An experimental habitat enhancement effort for Utah's desert rivers: San Rafael River restoration project

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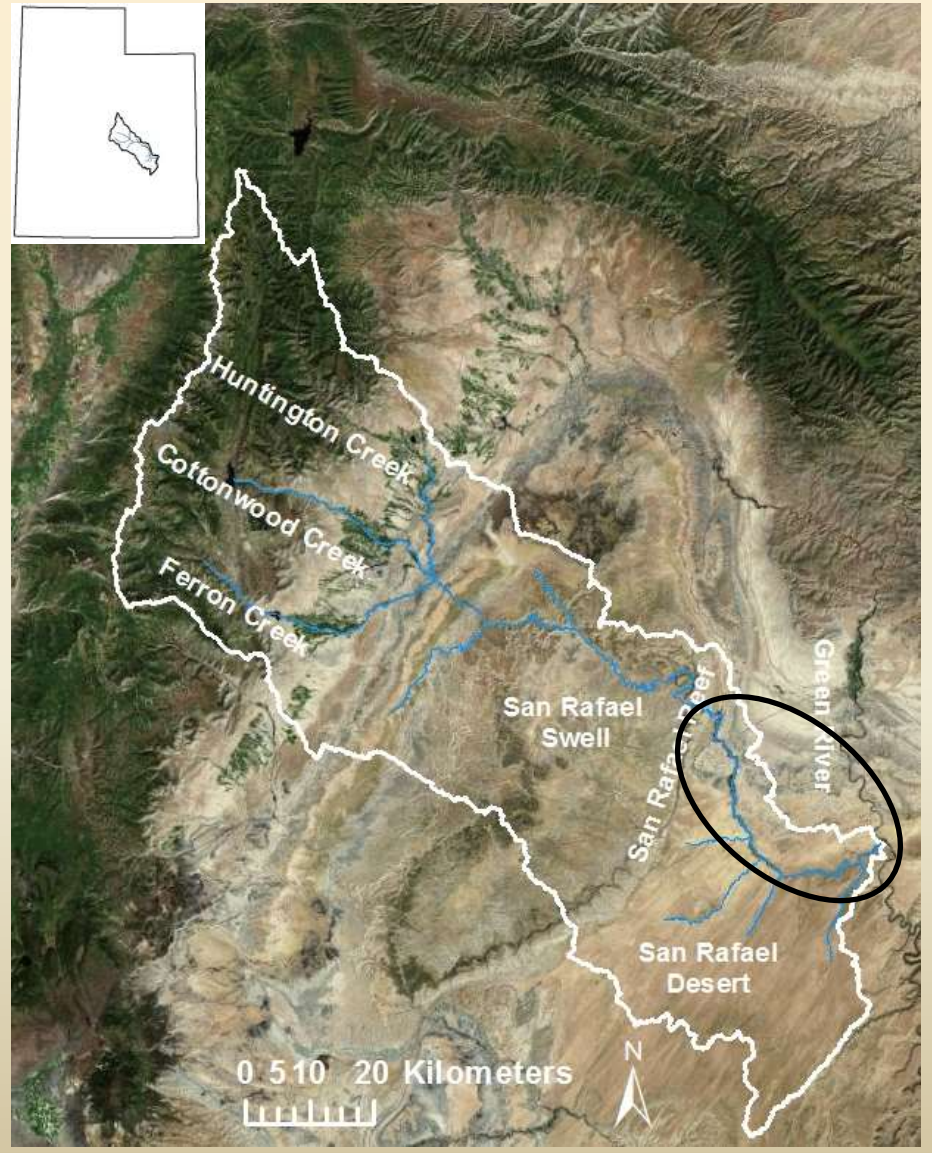
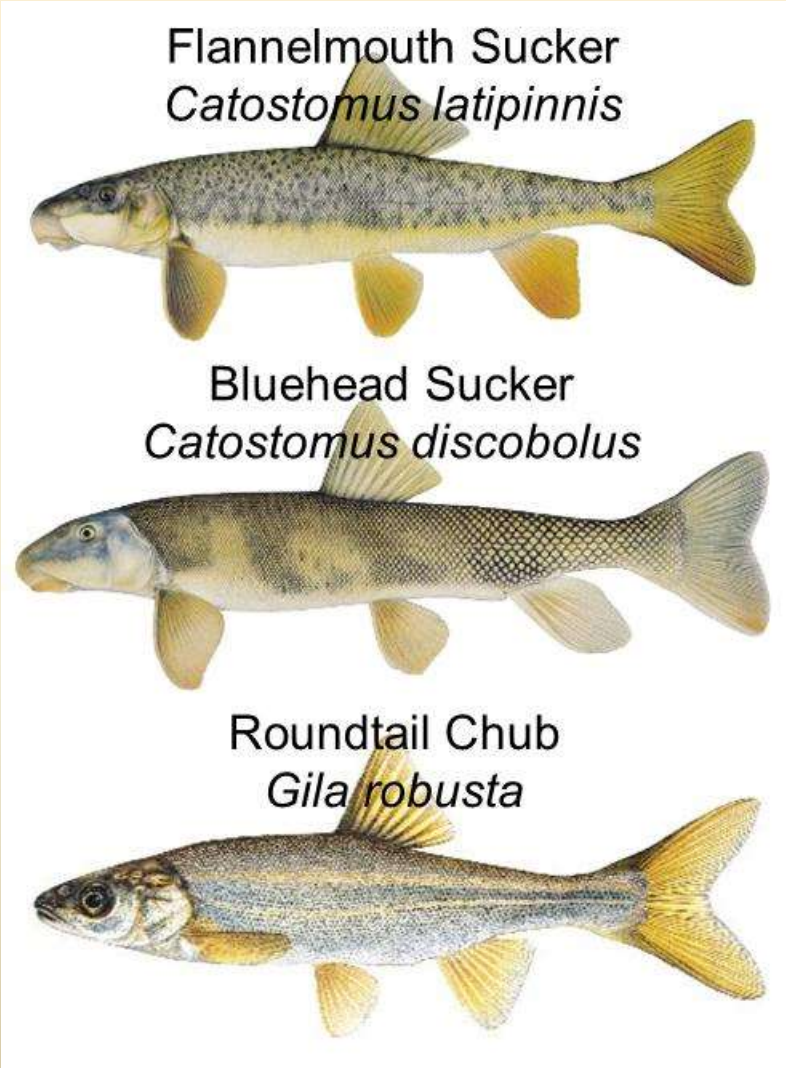
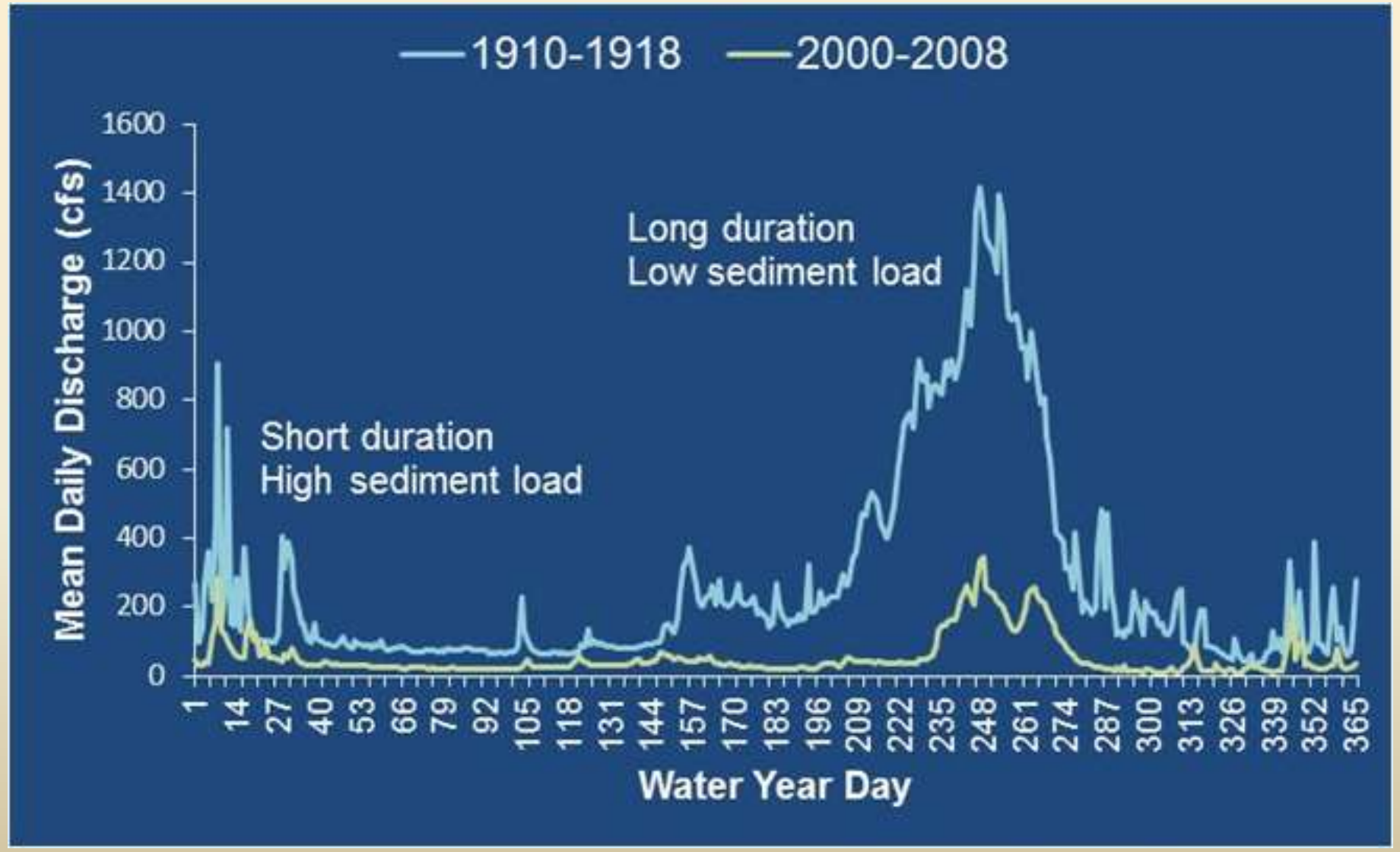
San Rafael River

