Managing Novel Ecosystems for Endangered Species Recovery

The Need for a New Funding Paradigm

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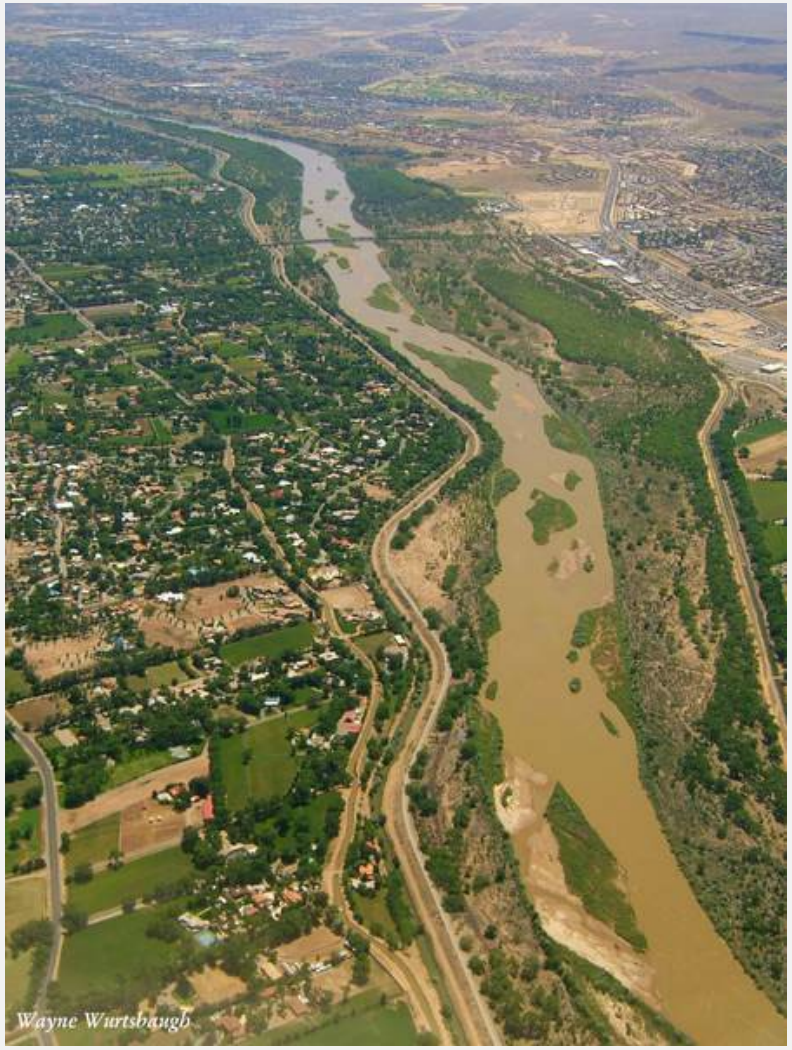
Today's Presentation – MRG Case Study

- Flow regimes are altered on most major rivers worldwide
  - Irreversible alteration → Novel Ecosystem
- Species extinctions
  - Imperiled species → require ongoing management in Novel Ecosystems
- Dearth of funding for long-term stewardship



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Short-Term Attention Span

- Disproportionate emphasis on planning, design, construction
- Short-term monitoring (at best)
  - 2-5 years tops
- No emphasis on long-term stewardship/functionality
  - Success = “acres restored”
- Poor accountability

