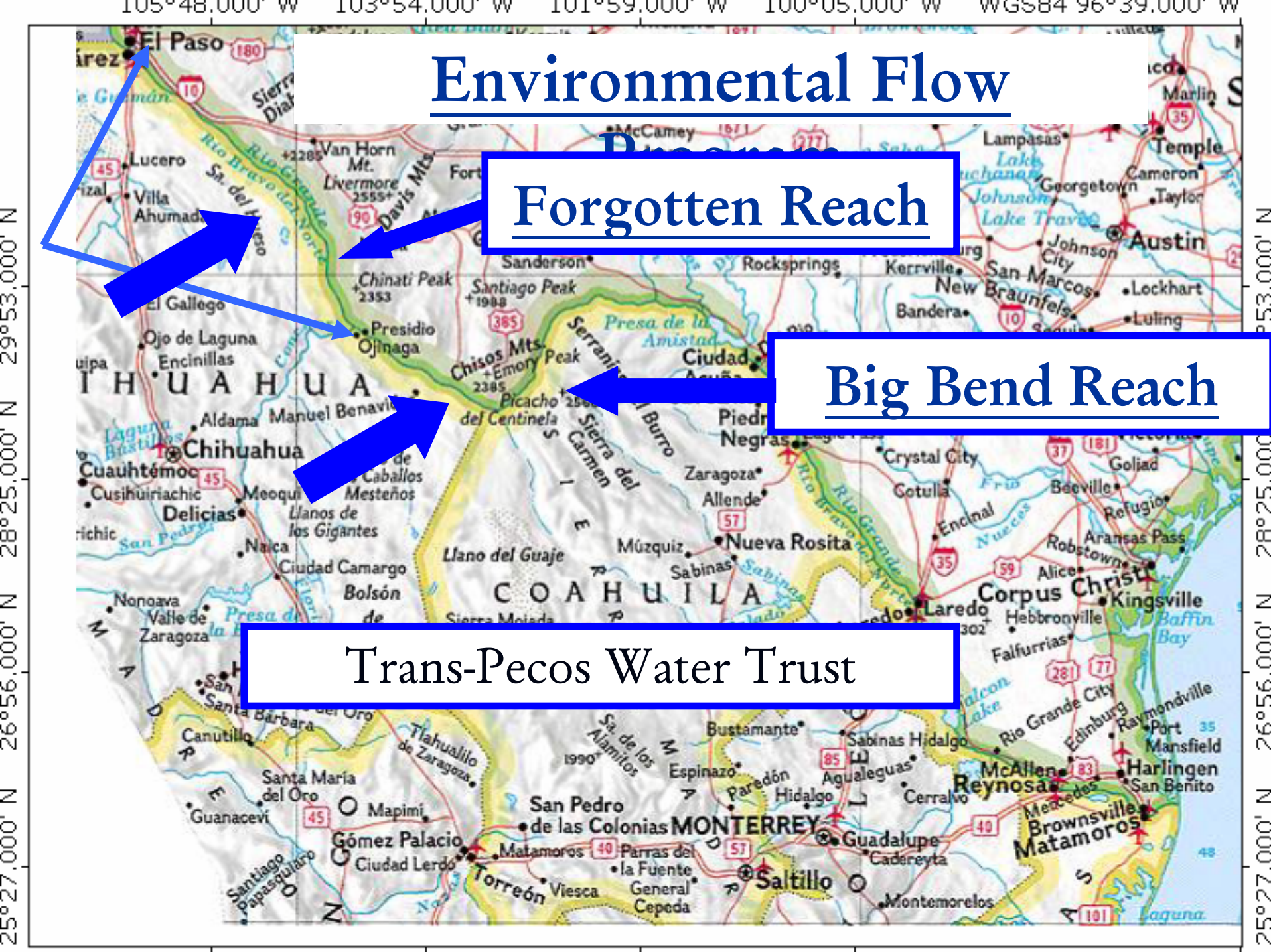
Step 3: Irrigation system installed

Step 4: Individual plant sites augered


Step 5: Plant vegetation

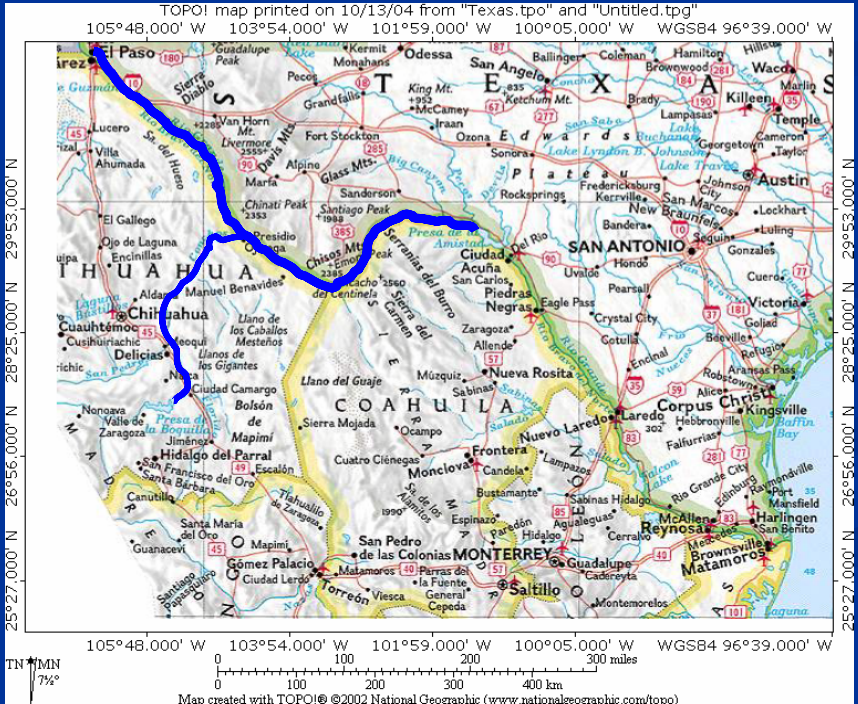
Step 6: Monitoring and Maintenance

Boquillas Canyon Saltcedar Eradication Effort


Environmental Flow
Forgotten Reach
Big Bend Reach