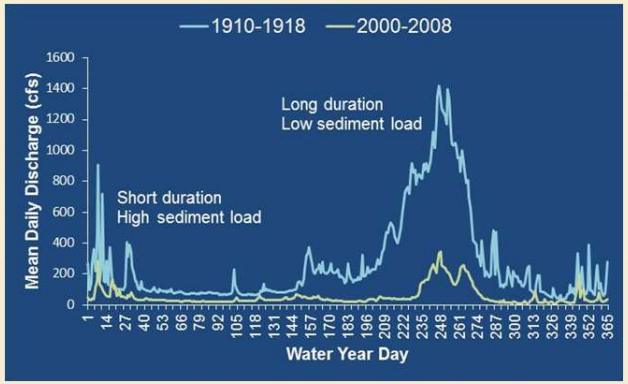


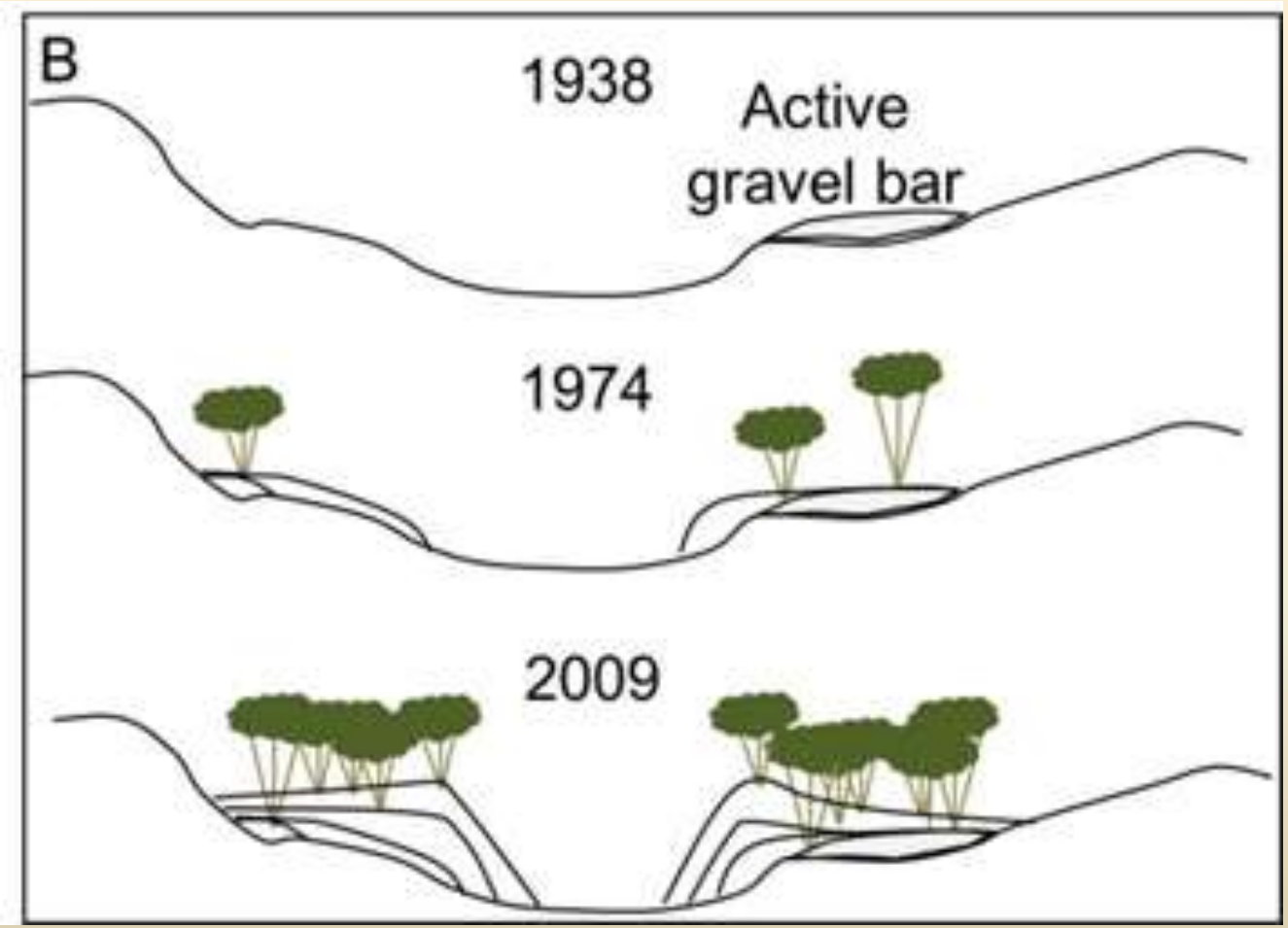


Hydrologic changes



Geomorphic changes