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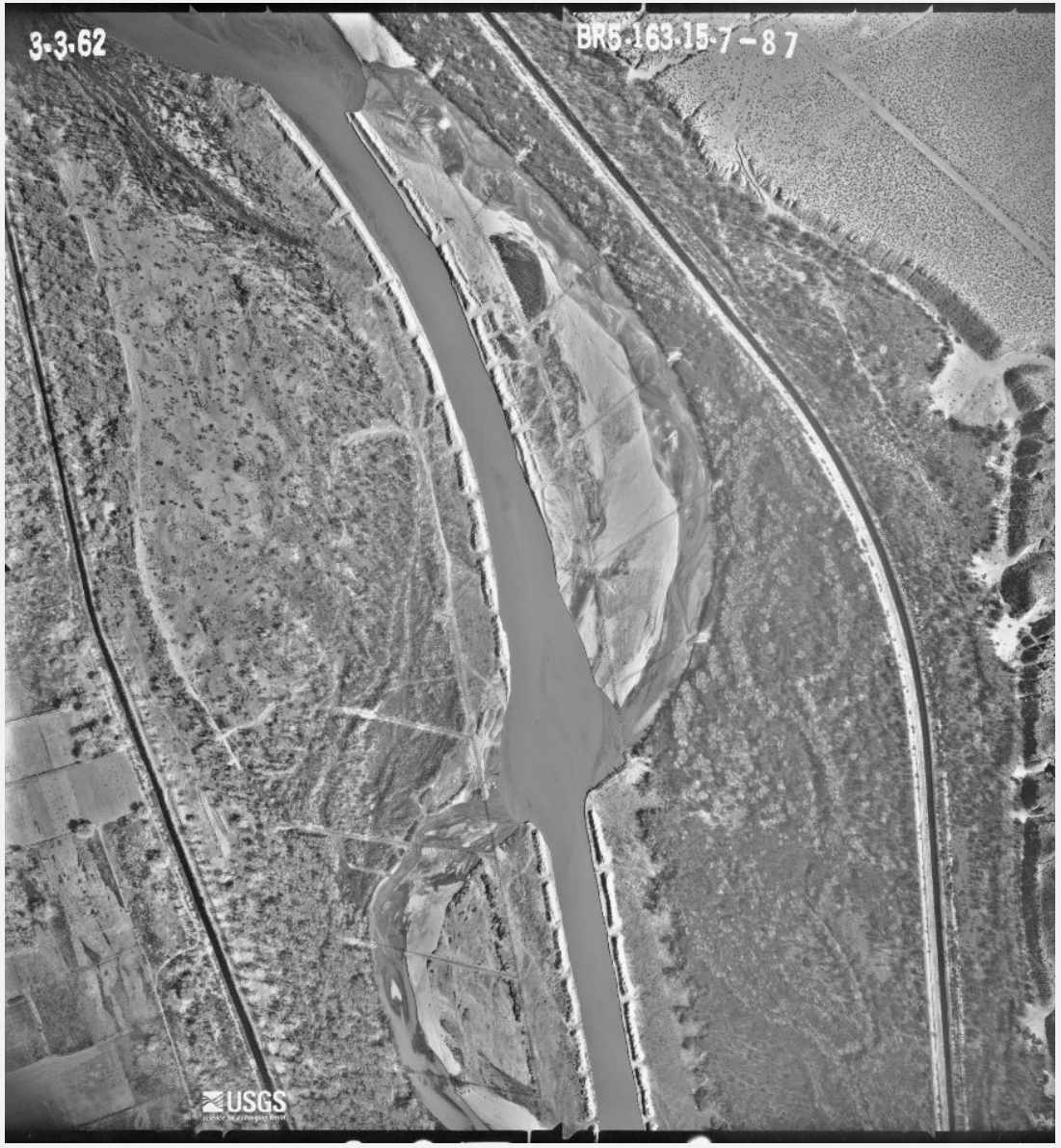