Trans-Pecos Water Trust

Fundamental Questions for an Environmental Flow Program

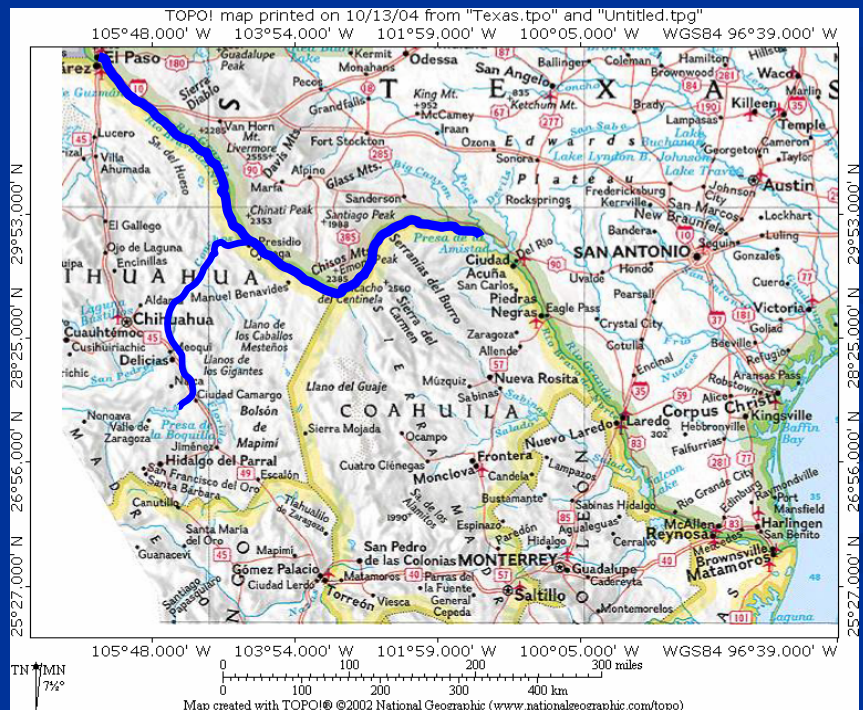
- # Legal Investigations;
- Are there water rights available?
- If so, how many?
- Where are they (which part of the river)?
- How much do they cost and do they vary along the river?