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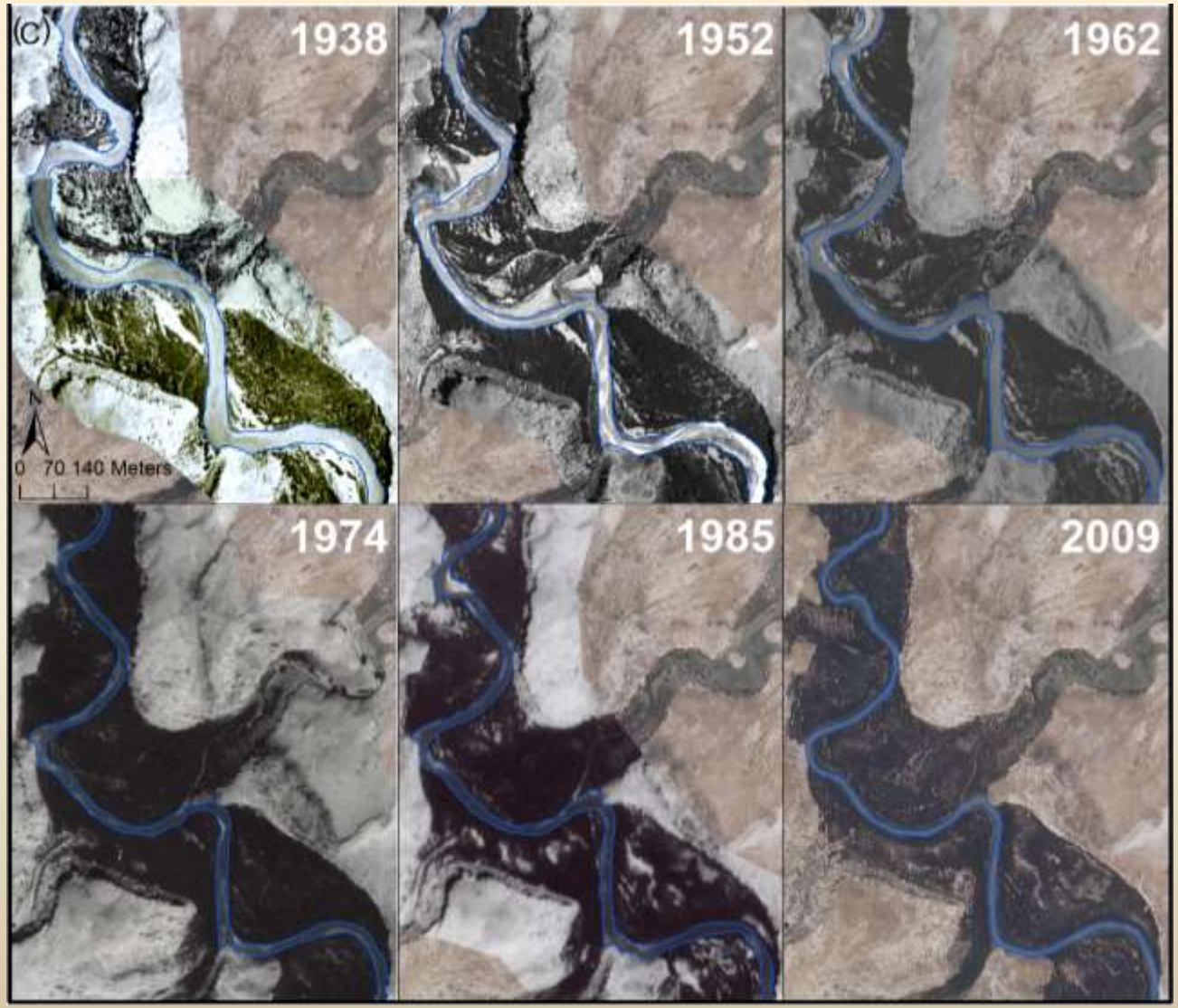
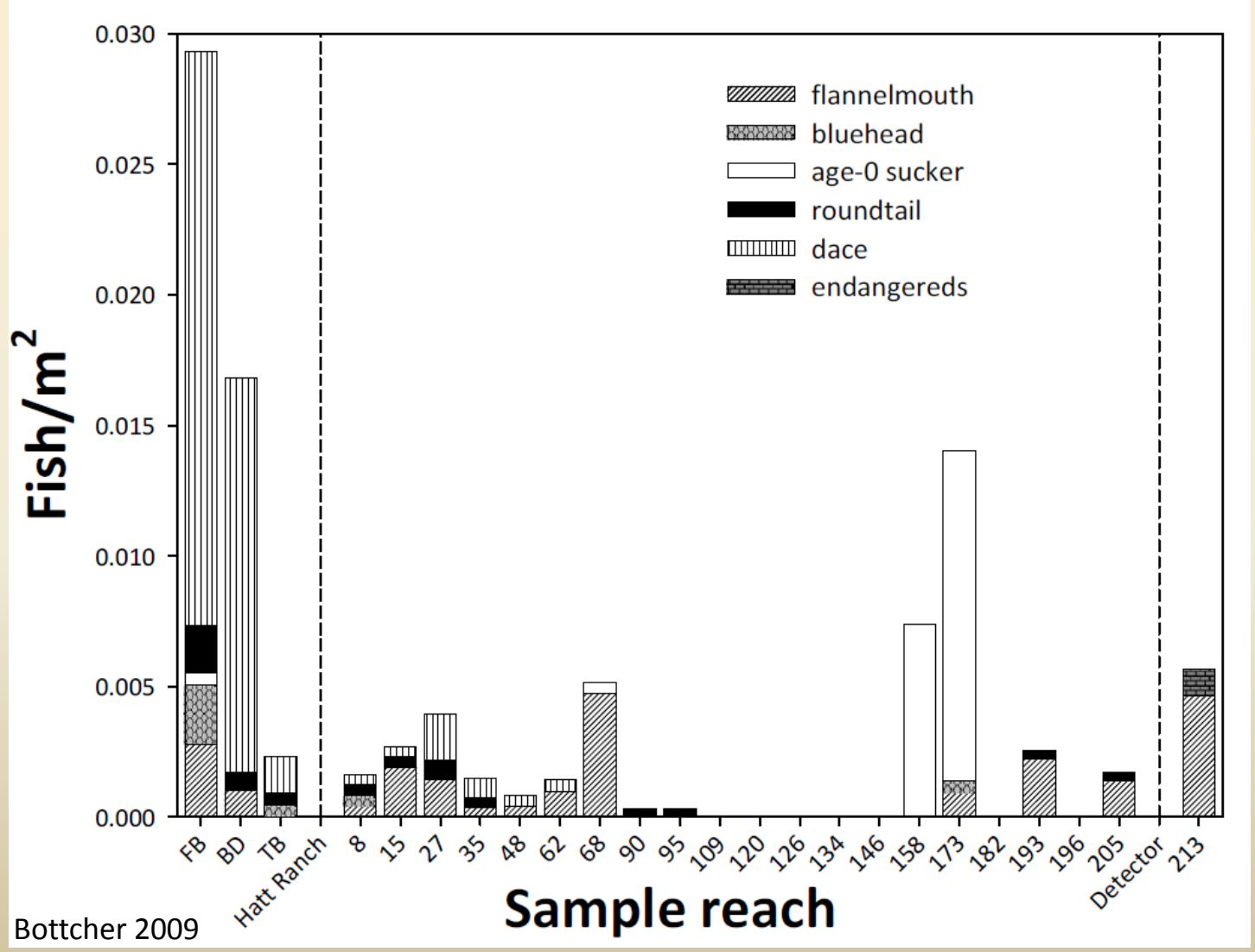


