Floodplain response
14 years after invasive removal in Canyon de Chelly National Monument, AZ

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Historic canyon land use

• Farming
  • Fruit and grains
• Grazing
• Residence
• Navajo and Hopi ceremonial sites
Floodplain changes 1930s-2005

*Native cottonwood, exotic tamarisk and Russian olive riparian forest*
Tamarisk and Russian olive

*Tamarix ramosissima* Ledebour,
*T. chinensis* Loureiro,
*T. pentandra* Karst,
and hybrids of these taxa

*Elaeagnus angustifolia* L.
(Russian olive)
Canyon de Chelly restoration

- National Park Service interest
  - Watershed restoration
  - Viewshed restoration

- Navajo interest
  - Historic farming practices
  - Viewshed restoration
Goals

1. History of invasion

2. Response to removal
   - Channel
   - Floodplain plant communities
History of Invasion

- Extract plants 2005-2006
- Slice, find germination points, and age plants
- Tree ring aging
- Climate reconstruction
History of Invasion

• 1980s: Wide-spread invasion (late! – compared to region)

• Invasion occurred on an active floodplain that then was abandoned.

• Establishment driven by wet years and interacted with channel change
  • Establishment facilitated channel change (incision)

  ~OR~

• Channel change (incision) facilitated seedling survival
History of Invasion


Study Sites

Exotic plant removal sites:
1. Navajo Fortress
2. Standing Cow
3. Lower White House
4. Upper White House
5. Sliding Rock
6. Spider Rock
Removal Sites

1. Control
2. Above-ground removal with herbicide
3. Whole plant removal
Response to invasive plant removal 2005-2019

1) How has the stream channel responded?

2) How do removal methods affect resulting plant communities? (3 yrs and 14 yrs post treatment)
Channel form 2005-2019

Downstream  Upstream
Sliding Rock Site (clay)

Control

Whole plant removal
2019 - Lower White House Whole Plant Removal
Response to invasive plant removal

Vegetation surveys:

• Summer 2005, 06, 07, 08 and 2019
2008

The image contains a bar graph with the following legend:
- Control (2008)
- Cut stump (2008)
- Whole Plant (2008)
- Soil Seed Bank

The x-axis represents different categories: Exotic, Native, and Wetland Indicator Scores. The y-axis represents mean relative abundance (cover or density) ranging from 0 to 100.

The graph shows comparisons between dry and wet conditions, with bars indicating the relative abundance for each category.
2019 Upper White House site
Grazing is ongoing
Grazing exclosures, seed additions (2012)
Summary

• Tamarisk and Russian olive invasion was driven by:
  • wet years, large floods -1980s
  • channel narrowing, channel incision – which caused which?

• After invasive plant removal:
  • Cohesive banks with clay and prior entrenchment facilitate further channel enlargement (including incision) and does not promote lateral movement: persistent entrenchment
Summary

1942
Ansel Adams

2005

2015

• Where bank sediments are dominated by sand, widening and channel migration is happening, with sufficient flow

• Vegetation in removal sites is dominated by exotic grasses and forbs, return of native plant communities is limited.

• Seeding and grazing exclosure are facilitating native grass persistence
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Questions?

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