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

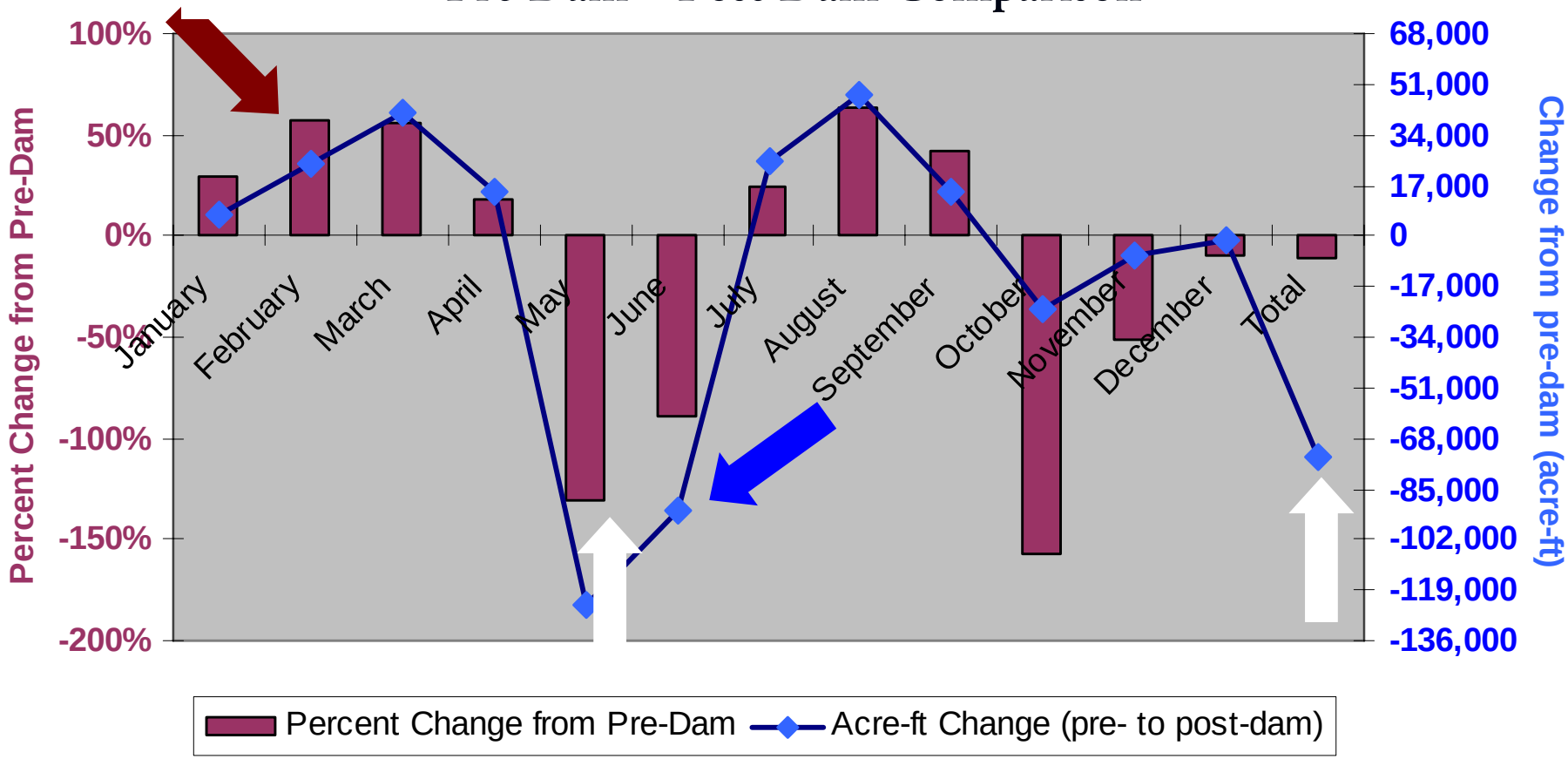
What are our 'restoration' objectives?