Fish and habitat complexity



Bottcher 2009

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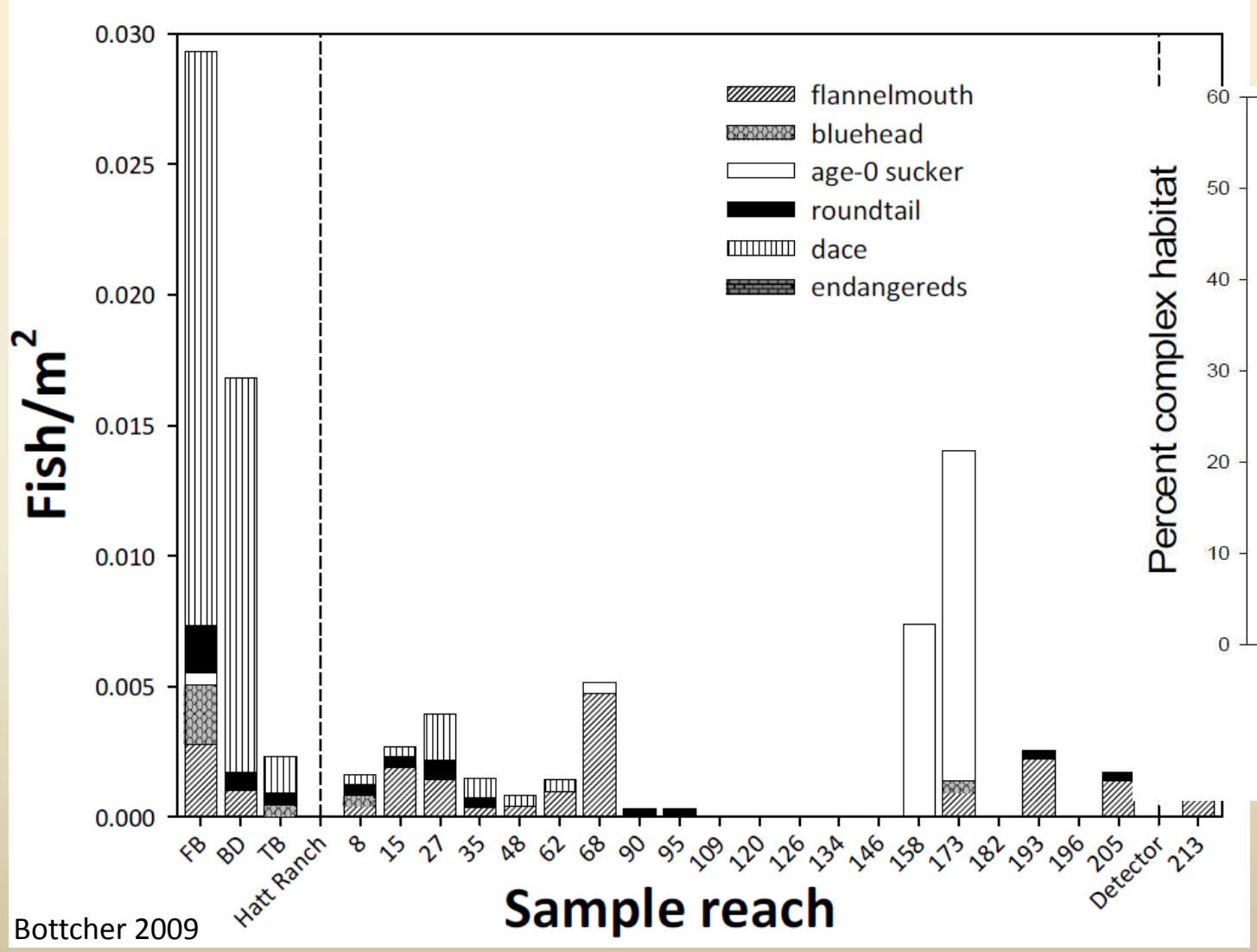
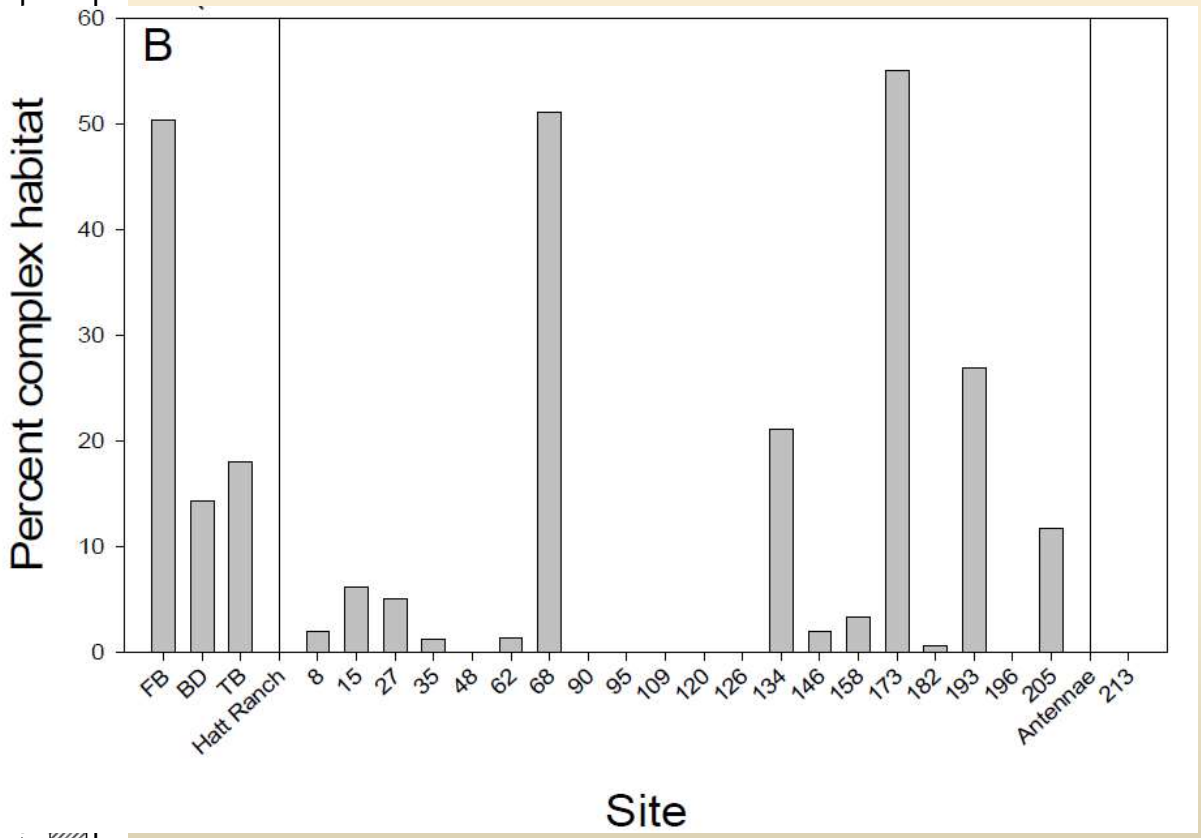
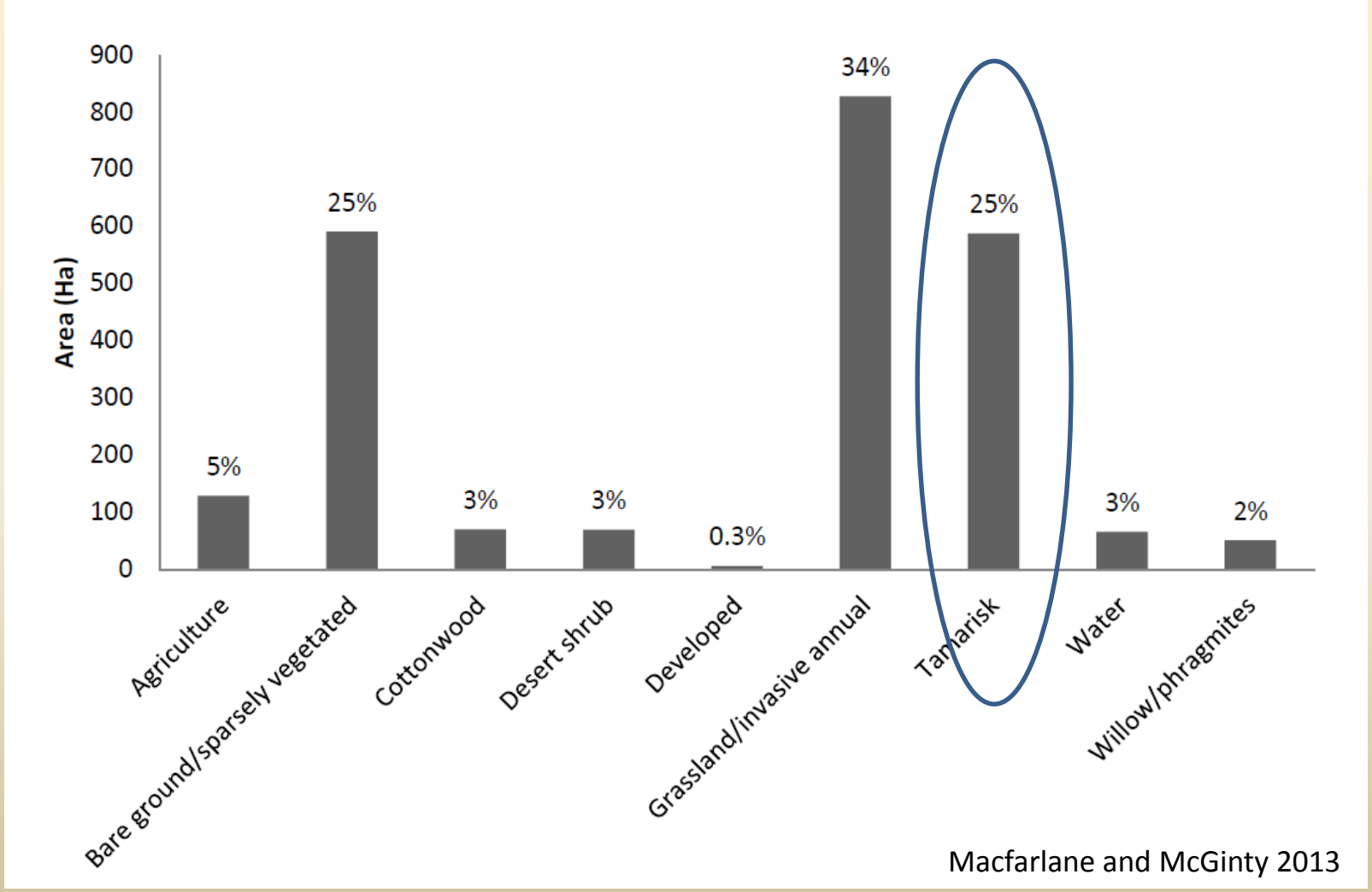




