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ERADICATION OF SALTCEDAR (*T. RAMOSISSIMA*) AND GIANT CANE (*ARUNDO DONAX*) ALONG THE BIG BEND REACH OF THE RIO GRANDE

LESSONS LEARNED AND BROADER IMPLICATIONS FOR BOTTOMLAND NON-NATIVE PLANT REMOVAL IN THE SOUTHWEST

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January 2009






World Wildlife Fund
Working to Save 19 Priority Places

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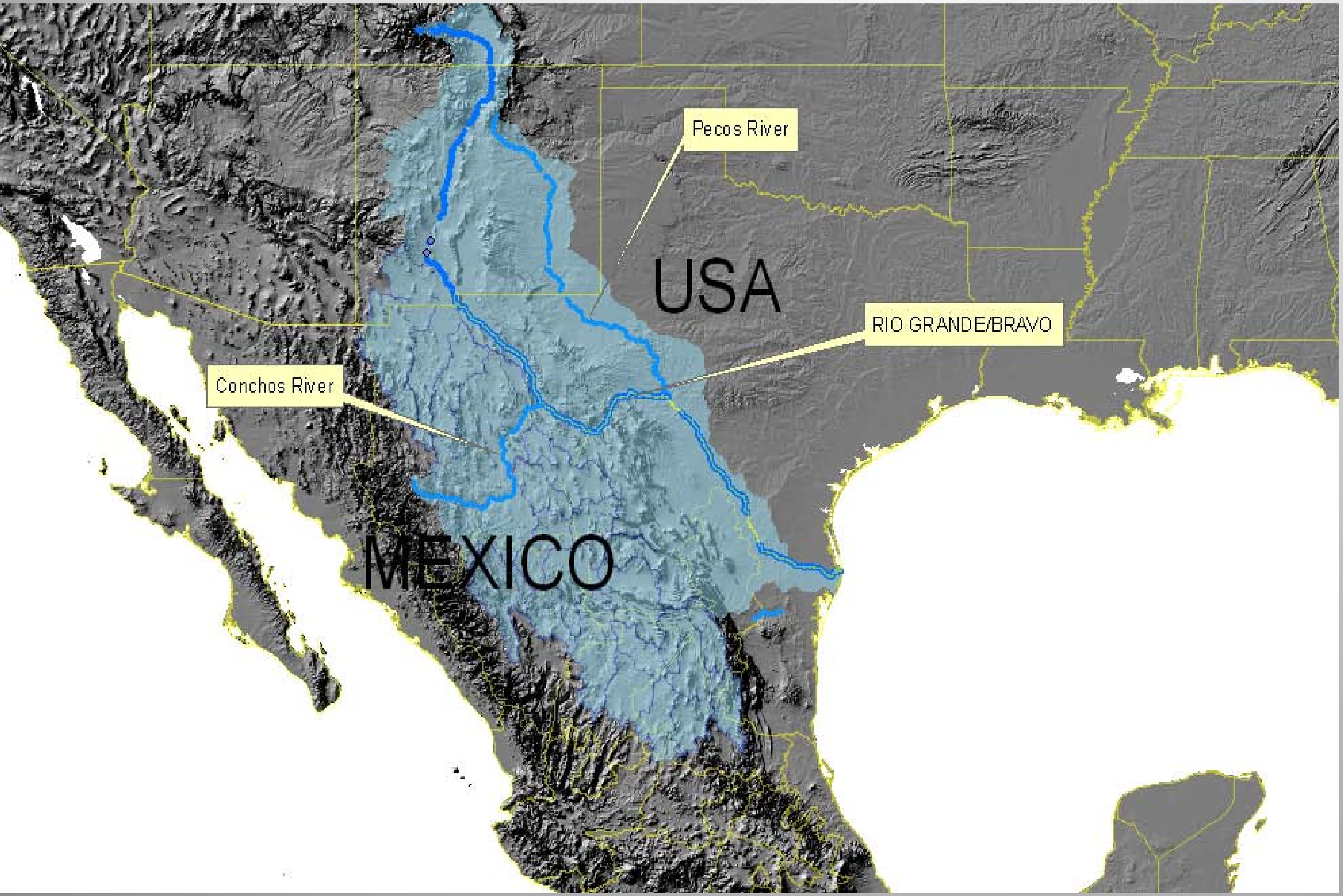
- Gulf of California
- Madagascar
- Mekong
- Mesoamerican Reef
- Namibia
- Northern Great Plains
- U.S. Southeast Rivers and Streams
- Southern Chile
- Yangtze






THE CHIHUAHUAN DESERT

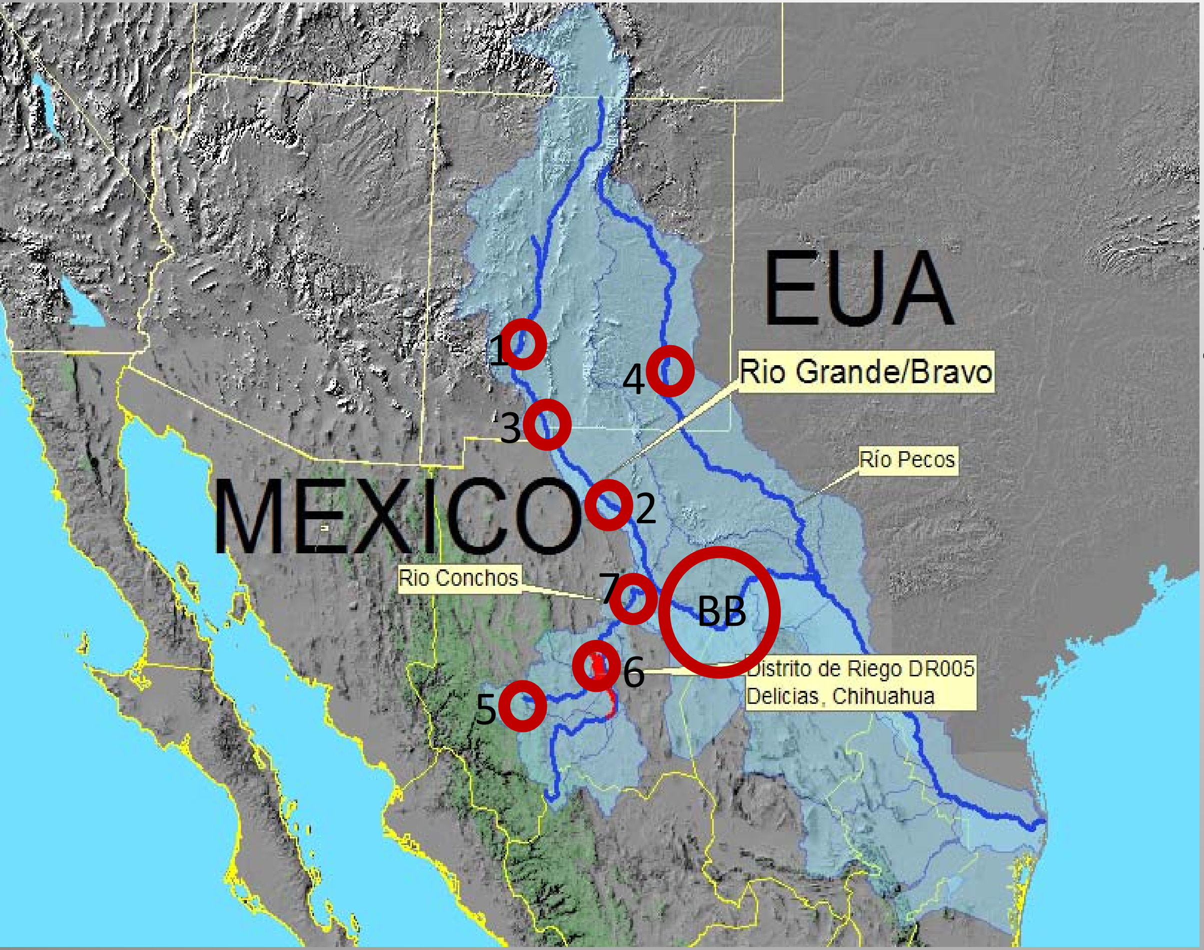


Home to more than 130 species of mammals, 3,000 plant species, provides nesting sites and migratory habitats for over 500 bird species, and 110 species native freshwater fish species in its rivers.