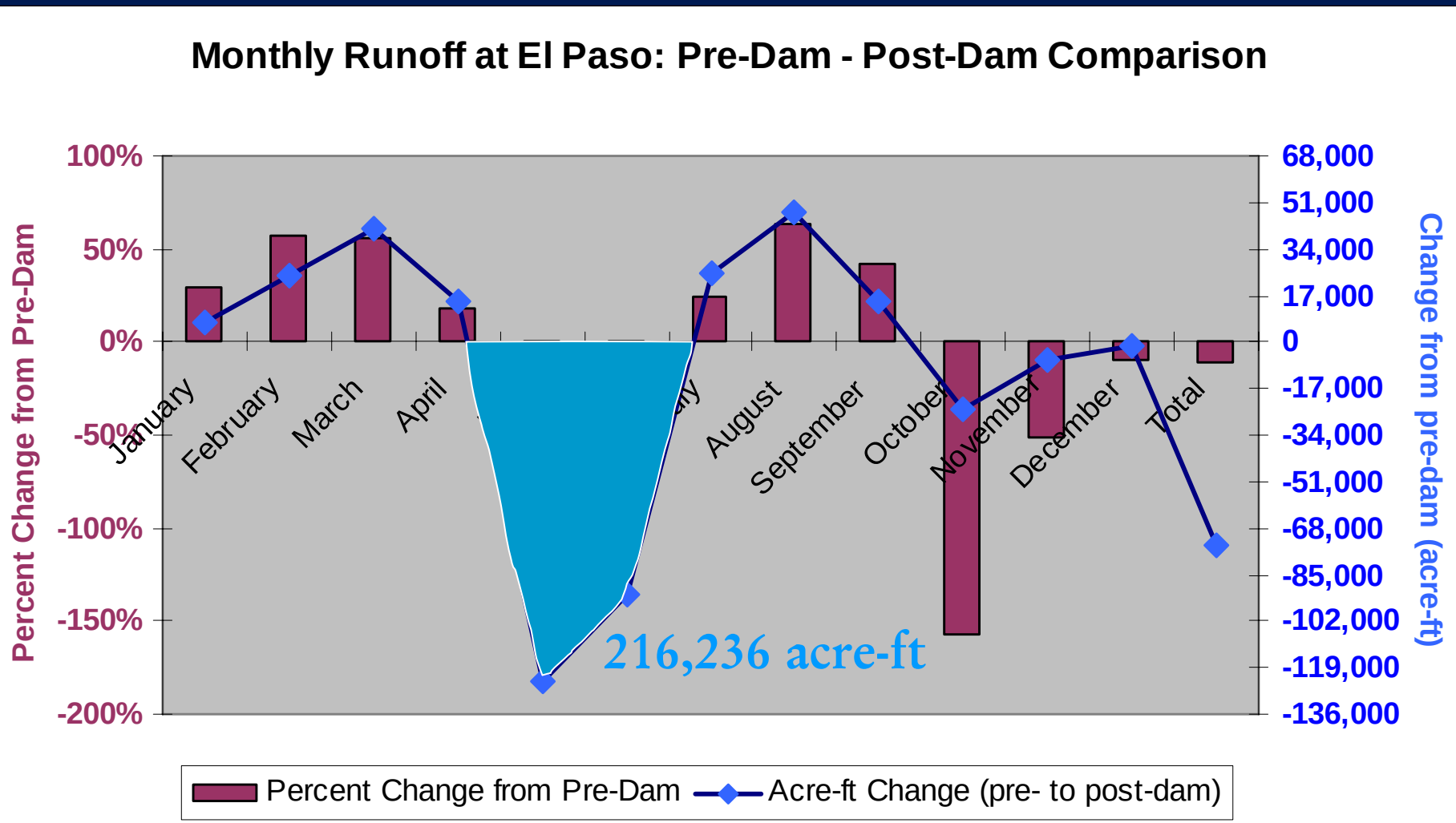
- Sediment budget
- Channel morphology
- Water quality
- Extent and distribution of bottomland flora and fauna