Bottcher 2009

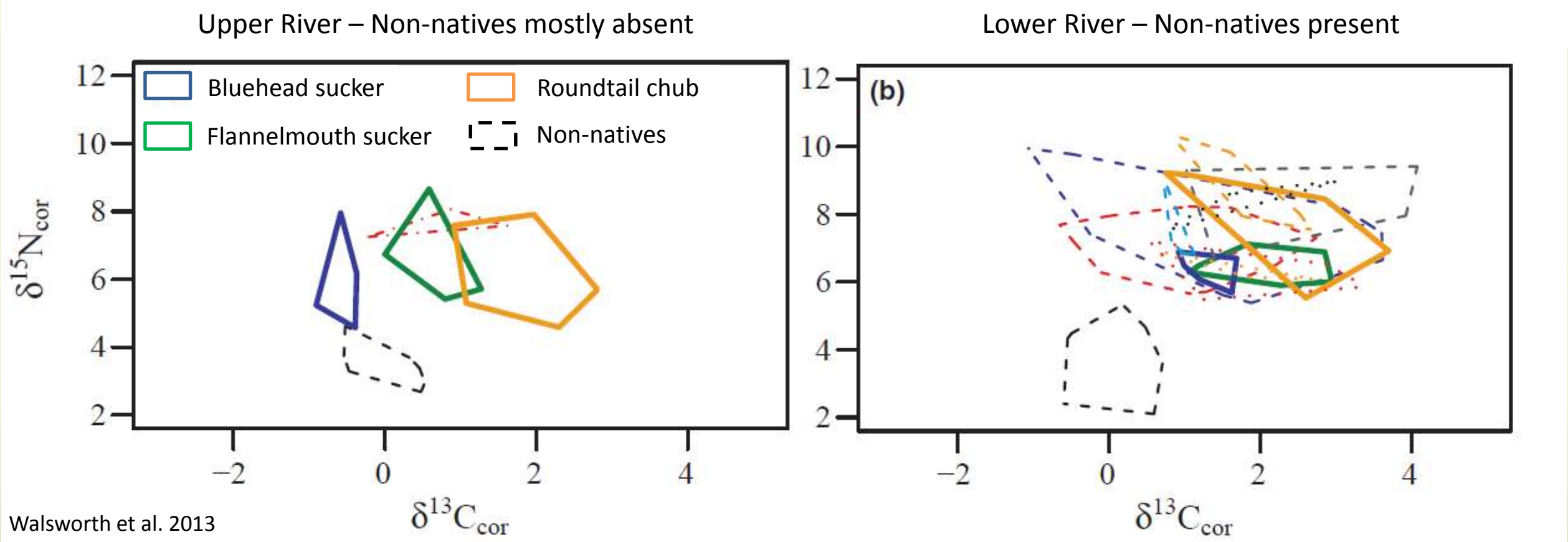
Vegetation Changes

Riparian Corridor Vegetation Cover



Macfarlane and McGinty 2013

Non-native Fish



Walsworth et al. 2013

Ecological Regime Shifts

Conservation of Desert Fish and Riparian Ecosystems

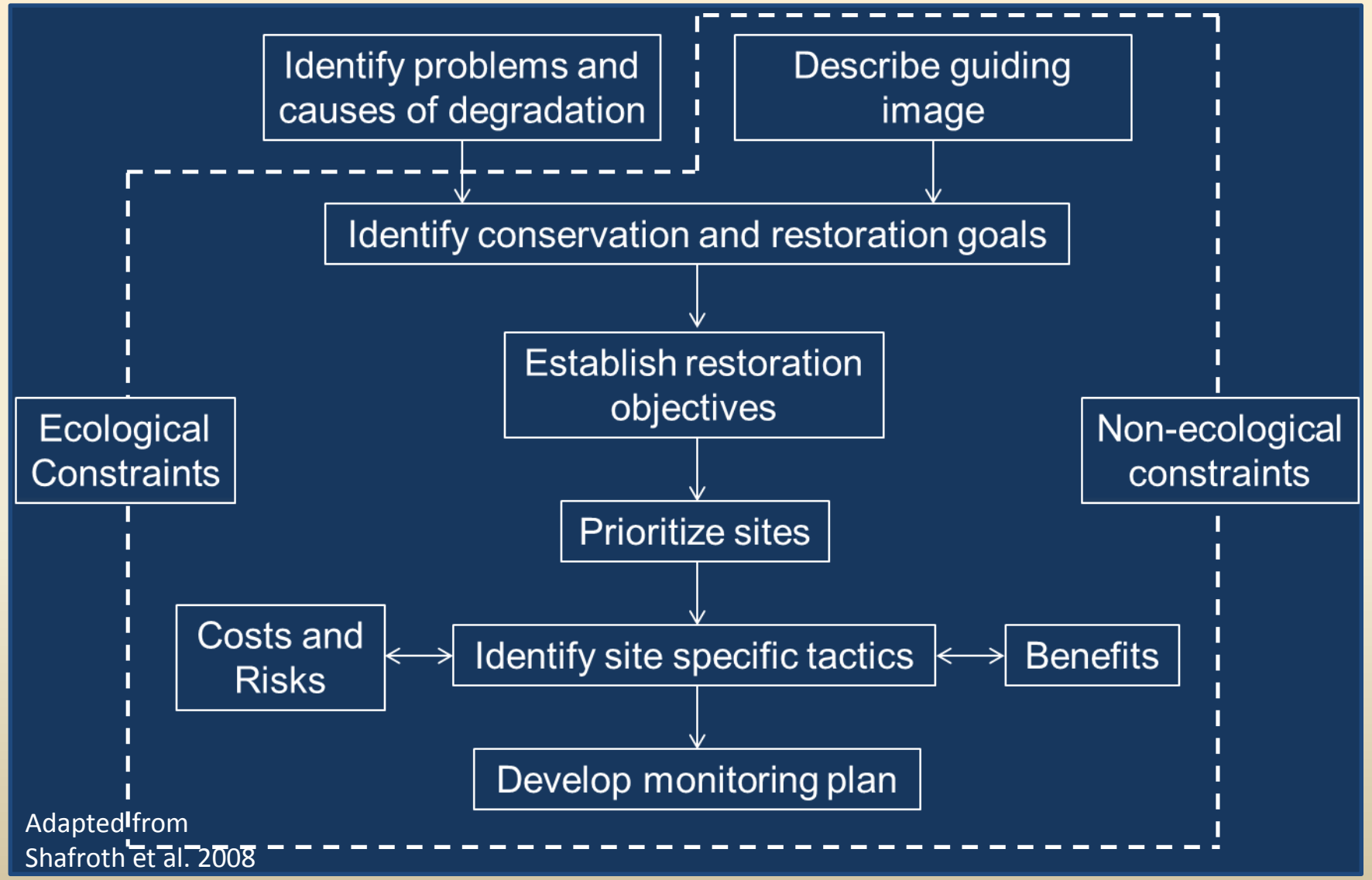
- Multiple approaches needed
  - Managed flows
  - Habitat enhancement
  - Non-native removal