Rio Grande
The Conservation Response



Focus is on a Series of Sites Along the Rio Grande/Rio Bravo and its two largest tributaries: Rio Pecos and Rio Conchos

Establishment of String of Pearls

Map showing location of Rio Grande basin pearls



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Bringing Back the Big Bend Reach of the Rio Grande/Rio Bravo

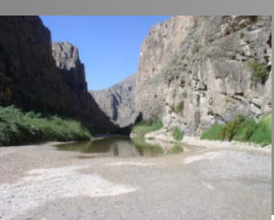
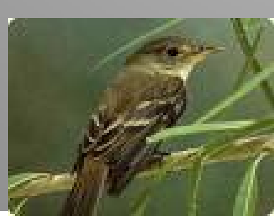
Formation of A Diverse Bi-National Team

Mexico

1) CONAGUA
2) CONANP
3) CONOFOR
4) PROFAUNA, AC
5) Universidad de las Americas
6) Universidad de Antonio Narro
7) Universidad Autonoma de Chihuahua
8) WWF – Mexico

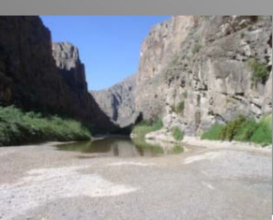
U.S.

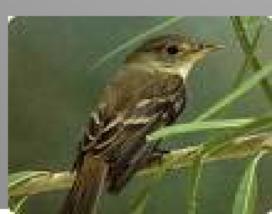
1) Environmental Defense
2) Rio Grande Institute
3) Texas A&M University
4) TCEQ
5) Texas Dept. of Parks and Wildlife
6) Texas State Parks
7) Trans-Pecos Water Trust
8) Sul Ross State University
9) US Corps of Engineers
10) USFWS
11) USGS
12) University of Texas
13) Utah State University
14) WWF - US

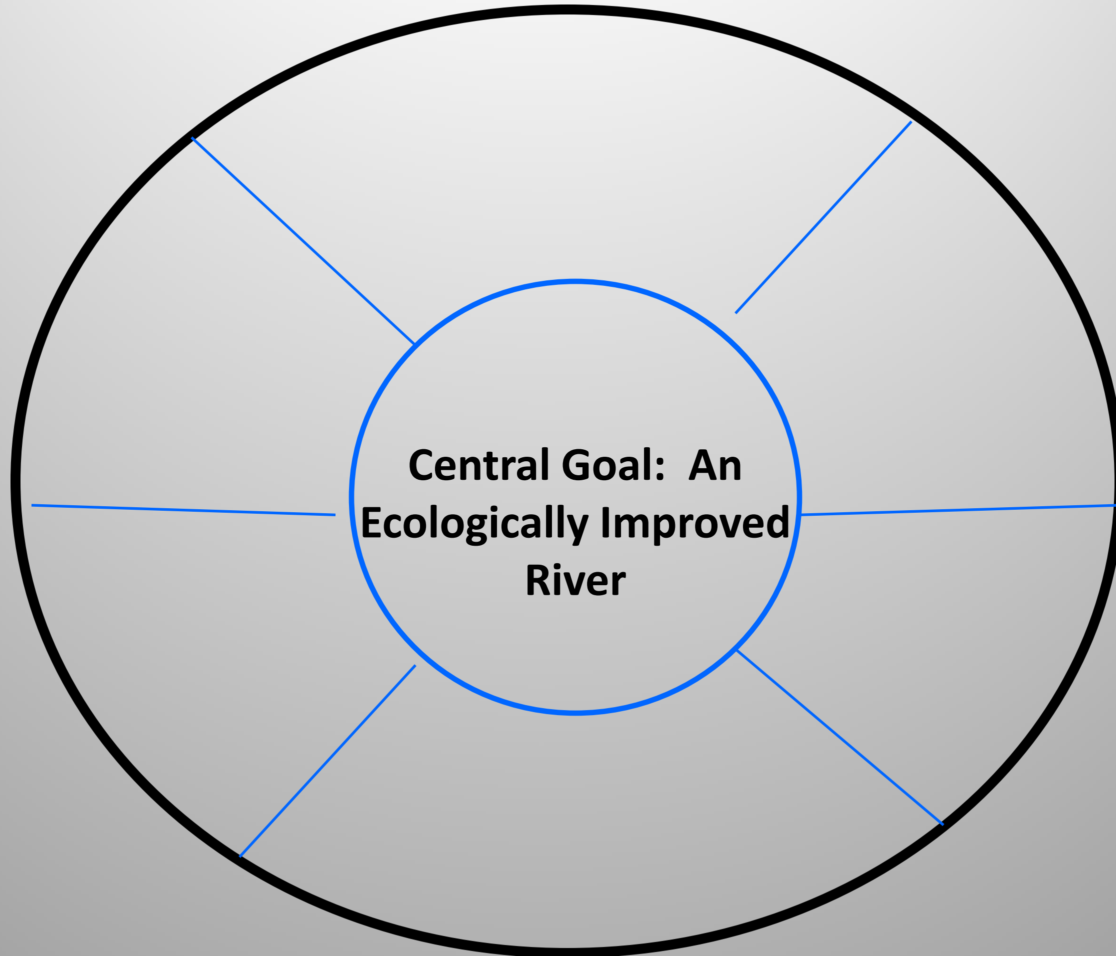


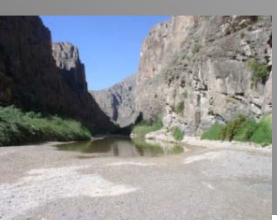
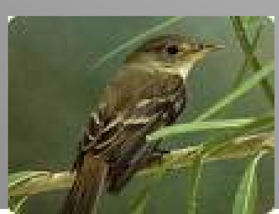
Saltcedar Leaf Beetle Will Affect Bottomland Plant Communities in the Near Future





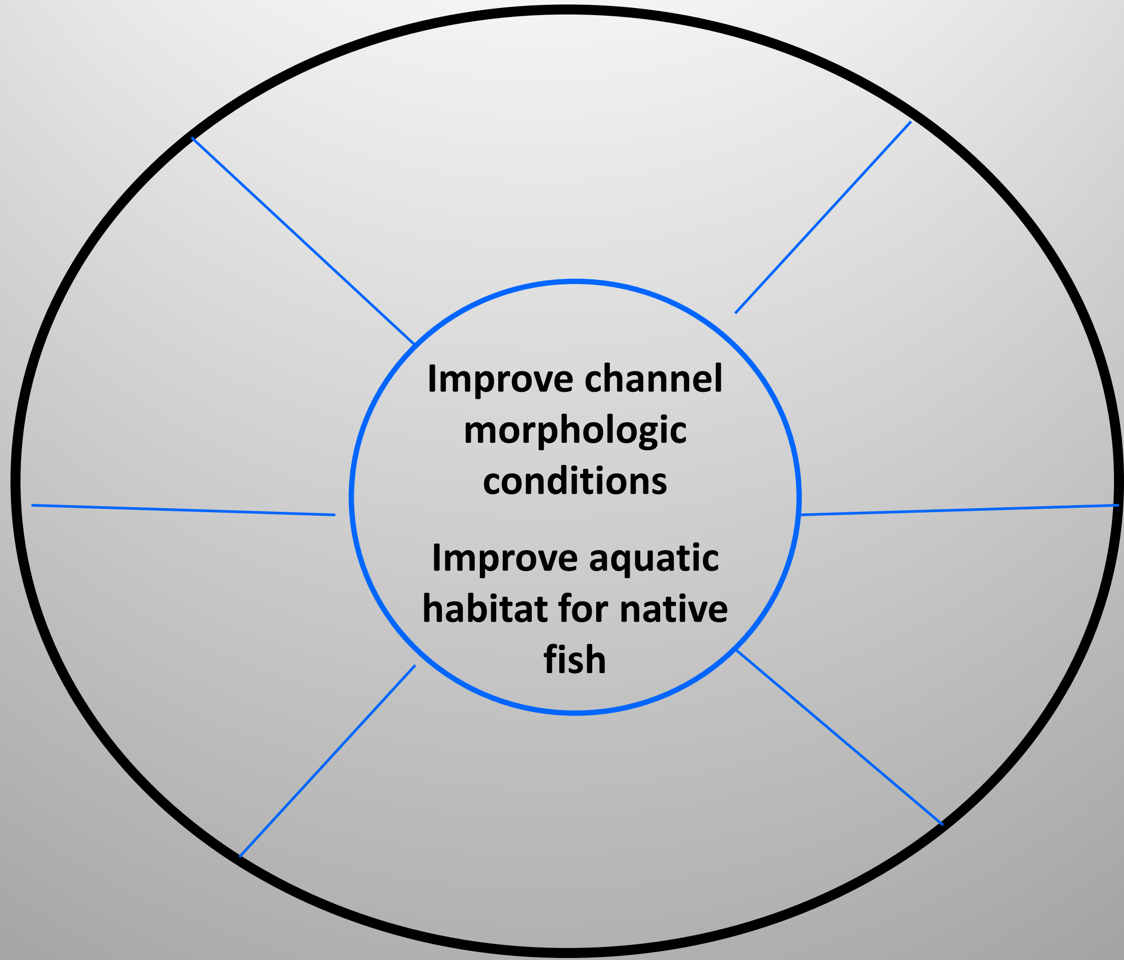
Central Goal and Main Activities of the Rio Grande Big Bend Effort