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



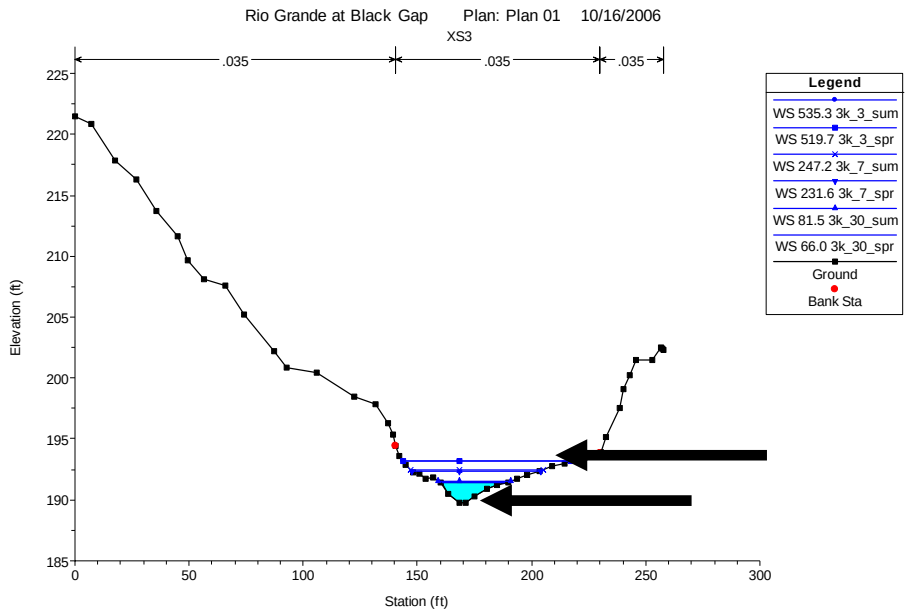

Monthly Runoff at El Paso: Pre-Dam - Post-Dam Comparison
Percent Change from Pre-Dam
100%
50%
0%
-50%
-100%
-150%
-200%
68,000
51,000
34,000
17,000
0
-17,000
-34,000
-51,000
-68,000
-85,000
-102,000
-119,000
-136,000
Change from pre-dam (acre-ft)
January
February
March
April
August
September
October
November
December
Total
216,236 acre-ft
Percent Change from Pre-Dam
Acre-ft Change (pre- to post-dam)