Dan Keller

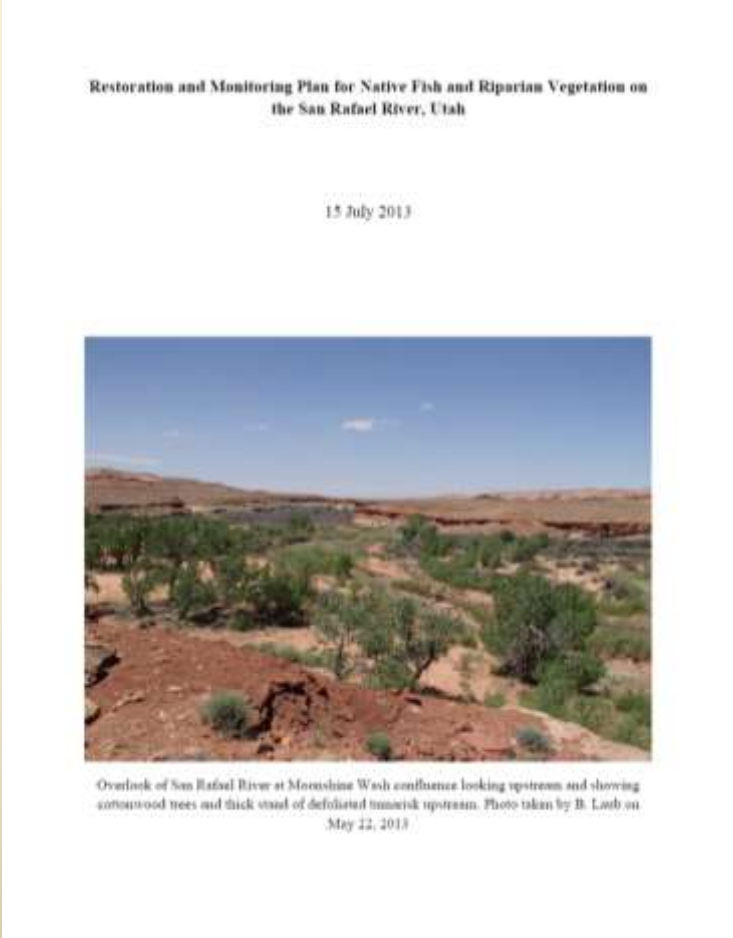
Habitat Enhancement

- Process-based
- Assist recovery of dynamic rivers

2012-2013: Restoration Planning



Adapted from Shafroth et al. 2008



Restoration and Monitoring Plan for Native Fish and Riparian Vegetation on the San Rafael River, Utah

15 July 2013

Overlook of San Rafael River at Moonshine Wash confluence looking upstream and showing cottonwood trees and thick stand of defoliated tamarisk upstream. Photo taken by B. Lamb on May 22, 2013

San Rafael River Experimental Activities

- Tamarisk Removal
  - Enhance lateral channel migration
  - Increase wood inputs to river
  - Promote native vegetation establishment

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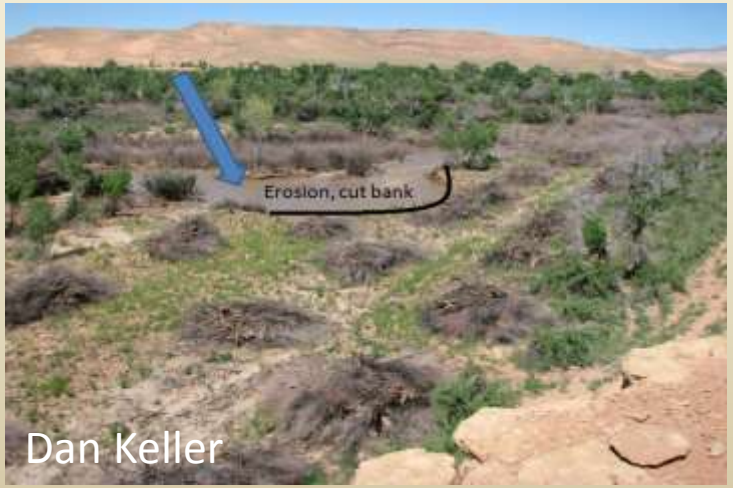

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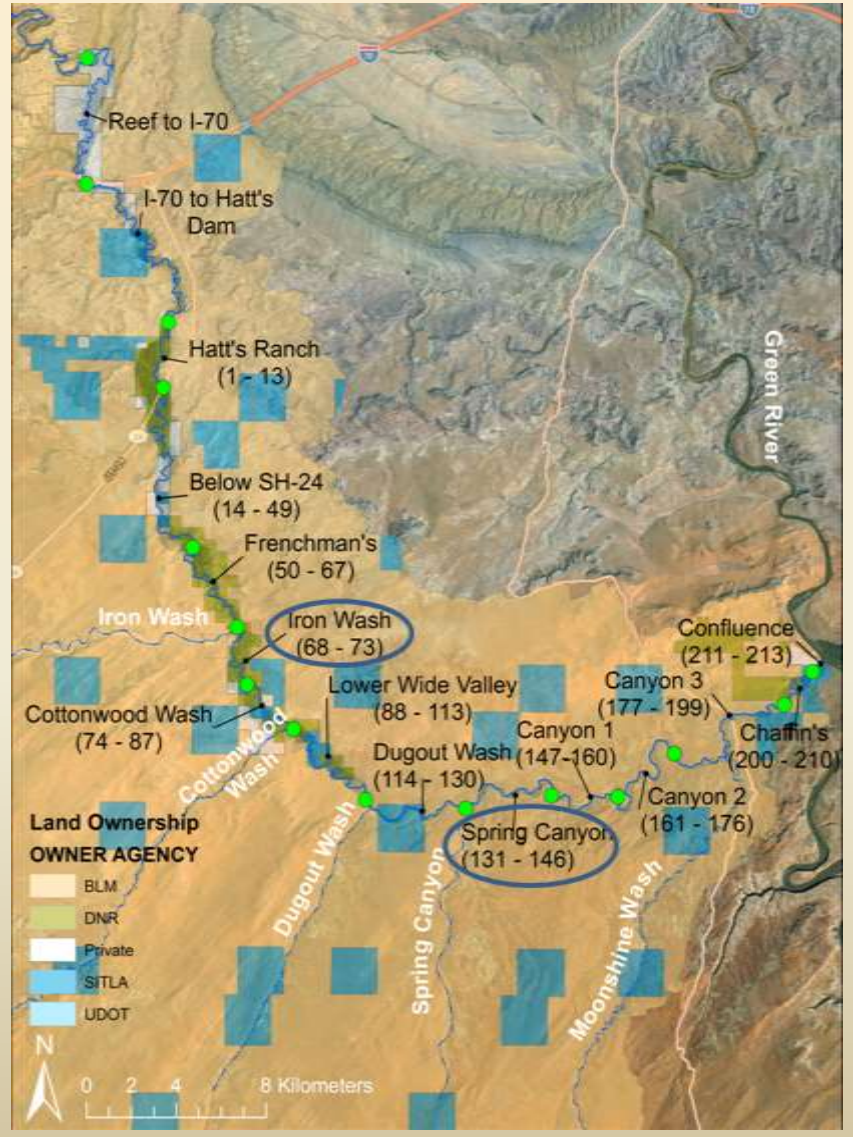
San Rafael River Experimental Activities

- Beaver-dam analogues (BDAs)
  - Enhance habitat formation
  - Increase bed elevation to promote river-floodplain connections
  - Raise water tables to promote native vegetation establishment