Central Goal and Main Activities of the Rio Grande Big Bend Effort

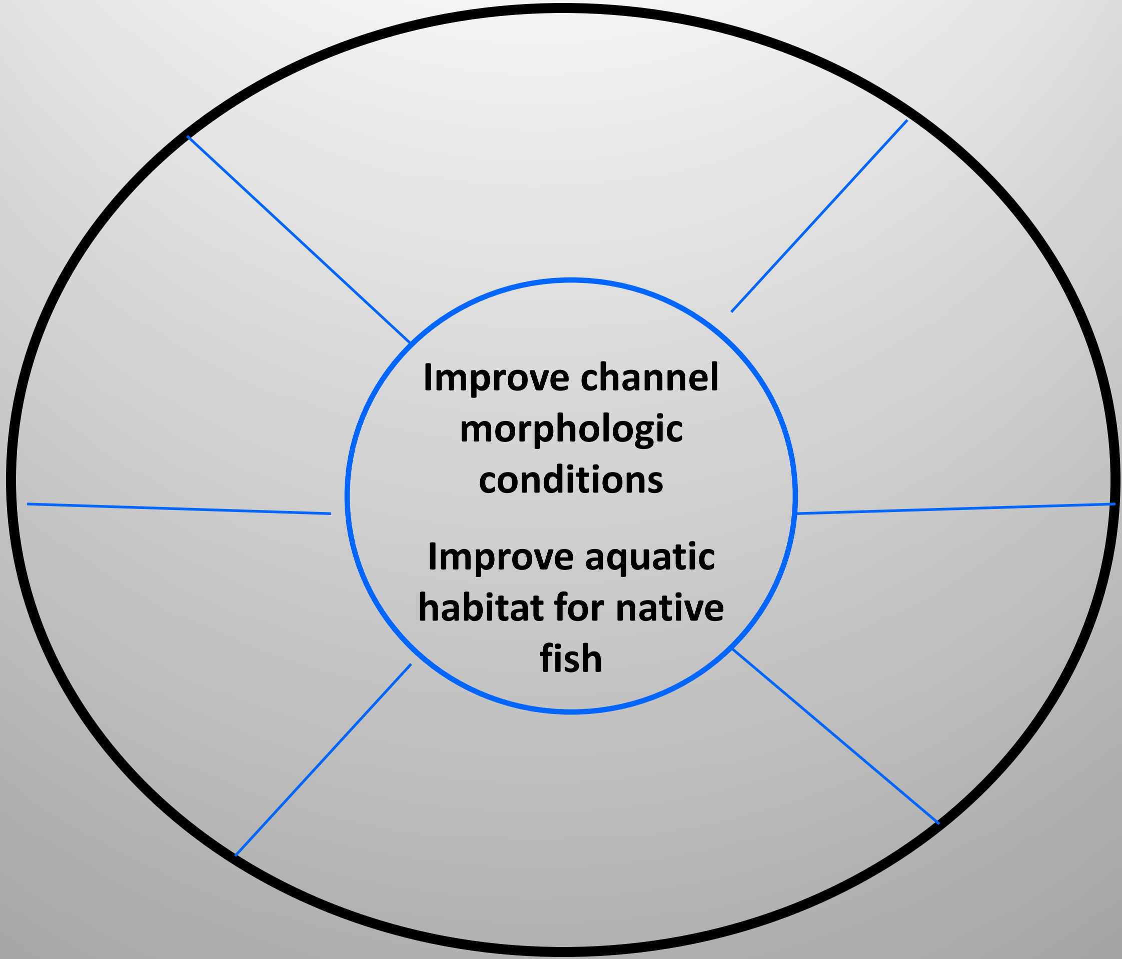


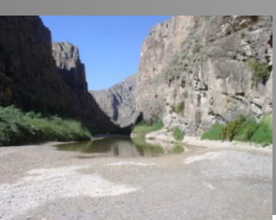
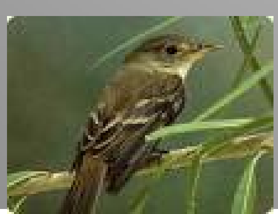





Central Goal and Main Activities of the Rio Grande <u>Big Bend Effort</u>

Eradication of Non-Native Plants





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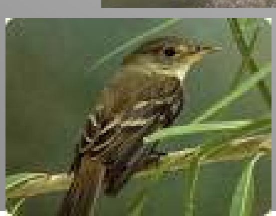
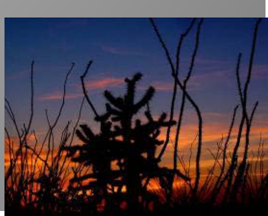
Combating Bottomland Invasive Non-Native Plants

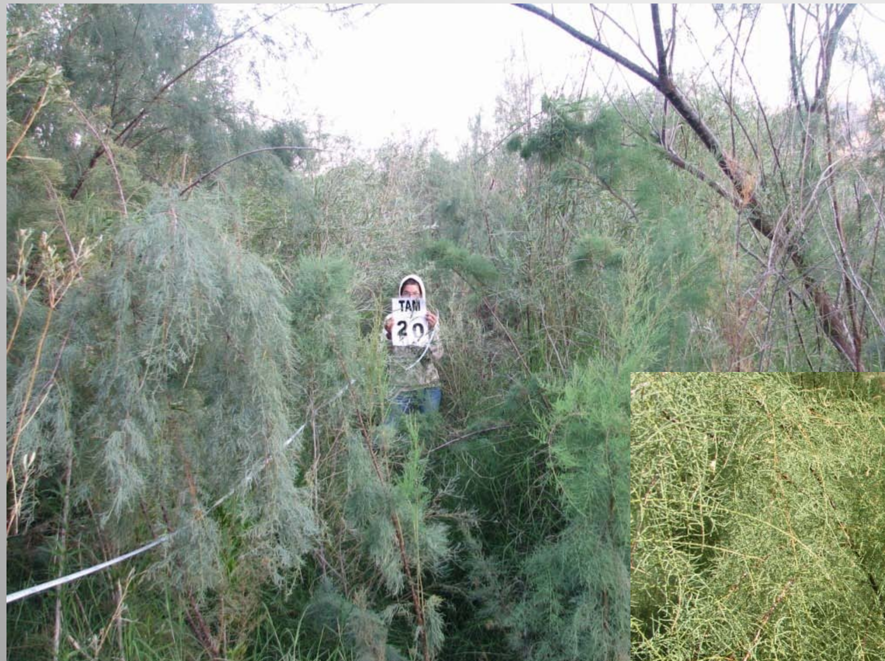
One Component of the Rehabilitation Response Along the Big Bend Reach of the Rio Grande

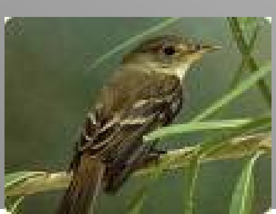





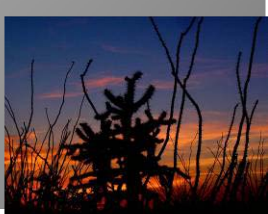


Saltcedar (Tamarix ramosissima)







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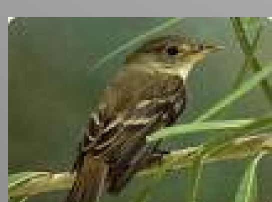
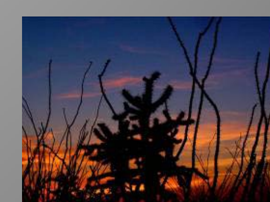
Giant cane (*Arundo donax*)





Hot Springs Canyon and Boquillas Canyon
A Bi-National Effort to Improve Aquatic Habitat and Eradicate Saltcedar and Giant Cane

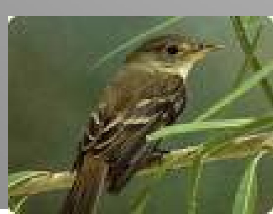
Five Main Steps

1) Monitoring and Evaluation

4) Plant native vegetation in targeted areas

2) Burn giant cane

3) Apply herbicide to saltcedar re-sprouts of giant cane



Lessons Learned From Eradication Efforts of Non-Native, Invasive Plants

<u>What We Know</u>

Labor intensive treatment of saltcedar with the herbicide Garlon has been effective



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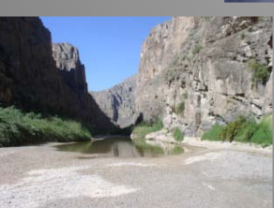

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Lessons Learned From Eradication Efforts of Non-Native, Invasive Plants

What We Know

Labor intensive treatment of saltcedar with the herbicide Garlon has been effective in killing saltcedar

Methods used to treat giant cane are effective in killing cane






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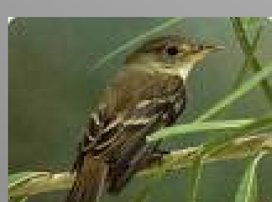