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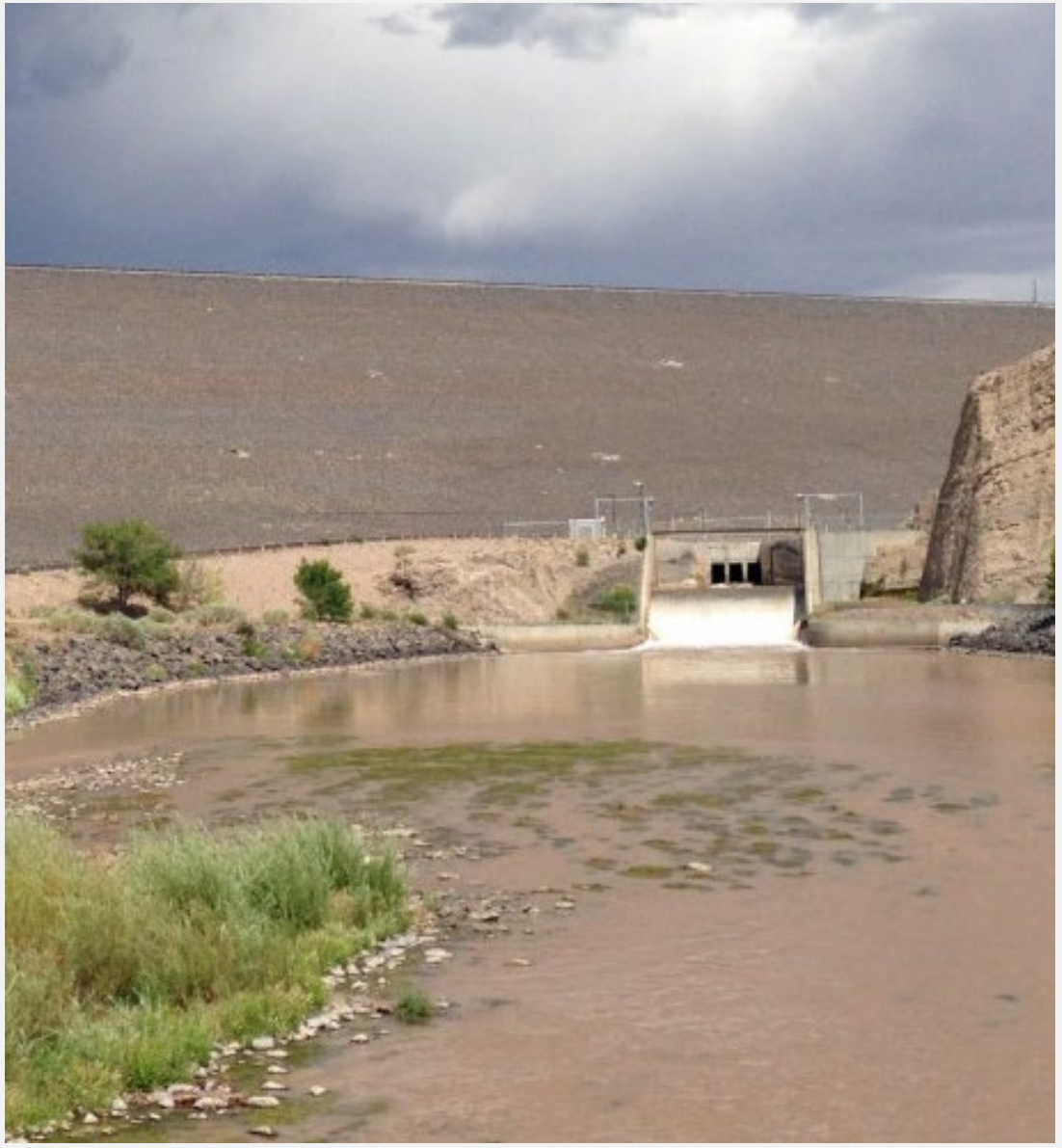
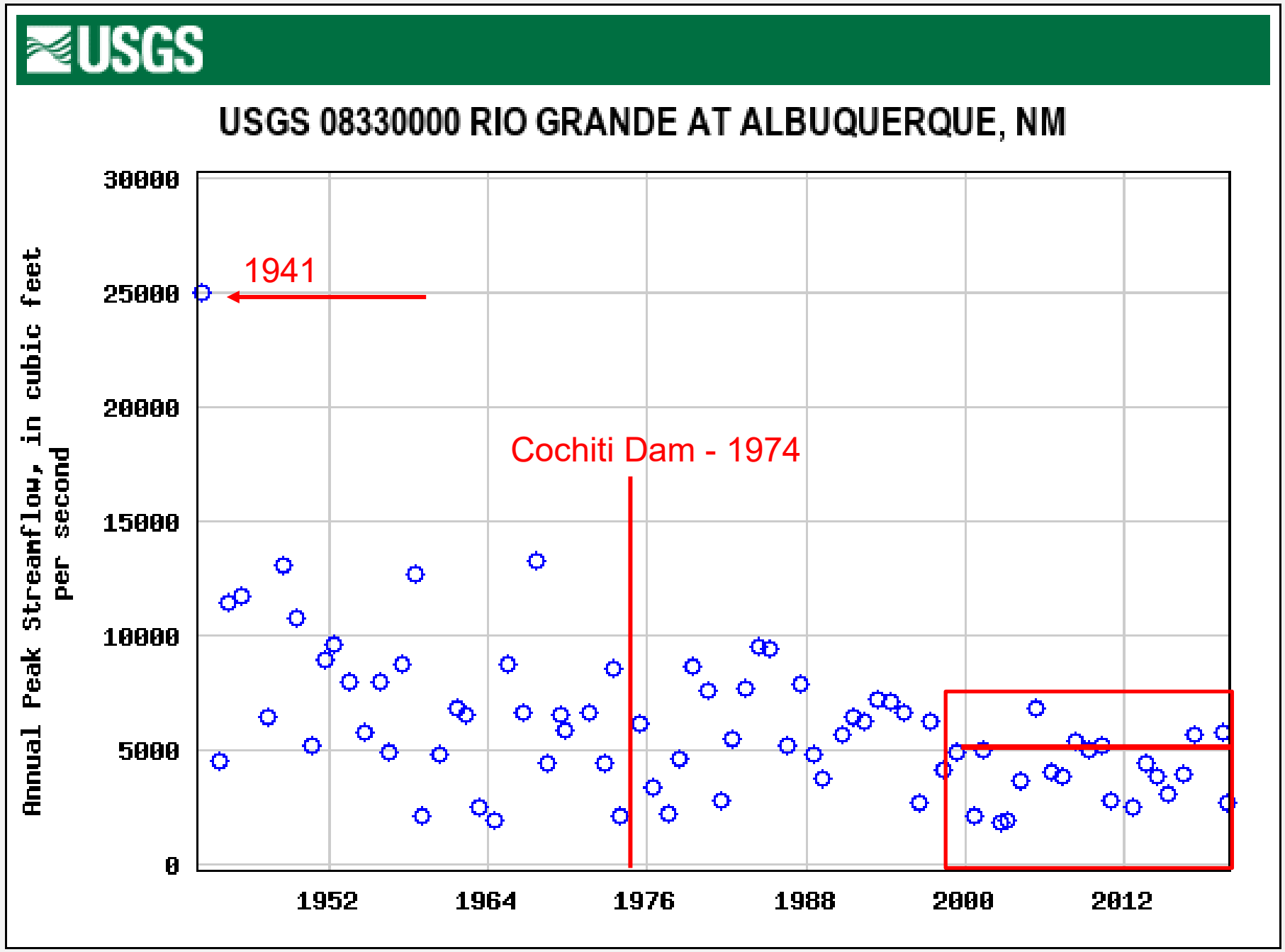
USGS