San Rafael River Experimental Activities

- Gravel Addition
  - Enhance gravel transport
  - Build riffles and gravel bars

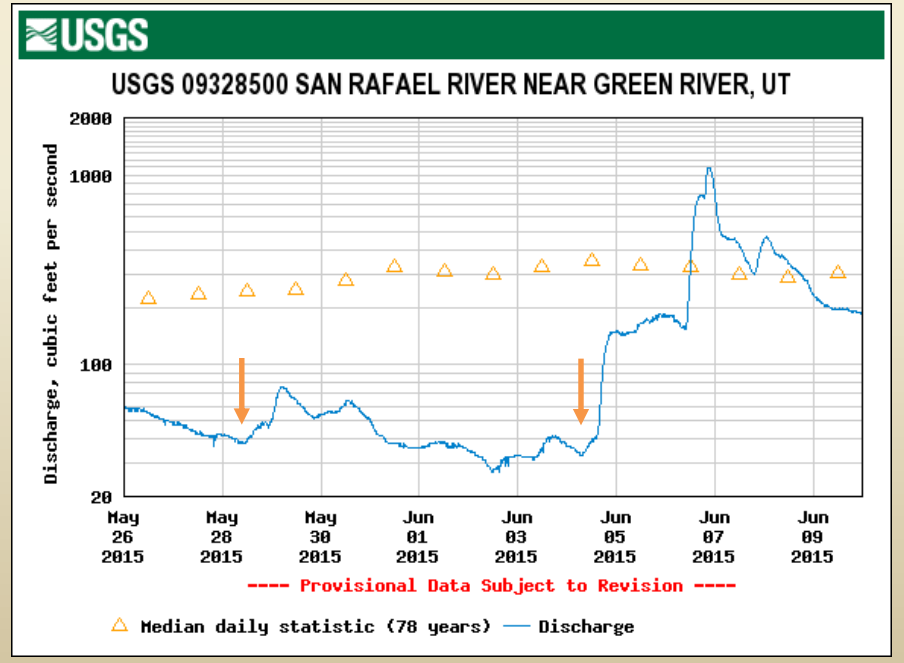


Tamarisk Removal

- Treatment
  - 63 acres
  - Cost – $41,000
- Outcomes
  - Some native vegetation recruitment
  - Non-native vegetation recruitment
- No cottonwood recruitment
  - Lack of spring flood

Gravel Addition

- Treatment
  - 2 gravel bars
  - Cost – $15,500
- Outcomes
  - Gravel movement during flood event
  - Possibly some gravel bar build-up at head of beaver dam structure



Beaver Dam Analogues (BDAs)

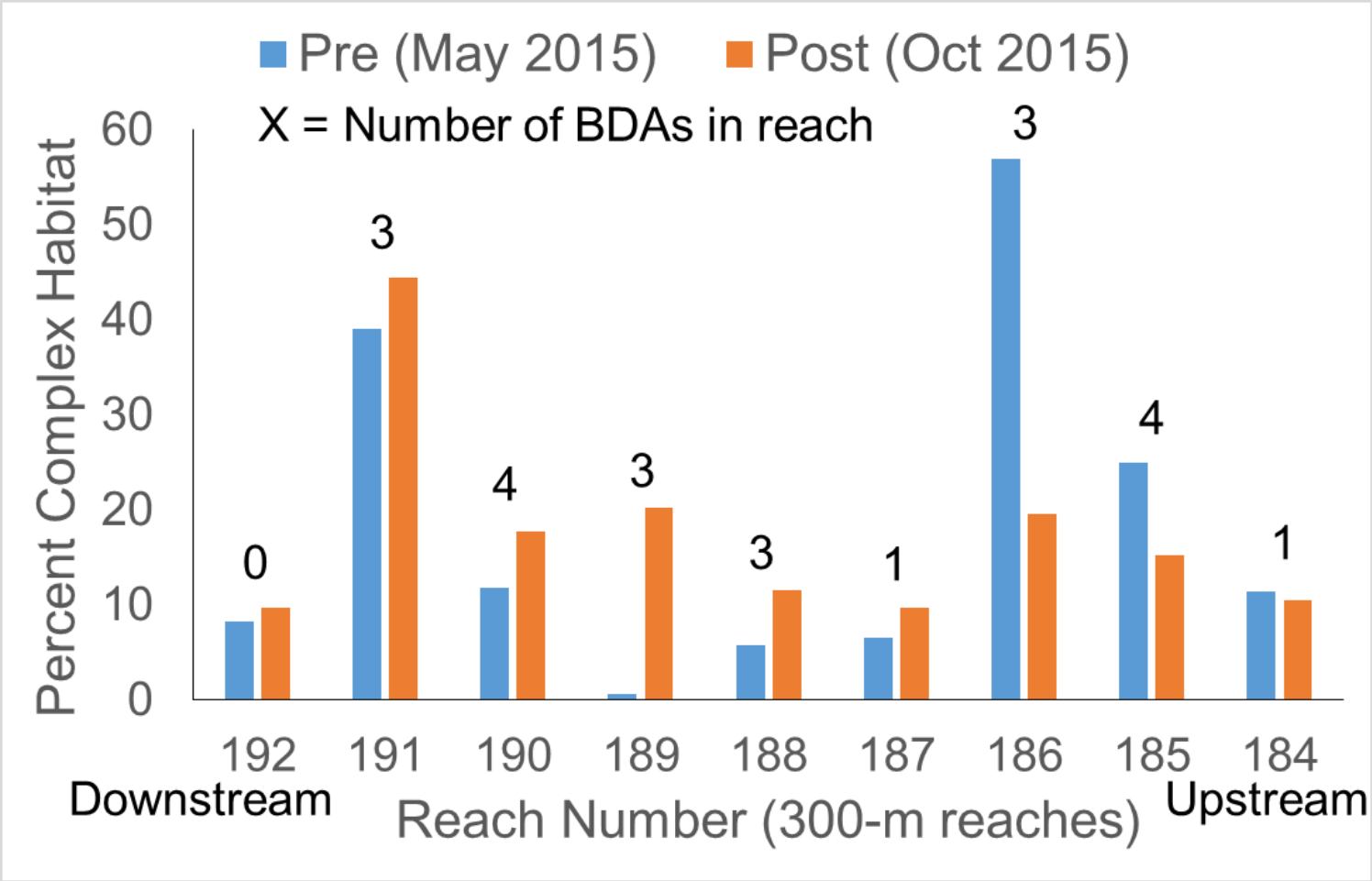
- Treatment
  - 8 complexes; 34 structures
  - Cost – $10,000 – mostly labor

Beaver Dam Analogues (BDAs)

- Outcomes
  - Most BDAs breached
    - Only 3 of 34 remained fully intact
  - Even BDAs without willow weave breached
    - Breaching mainly occurred through post scour
  - Breached BDAs still provided some flow alteration

Beaver Dam Analogues (BDAs)

- Habitat outcomes
  - Overall, little net change in habitat complexity



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  - Some BDAs did create new habitats
    - 41% of all BDAs assessed
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Management Implications

- Timing of activities with flows is important
  - Little opportunity for cottonwood recruitment following tamarisk removal
  - Flows did transport gravel after placement
  - High flows breached BDAs soon after placement
- Gravel placement/BDAs had mixed success
  - Many BDAs breached but a few did hold through high flows
  - Some habitat was created
  - Maintenance activity required is high
  - Learning success

Future Restoration Efforts

- Cottonwood planting/non-native weed control
- BDA design
  - Focus effort on a few locations
  - Improved construction design
    - Longer posts
    - Sand bags/straw bales at base of posts
    - Locations where flow energy is dissipated on floodplain or at meander bends

Acknowledgements

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- Bureau of Land Management
- National Fish and Wildlife Foundation
- Utah Division of Wildlife Resources
- US Geological Survey – Utah Cooperative Fish and Wildlife Research Unit
- Utah Watershed Restoration Initiative