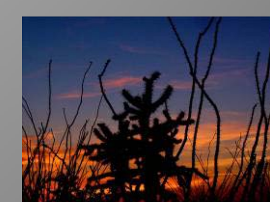

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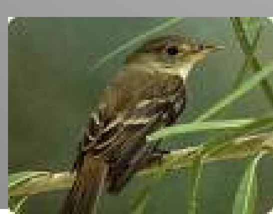



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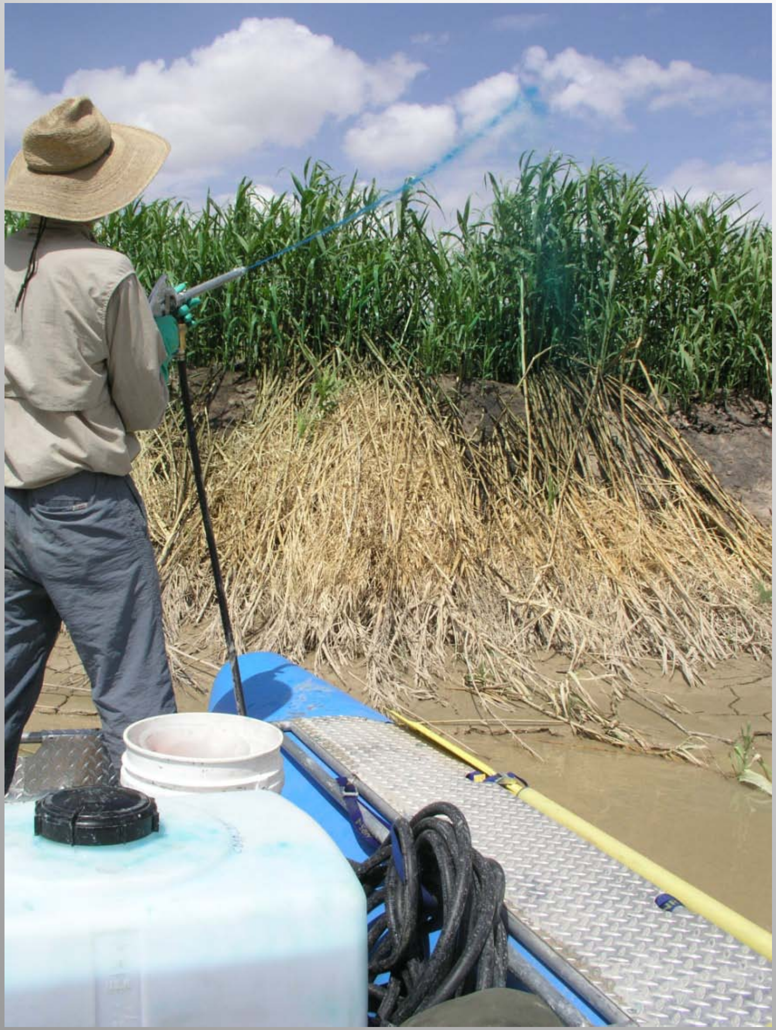

Using the aqueous friendly herbicide ‘Habitat,’ dense stands of giant cane along the banks are sprayed from a converted river raft.






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Lessons Learned From Results of Eradication Efforts of Non-Native, Invasive Plants

What We Know

- Labor intensive treatment of saltcedar with the herbicide Garlon has been effective in killing saltcedar
- Methods used to treat giant cane are effective in killing cane
- Rapid plant succession can occur following eradication






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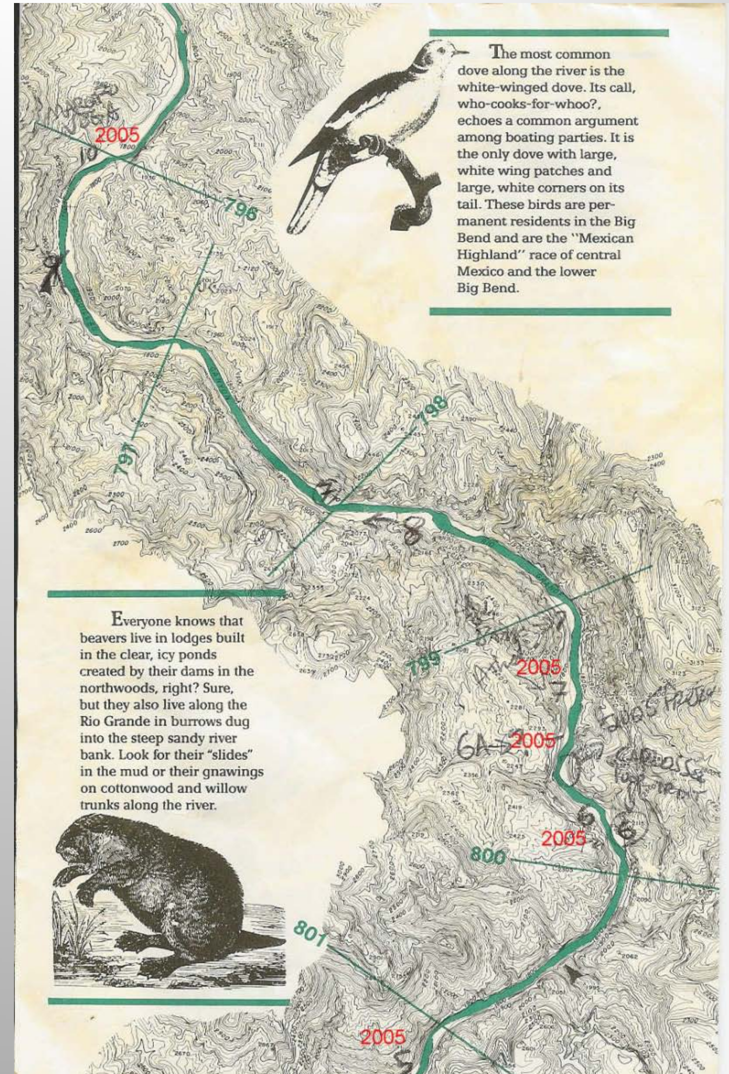
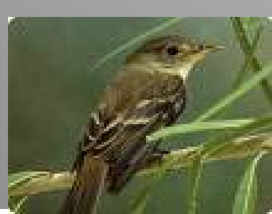
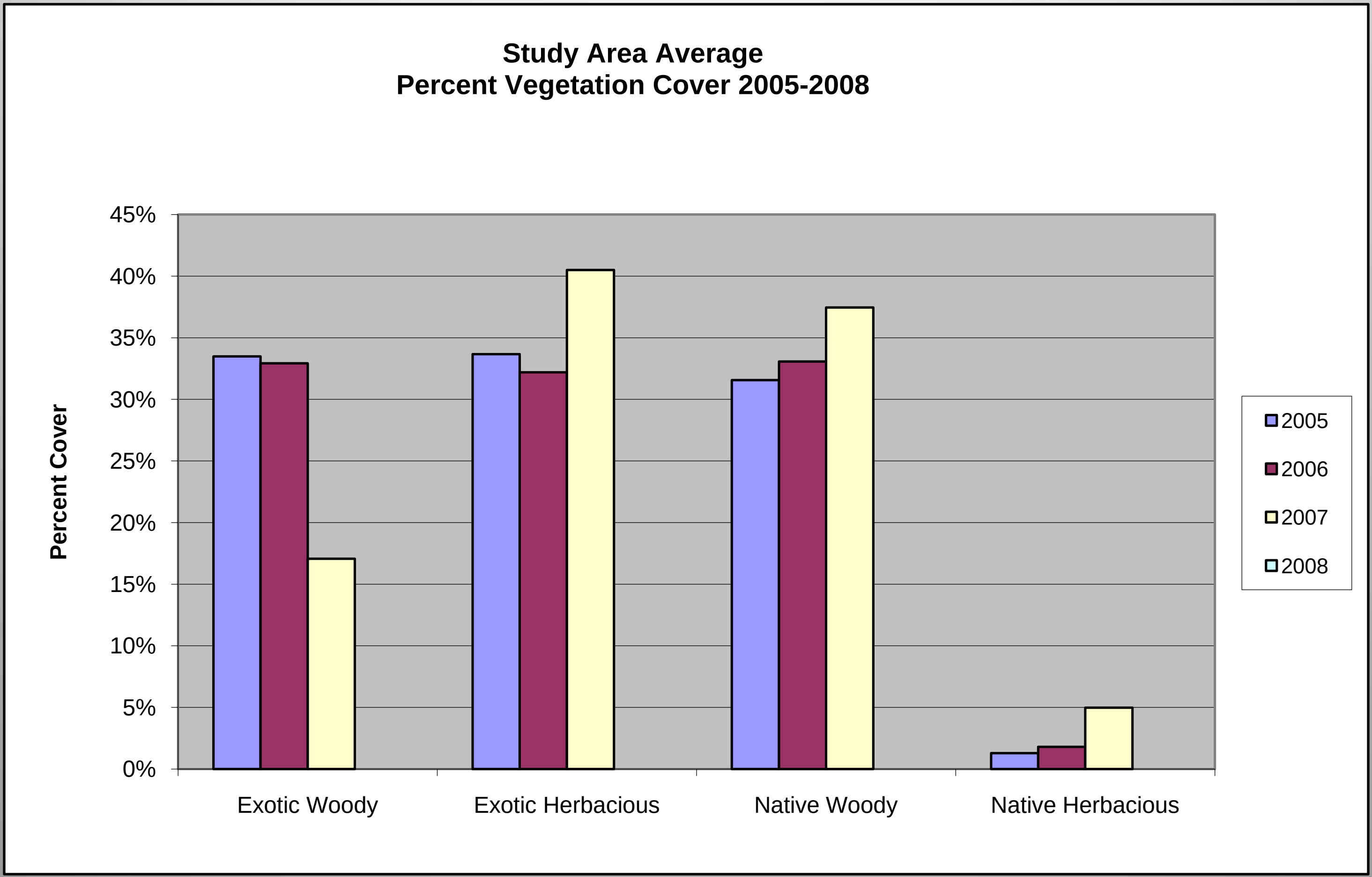
Long-Term Bottomland Vegetation and Channel Morphology Plots and Transects Established Throughout Treatment Area