USGS
USGS 08330000 RIO GRANDE AT ALBUQUERQUE, NM
Annual Peak Streamflow, in cubic feet per second
30000
25000
20000
15000
10000
5000
0
1941
Cochiti Dam - 1974
1952
1964
1976
1988
2000
2012

Decoupled Floodplains

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Ecological Implications

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MRG Restoration Focus

- System Scale (e-flows)
  - Dam operational flexibility
    - Hydrograph shape
    - Timing
  - Constraints
    - RG Compact (1939)
    - Reservoir Authorizations
    - Non-Engineered Levees
    - Water Rights
    - Infrastructure (peak flow cap)
- Site Scale (physical actions)
  - Removing non-native
  - Lowering floodplain terraces
  - Designing for contemporary hydrology
  - RGSM life-cycle

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RESEARCH ARTICLE

WILEY

Managed spring runoff to improve nursery floodplain habitat for endangered Rio Grande silvery minnow

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Funding information
New Mexico Interstate Stream Commission

Abstract

Water managers in New Mexico, USA, stored water in El Vado Reservoir and coordinated releases into the Chama River that augmented the runoff of the Rio Grande, resulting in a discharge >1,500 ft^3/s (42.5 m^3/s) for 35 days (May 17 to June 20, 2016) at Albuquerque. The managed runoff inundated over 400 ha of previously restored floodplains in the Middle Rio Grande, thereby providing spawning and nursery habitat for the endangered Rio Grande silvery minnow (*Hybognathus amarus*, RGSM). Spawning began April 9 at annual cumulative degree-days of 717, during daily increases in discharge of 200–300 ft^3/s (5.7–8.5 m^3/s), and hatch dates were normally distributed over 53 days (April 11 to June 3). RGSM were 73% of larvae collected in six restored floodplain sites and found in shallow water (mean = 19.6 cm), low velocity (mean = 3.9 cm/s), near vegetative cover, and with 75% within 1 m of the water's edge. Declining proportions of early to late larval phases and a near absence of juveniles indicate a gradual departure from floodplains as postflexion mesolarvae and metalarvae 14–22 days post hatch (dph), with most leaving by the juvenile stage 40 dph. The annual RGSM October census showed an increase of 0.16 to 7.20 fish/100 m^2 from 2015 to 2016, indicating that the managed runoff resulted in a positive population response. This study showed that constructing floodplains and managing river and reservoir operations to inundate those floodplains during and after RGSM spawning can provide nursery habitat that improves reproductive success and recruitment.

KEYWORDS

degree-days to spawning, larval hatch time, managed runoff, nursery habitat, restored floodplains, Rio Grande silvery minnow

1 | INTRODUCTION

Floodplain formation during spring runoff is an important feature of arid-land rivers that provides sheltered productive habitats for fish feeding, spawning, and nurseries (Galat et al., 1998; Graham & Harris, 2005). Many rivers in western North America have been modified by flood control, water use, and ongoing climate change, causing riverside floodplains to become delinked from the main channel and negatively affecting riparian habitats and associated species (Petts, 2009). Managed releases from dams and reservoirs have been implemented to simulate a natural hydrograph and restore floodplain connection to benefit fish species (Chen & Olden, 2017), but reduced river volume and channel degradation have necessitated mechanically lowering floodplain inundation levels and coordinated water releases (Holden, 1999; Patno, LaGory, Chart, & Bestgen, 2012; Valdez & Nelson, 2004).

The Rio Grande is a medium-size river of the southwestern United States, in which the abundance and diversity of native fishes have declined over the last few decades as flood control and river regulation