Environmental Flow Reality Check

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

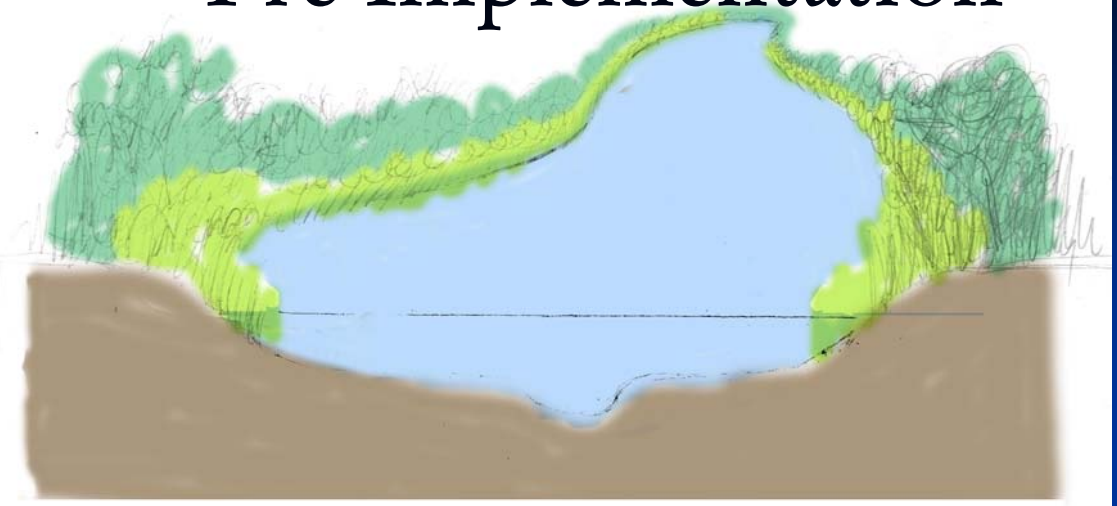
To be effective, environmental flows:

- 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

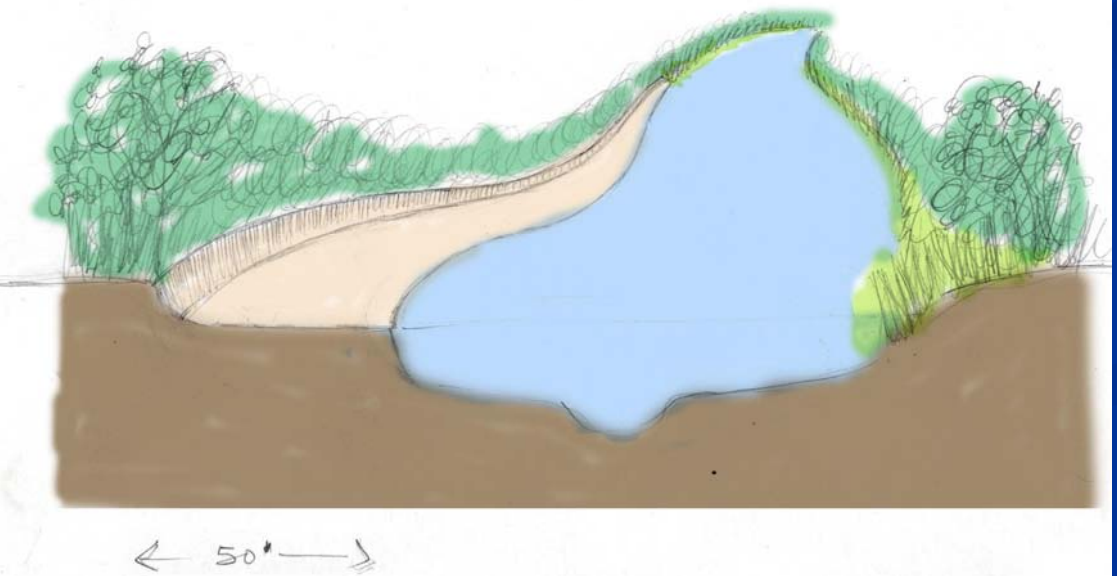
Planned On-the-Ground Efforts

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

Pre-Implementation



Post-Implementation



In select areas, artificially create:

- ♣ floodplain surfaces that could be inundated by modest environmental flows
- ♣ planted with native bottomland vegetation species

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