Changes in Plant Cover Following Eradication of Saltcedar





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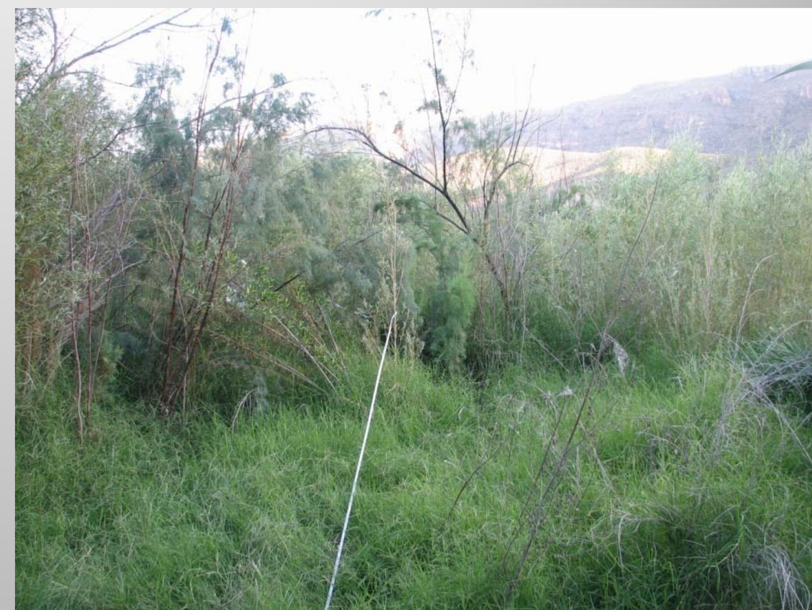
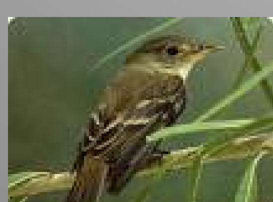
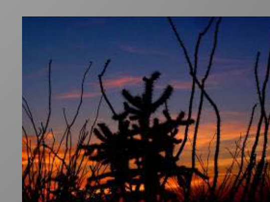
Plant Succession Following Eradication







Lessons Learned From Results of Eradication Efforts of Non-Native, Invasive Plants

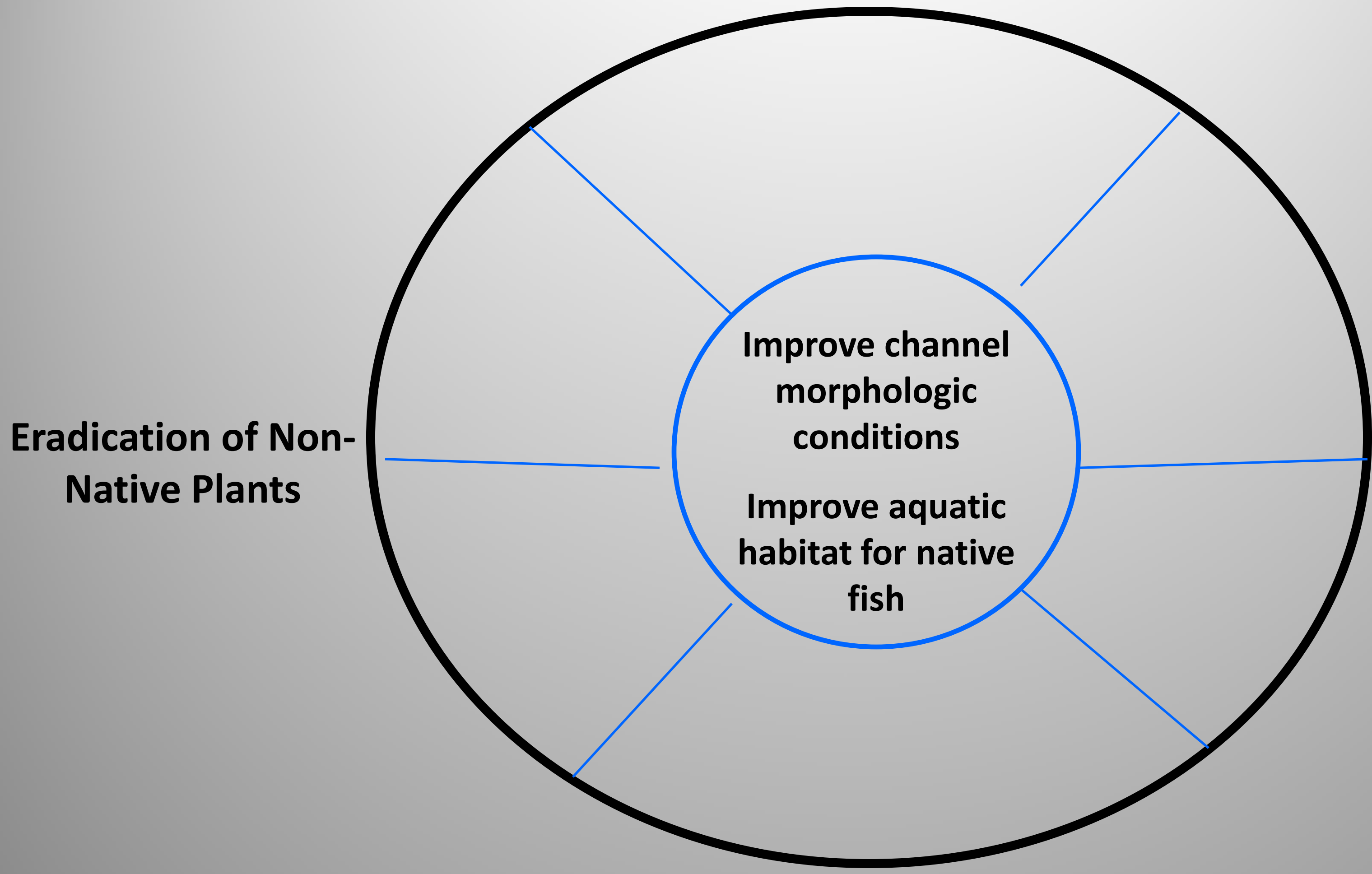
What We Don’t Know

- Effectiveness of using eradication methods to promote alluvium remobilization and reestablishment of wide and shallow channel conditions;






Central Goal and Main Activities of the Rio Grande
Big Bend Effort





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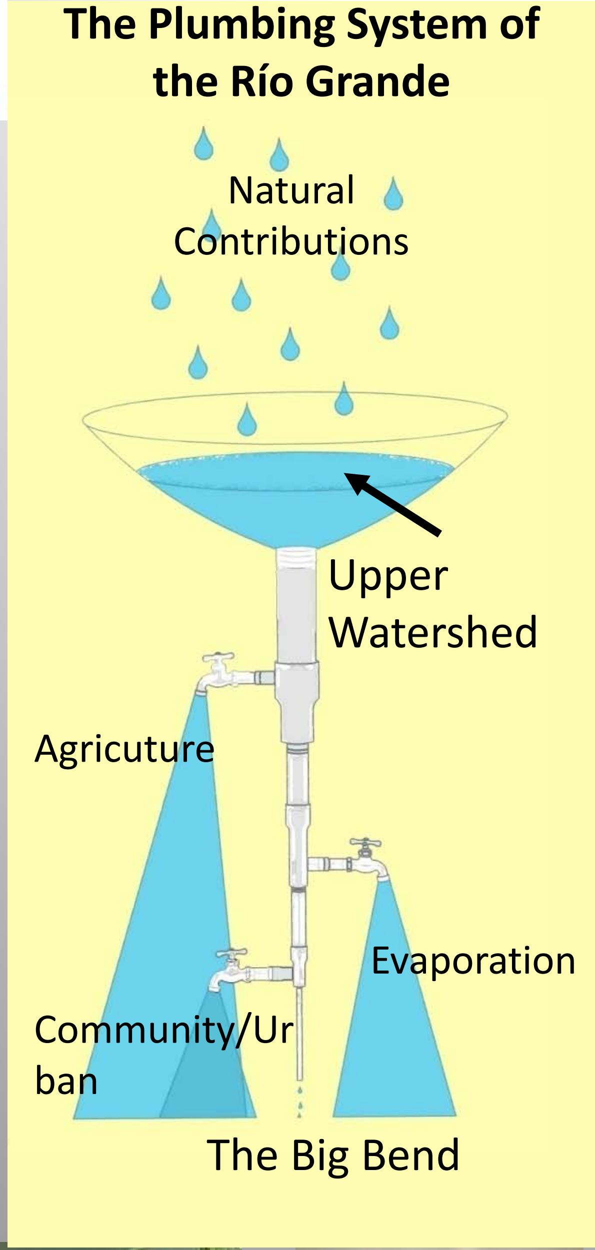

Rio Grande – What is the problem?