Seedling Distribution: RM 100.5

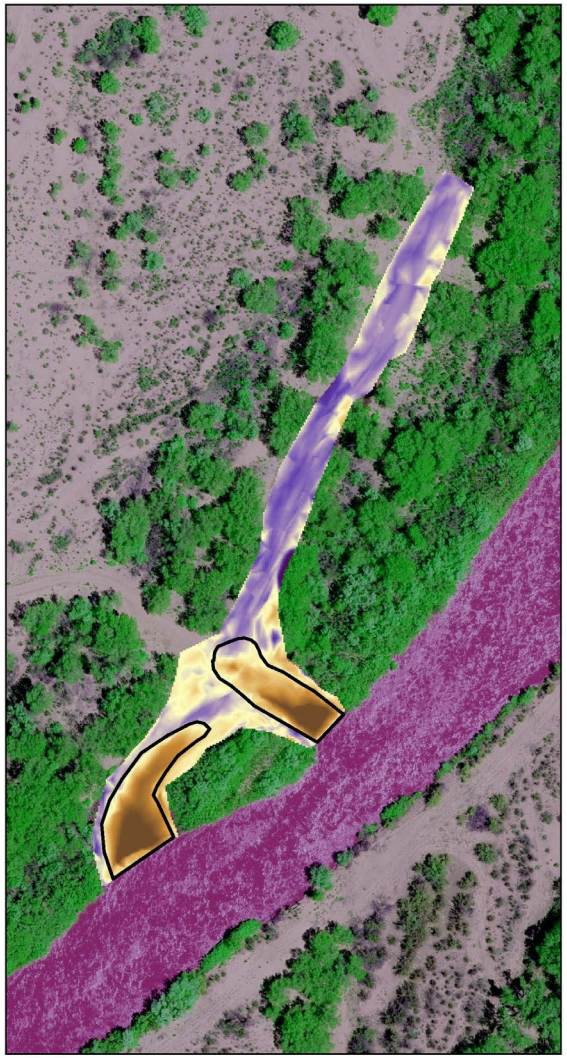
0 100 200 400 Feet

N

Exotic Woody Spp Distribution: RM 100.5

0 100 200 400 Feet

N



2019 Sedimentation Depth: RM 114

Legend

Potential Channel Maintenance Zone

Sediment Deposition Thickness (Feet) RM 114

Deposition: 3.3
0 Change
Scour: 5.6

Depostion thickness based on calculating elevation difference between surfaces generated from RTK surveys after construction (as-builts) and after 2019 runoff (September 2019 surveys)

0 25 50 100
Feet

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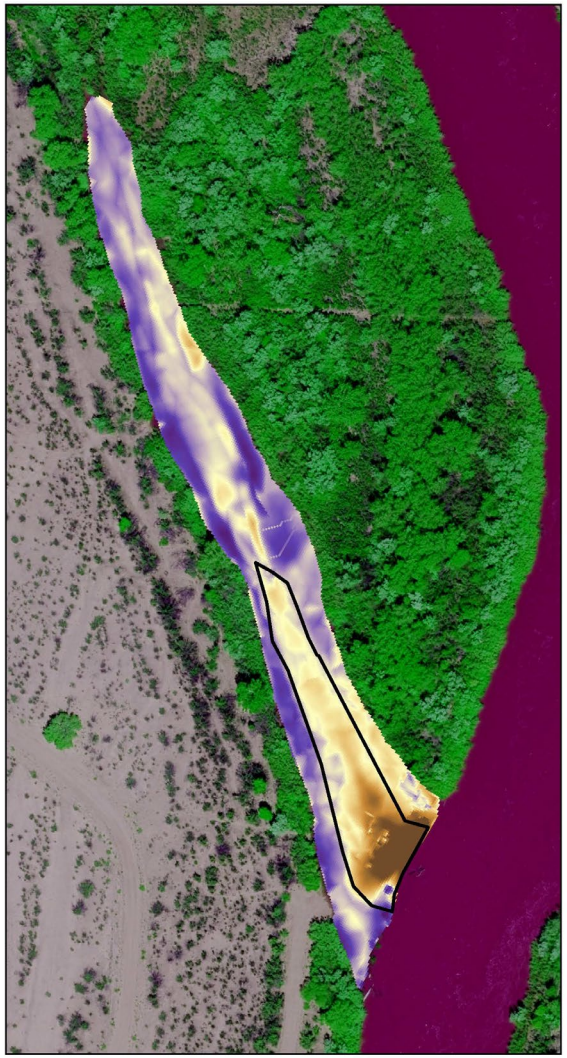
N



2019 Sedimentation Depth: RM 112

Legend

Potential Channel Maintenance Zone

Sediment Deposition Thickness (Feet) RM 112

Deposition: 3.5
0 Change
Scour: 0.7

Depostion thickness based on calculating elevation difference between surfaces generated from RTK surveys after construction (as-builts) and after 2019 runoff (September 2019 surveys)