People

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- San Rafael Team
  - Paul Birdsey, Jeff Brower, Dave Dean, Dan Eddington, Ian Gowing, Carl Ivory, Jeremy Jarnecke, Dan Keller, Sam Lyster, Wally Macfarlane, Peter MacKinnon, Milada Majerova, Chris McGinty, Cassie Mellon, Justin Miner, Elijah Portugal, Jared Reese, Jack Schmidt, Mike Scott, Dave Speas, Gary Thiede, Dana Truman, Peter Wilcock, Krissy Wilson, et al.
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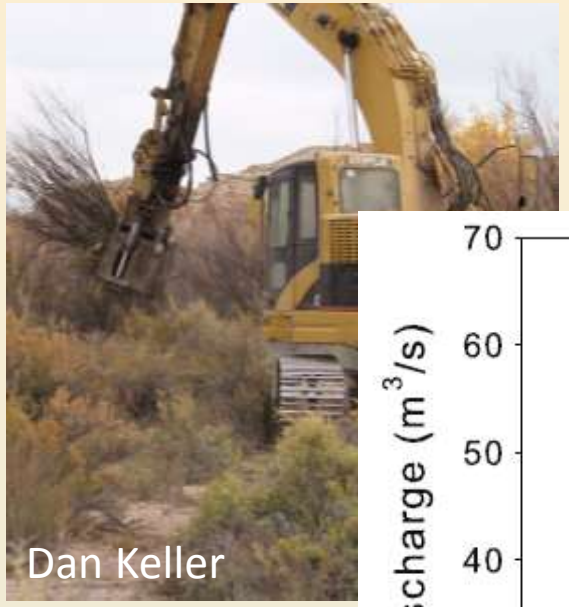
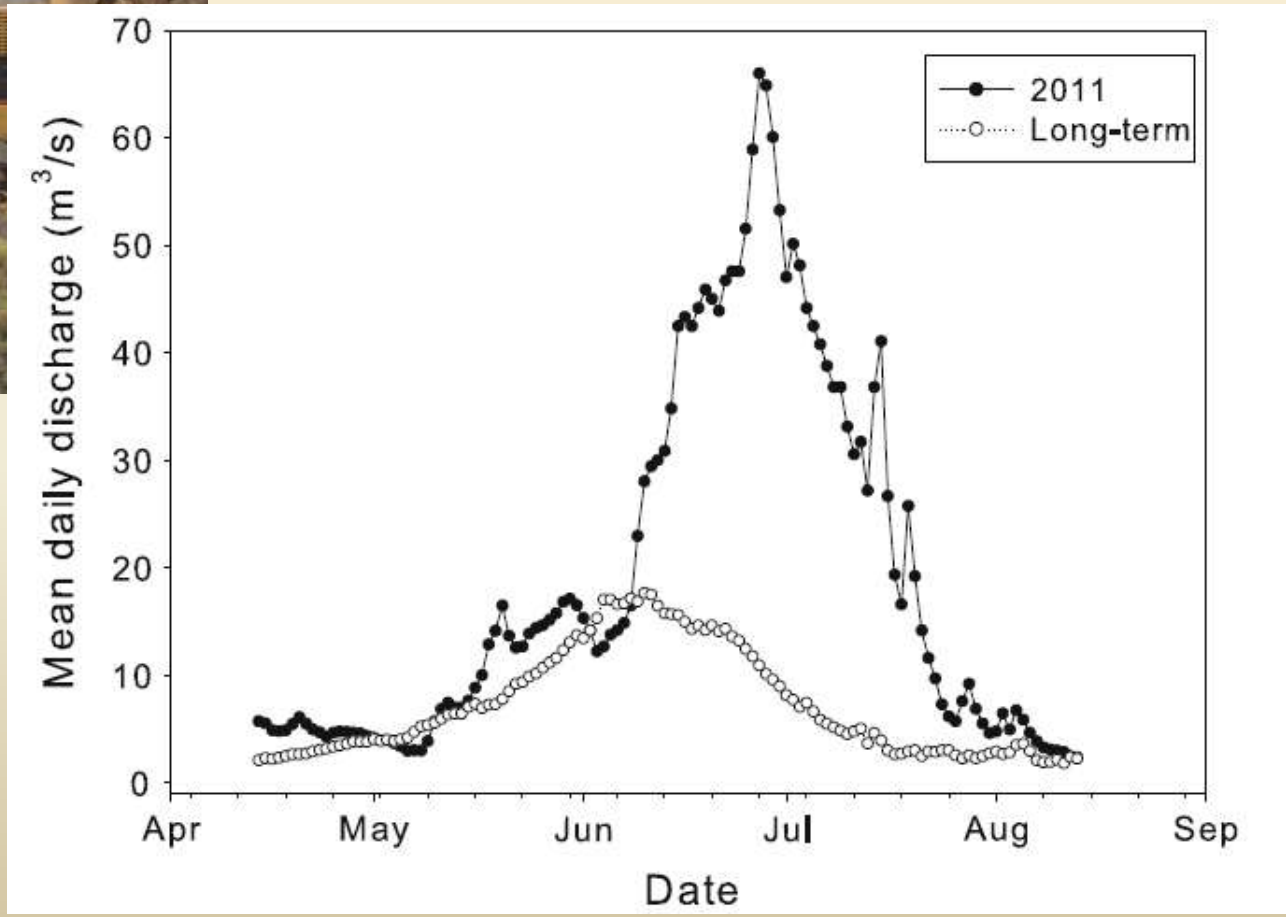
People

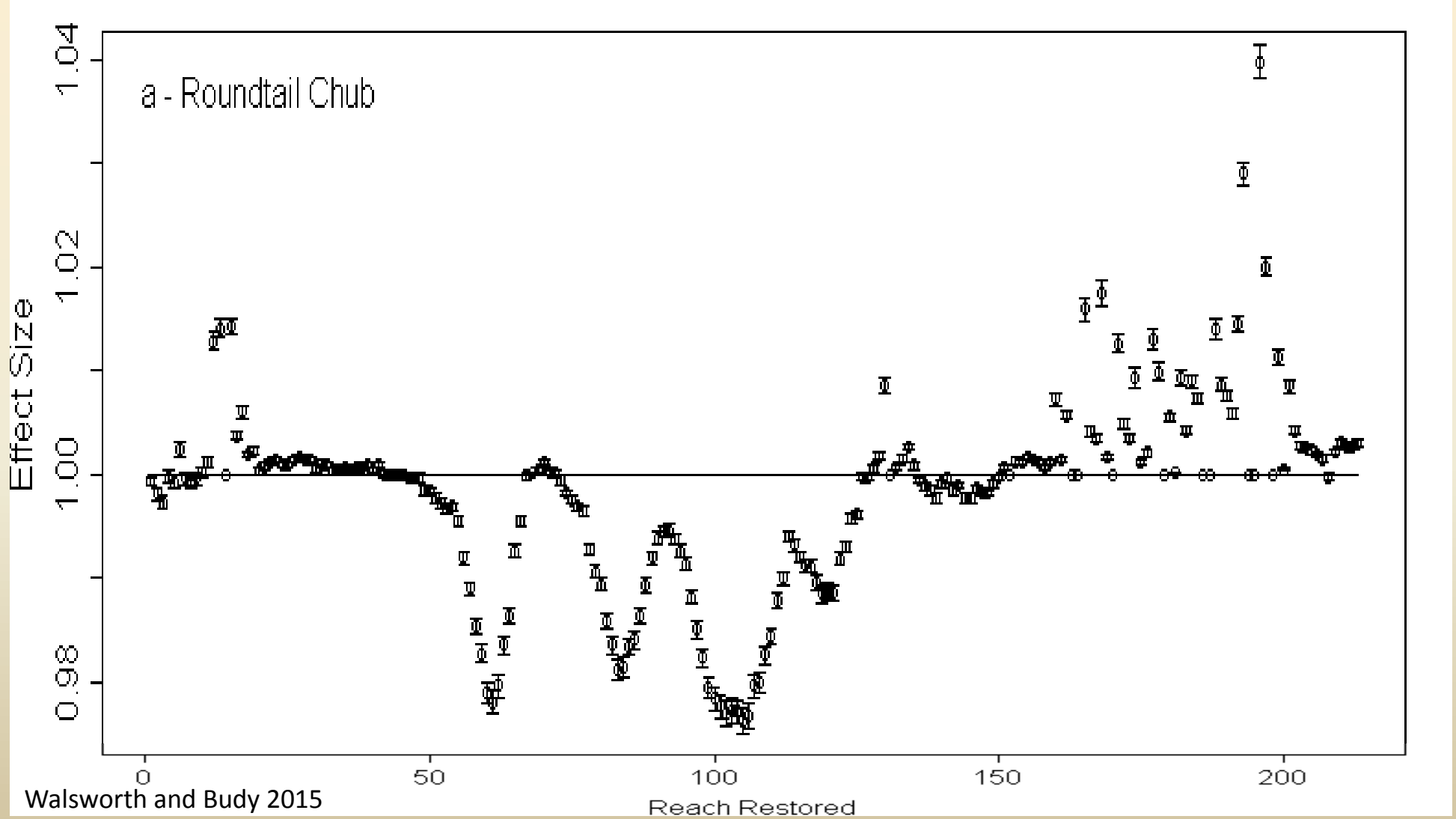
- Beaver Analogs
  - Ben Stout, Kelsey Ballard, Alex Walker, Others: Angela, David, Jayla, Jordan, Michaela, Mike, Nicole, Sean, TJ

2010-2012: UDWR Tamarisk Removal





Restoration Site Prioritization



Walsworth and Budy 2015