Impounded and Over-allocated






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Some of the Major Changes Along the Rio Grande

Number of major dams	none (prior to 1916)	Six (today)
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)






Rio Grande – What is the problem?

Impounded and Over-allocated

↓

Significant Changes in Hydrologic Characteristics

↓

Significant Changes in Channel Morphology

↓

Significant Biological Change






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Significant Decline in Native Biota

Monotypic stand of saltcedar along Forgotten reach, downstream of El Paso (Nat Stone)

- 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.






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Eradication of Non-Native Plants Alone Does Not Address Main Causes of Ecological Decline

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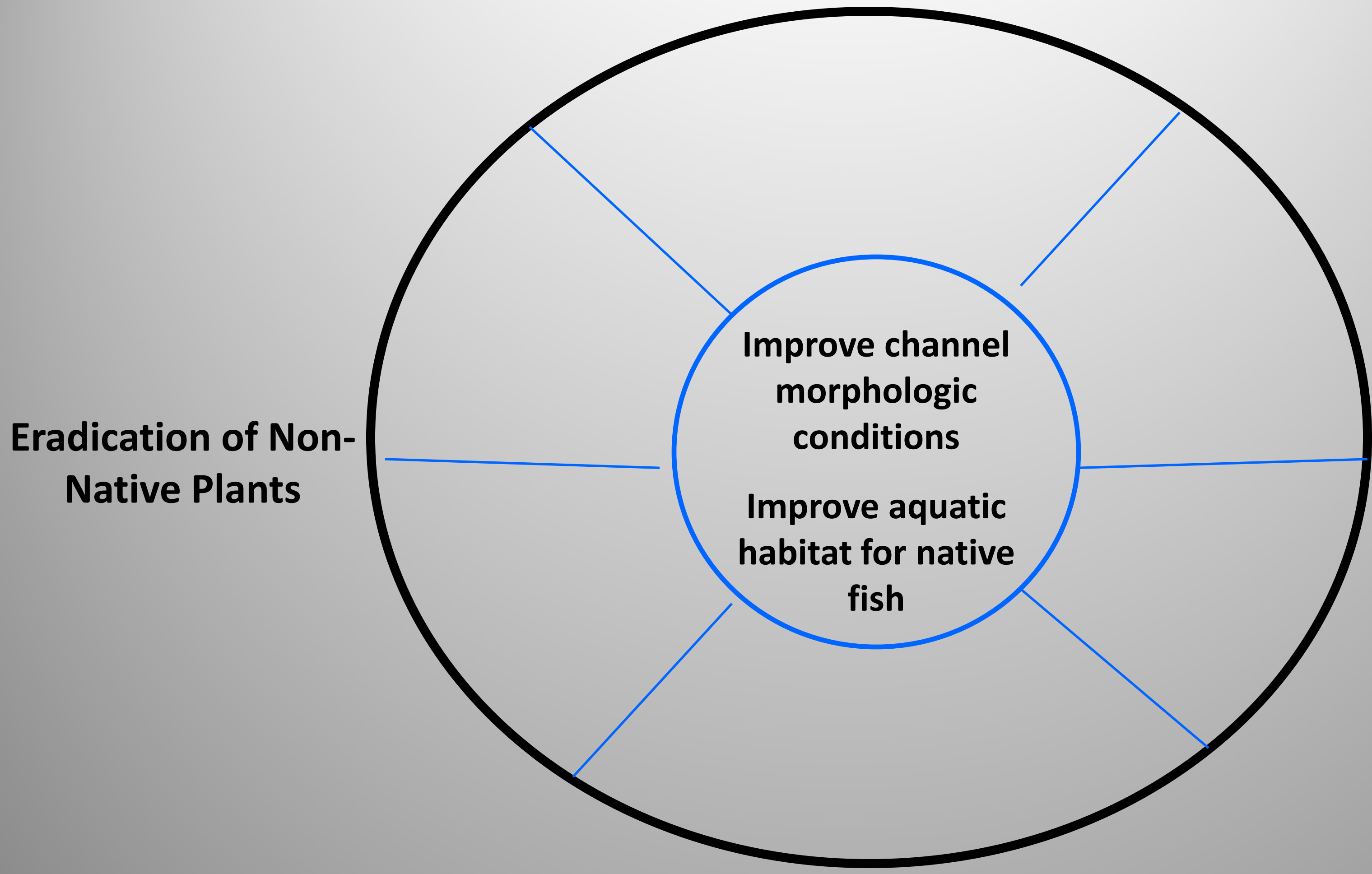
Focusing Solely on the Eradication of Non-Native Plants Will Probably Produce Limited Results