0 25 50 100
Feet

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N

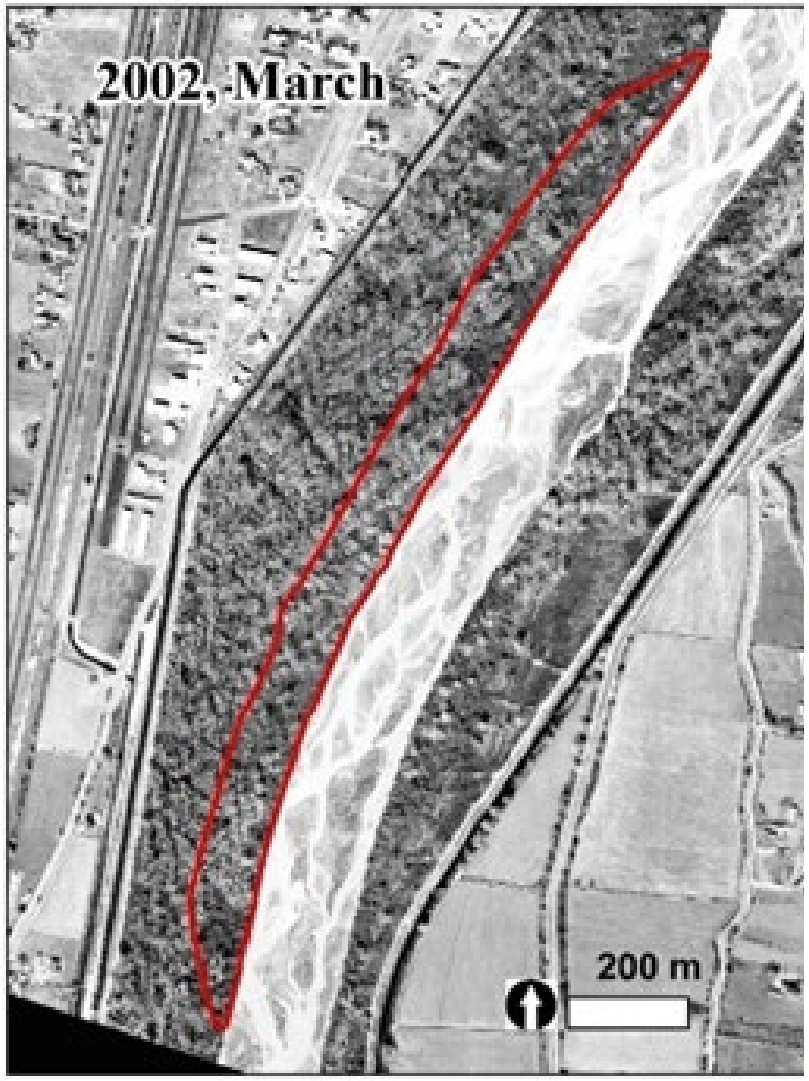
Sediment Deposition
vs.
Volume Removed for Construction

Site	Acres	Volume Removed During Construction	Deposition at Inlets Post-Inundation	% of Construction Volume
RM 114	1.7	2,000	781	39%
RM 112	1.5	3,500	387	11%
RM 100.5	8.2	15,000	265	2%
RM 100	1.4	7,000	67	1%
RM 99.5	3.5	21,000	438	2%

48,500 cu yds
X $5/cu yd
$242,500

1,928 cu yds
X $5/cu yd
$9,640

The Fate of Most MRG Habitat Restoration Projects



Key Findings & Management Implications

- Projects often function as designed (at first)
- Predictable stewardship triggers
  - Sedimentation in backwater inlets
  - Non-native species
- Well-designed bio-physical monitoring
  - Enables timely, cost-effective management intervention
  - Maintains project functional longevity
- FAR LESS EXPENSIVE TO MAINTAIN EXISTING PROJECTS THAN TO CONSTANTLY BUILD NEW ONES!