Central Goal and Main Activities of the Rio Grande
Big Bend Effort





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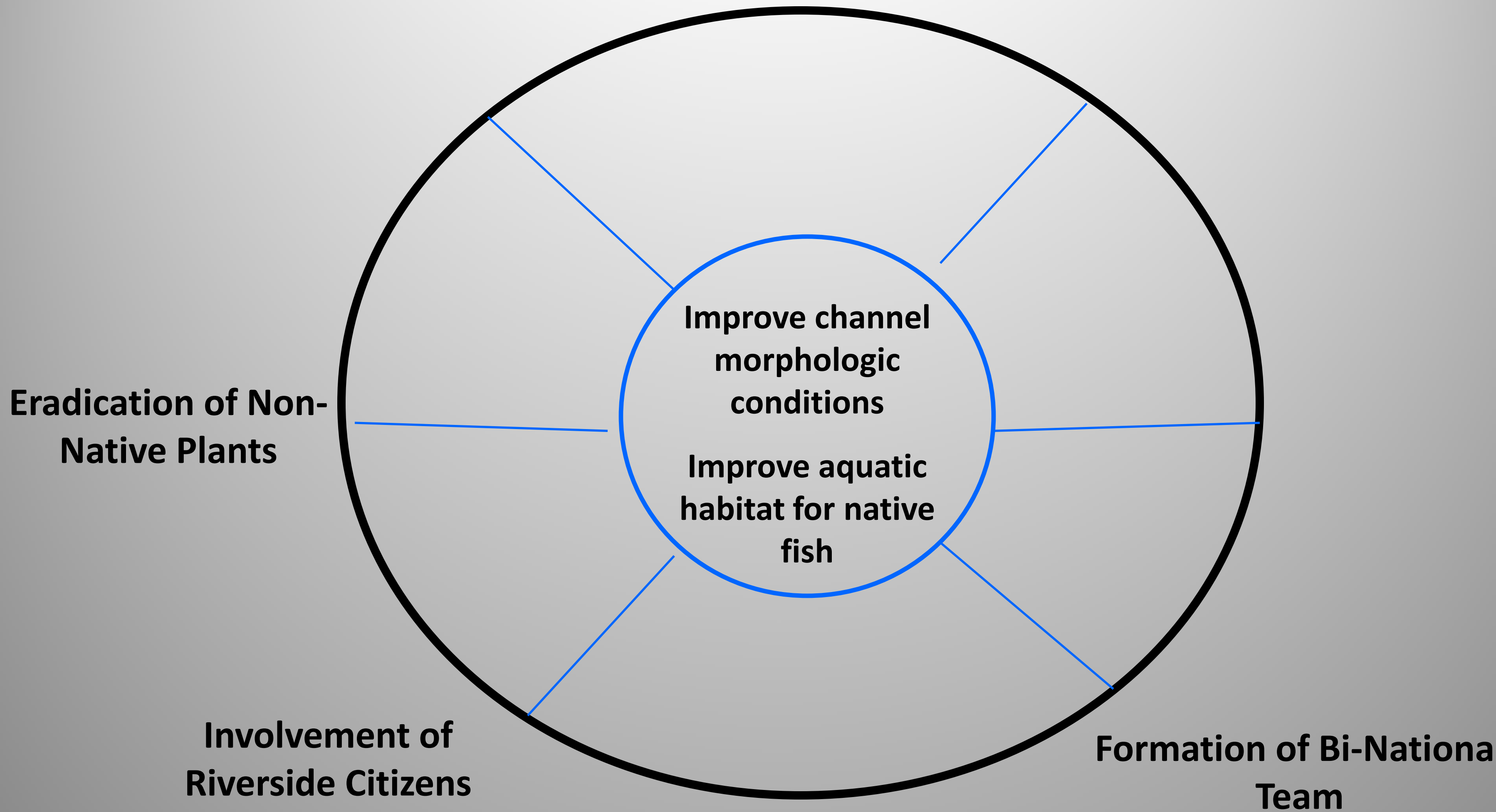
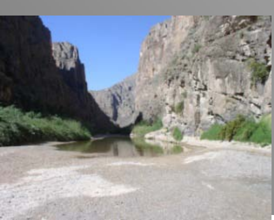
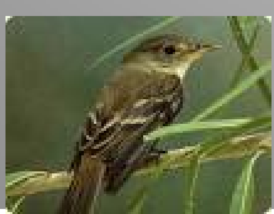
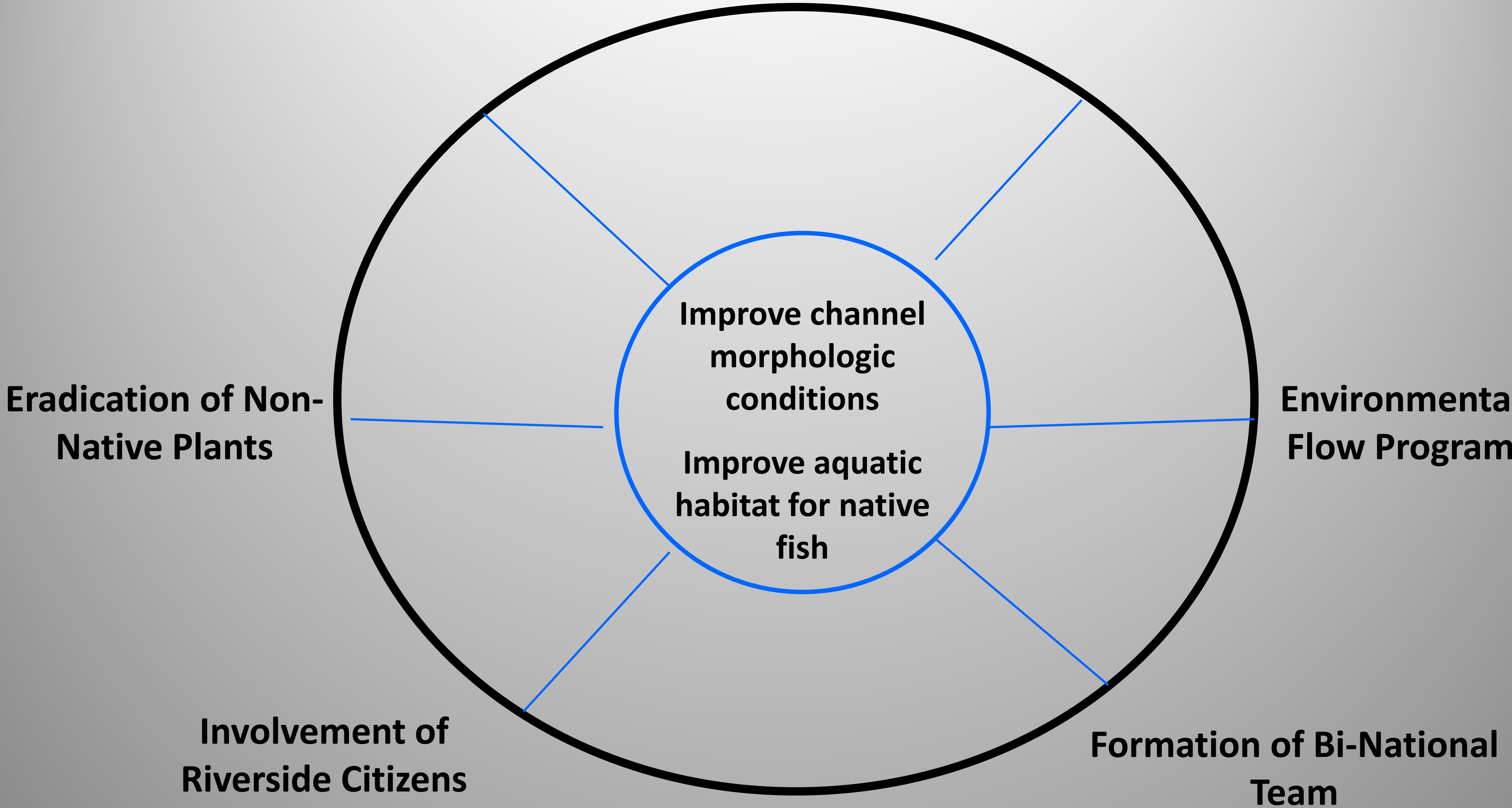
Central Goal and Main Activities of the Rio Grande Big Bend Effort





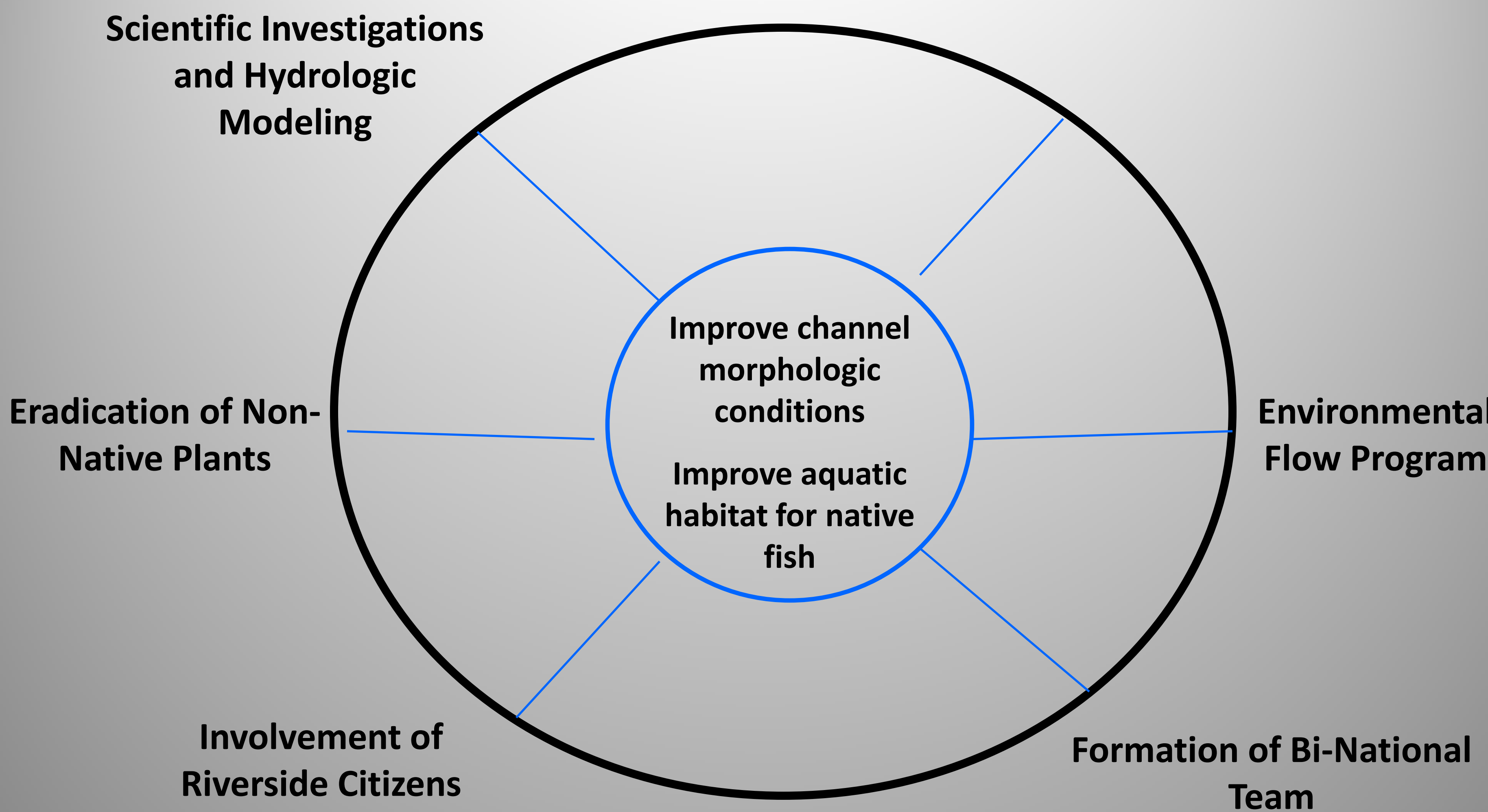
Central Goal and Main Activities of the Rio Grande Big Bend Effort







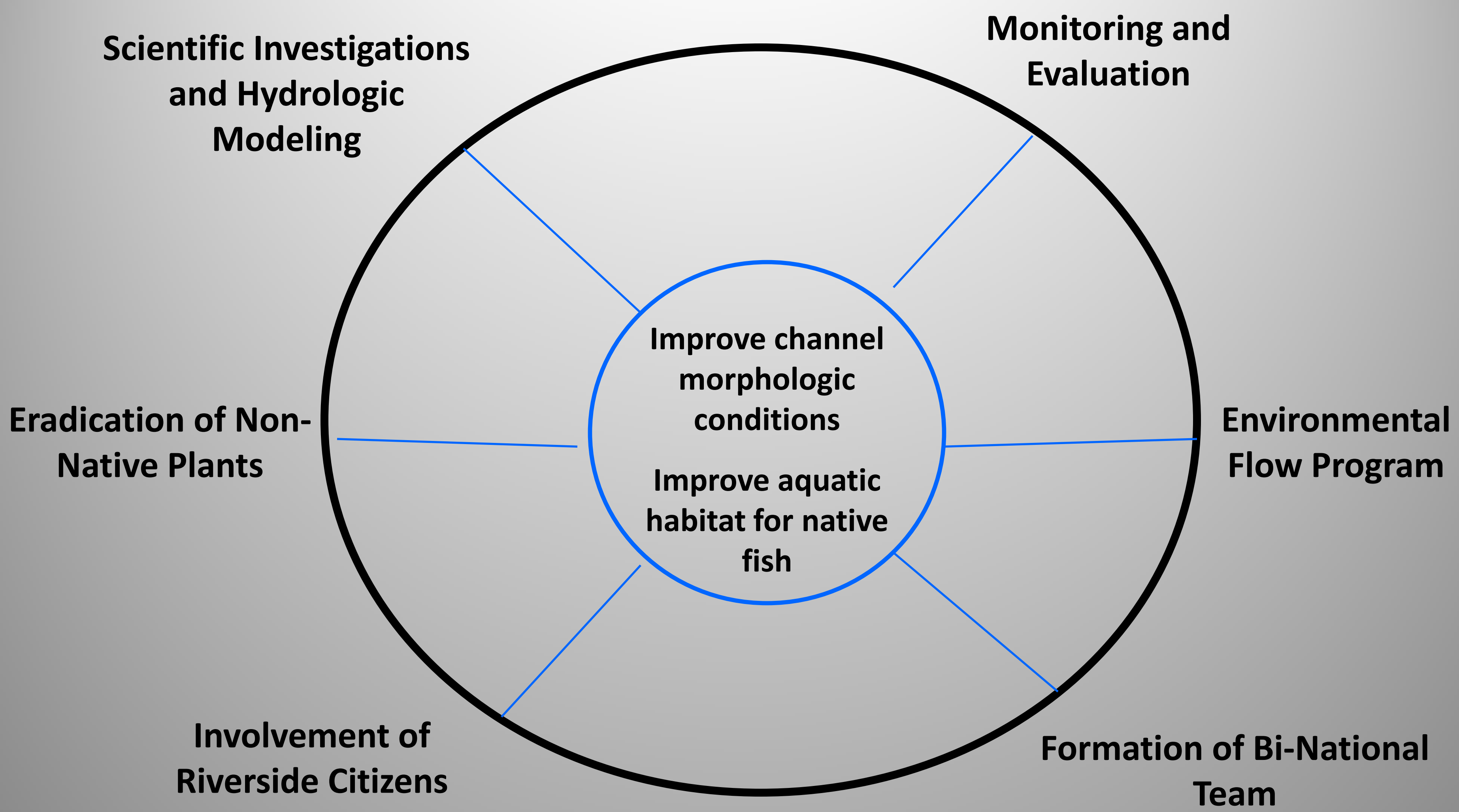

Central Goal and Main Activities of the Rio Grande
Big Bend Effort








Central Goal and Main Activities of the Rio Grande Big Bend Effort





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Bringing Back the Big Bend Reach of the Rio Grande

Main Lessons Learned From Efforts to Eradicate Saltcedar and Giant Cane

- **Eradication efforts should be placed in the context of an overarching goal that is scientifically supported and realistic;**
- **Eradication efforts alone do not address causes of ecological decline and therefore may produce limited results;**
- **Eradication efforts should be implemented in concert with other strategies address the root causes of ecological decline (e.g., environmental flow);**
- **Monitoring is critical;**
- **Understanding current ecological conditions and developing criteria that allow project prioritization are important**






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Restoration Ecology, 2008, vol. 16 , No. 1

Restoration Ecology
THE JOURNAL OF THE SOCIETY FOR ECOLOGICAL RESTORATION INTERNATIONAL

Planning Riparian Restoration in the Context of *Tamarix* Control in Western North America

Patrick B. Shafroth,[1,2] Vanessa B. Beauchamp,[3] Mark K. Briggs,[4] Kenneth Lair,[5] Michael L. Scott,[1] and Anna A. Sher[6,7]

Abstract

Throughout the world, the condition of many riparian ecosystems has declined due to numerous factors, including encroachment of non-native species. In the western United States, millions of dollars are spent annually to control invasions of *Tamarix* spp., introduced small trees or shrubs from Eurasia that have colonized bottomland ecosystems along many rivers. Resource managers seek to control *Tamarix* in attempts to meet various objectives, such as increasing water yield and improving wildlife habitat. Often, riparian restoration is an implicit goal, but there has been little emphasis on a process or principles to effectively plan restoration activities, and many *Tamarix* removal projects are unsuccessful at restoring native vegetation. We propose and summarize the key steps in a planning process aimed at developing effective restoration projects in *Tamarix*-dominated areas. We discuss in greater detail the biotic and abiotic factors central to the evaluation of potential restoration sites and summarize information about plant communities likely to replace *Tamarix* under various conditions. Although many projects begin with implementation, which includes the actual removal of *Tamarix*, we stress the importance of pre-project planning that includes: (1) clearly identifying project goals; (2) developing realistic project objectives based on a detailed evaluation of site conditions; (3) prioritizing and selecting *Tamarix* control sites with the best chance of ecological recovery; and (4) developing a detailed tactical plan before *Tamarix* is removed. After removal, monitoring and maintenance as part of an adaptive management approach are crucial for evaluating project success and determining the most effective methods for restoring these challenging sites.

Key words: invasive species, passive restoration, revegetation, saltcedar, soil salinity, tamarisk.

Introduction

Riparian ecosystems are recognized globally as important sources of numerous functions and services including havens of biodiversity, water quality enhancement, and sites for esthetic enjoyment and recreation (Brinson et al. 1981; Naiman et al. 2005). Throughout the world, the ecological condition of natural riparian systems has declined due to a number of sometimes interacting factors, including streamflow regulation, floodplain development, channelization, and the spread of non-native species (de Waal et al. 1994; Naiman et al. 2005). As a consequence, restoration of riparian vegetation has become a global resource management priority (Webb & Erskine 2003; Holmes et al. 2005; Hughes et al. 2005; Richardson et al. 2007).

The spread of non-native plant species can be one of the causes of riparian ecosystem decline (Tickner et al. 2001; Richardson & van Wilgen 2004), and many restoration efforts in riparian and other ecosystems include the control or removal of invasive species (D'Antonio & Meyerson 2002; Holmes et al. 2005; Richardson et al. 2007). In western North America, shrub/small tree species and hybrids in the genus *Tamarix* (common names – tamarisk, saltcedar) have colonized several hundred thousand hectares of river bottomlands and reservoir margins (Zavaleta 2000; Gaskin & Schall 2002). The taxa that comprise the bulk of invasive *Tamarix* in western North America are *Tamarix ramosissima*, *T. chinensis*, and *T. ramosissima* x *T. chinensis* (Gaskin & Schaal 2002). In this manuscript, we use the genus name alone (*Tamarix*) to refer to this complex of species. *Tamarix* have been implicated in decreasing water yield, degrading wildlife habitat, displacing native vegetation, and increasing fire severity and frequency (Brock 1994; DiTomaso 1998; Dudley et al. 2000). Although there is disagreement in some cases about the degree to which these negative effects actually occur and the relative role of *Tamarix* invasion *per se* versus other impacts to riparian systems (Anderson 1998; Glenn & Nagler 2005), millions of dollars at federal, state, and local levels have been spent and are proposed to be spent on *Tamarix* control in western United

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Thank you!
Muchísimas gracias!