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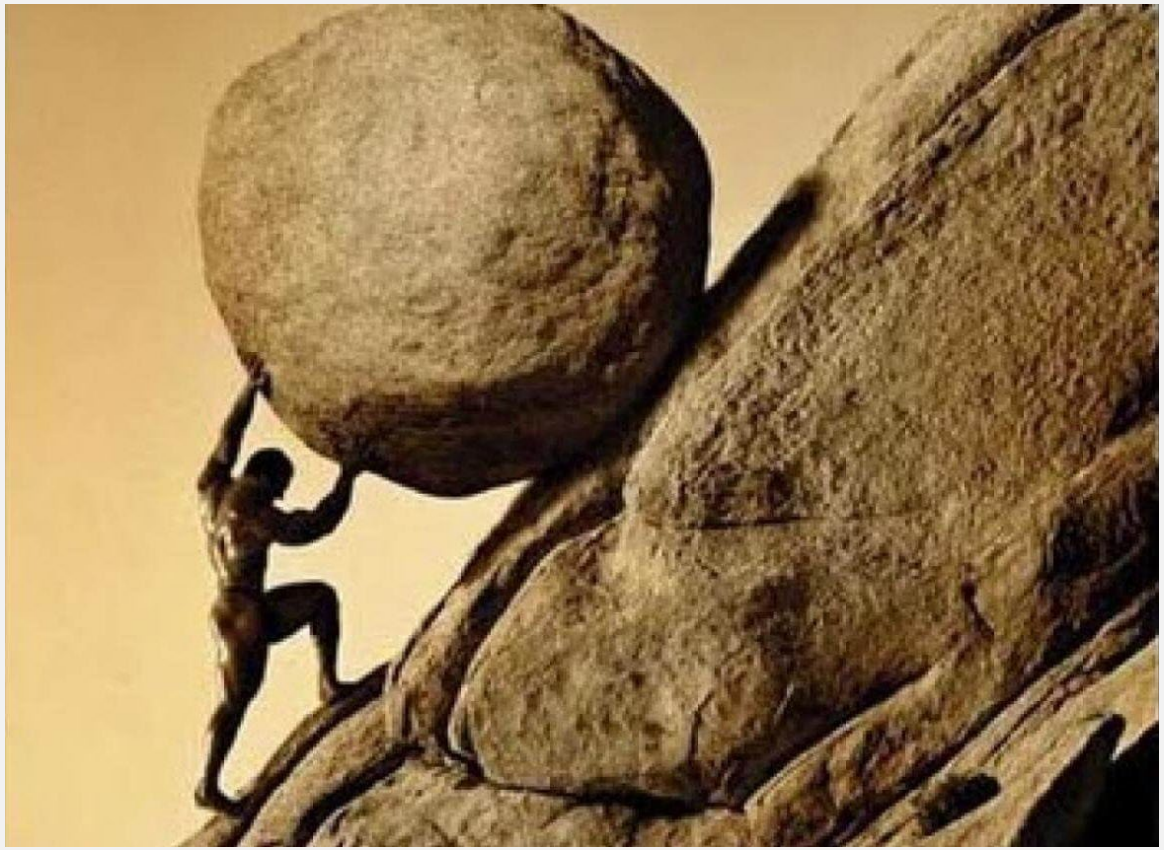
Wake Up Call

- Recognition that Stewardship informed by focused biophysical monitoring and timely action will keep projects functioning
  - Low cost
- Break the cycle of perpetually building new projects
  - Accountability to taxpayers



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Vision

- Create mechanism where agencies can transfer long-term stewardship to local watershed organizations
- Develop Long-Term / Permanent Funding
  - Trust/Endowment
    - Public-Private Partnership
    - State Revenue Sources
- Disseminate Recurring Grants
  - Require quantitative success criteria and monitoring plan
  - Require adaptive management committee
  - Annual Reporting
  - Accountability

Partners

- University of New Mexico Utton Center
- Audubon Society
- The Nature Conservancy
- New Mexico Riparian Council
- New Mexico Interstate Stream Commission
- Middle Rio Grande Conservancy District

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