The Role of a Non-native Tree in Riparian Vegetation Expansion and Channel Narrowing Along a Dryland River

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Escalante River—Russian olive invasion

Below Harris Wash

Photos by: Bill Wolverton, with permission
Study area

- Targeted sampling in the agricultural communities of Boulder and Escalante
- Systematic sampling in two entrenched meander study reaches
- Downstream reaches complicated by bedrock geology, early removal and subsequent erosion of treated stems
Approach—field and lab

- Large-scale removal began in 2010
- Geospatial analysis of aerial imagery: ‘51(’60); ’81; ‘10
  - map geomorphic surfaces (ArcMap)
  - estimate woody vegetation cover
  - map Russian olive cover (2010)
  - ArcGIS spatial analyses
  - modeled flow and climate correlates of invasion
- Ring counts and GPS locations on 714 cut stems
ERWP geodatabase: treatment years

treatment year - # of rings = establishment year
Results—Vegetation cover and channel width

- Overall, vegetation cover expands (60-80%) as channel narrows (~76%)
- Cottonwood (canopy expansion) ~matched by R-o (establishment); ’81 to ’10
Results—Russian-olive establishment pattern

- R-o planted/naturalized beginning in 1950; Boulder & Escalante towns
- Exponential increase ~1980 in reach 1; time transgressive establishment reach 2
- 30 yr lag matches MT model (*Lesica & Miles 2001*); 10 yrs to reproductive maturity
Results—Russian-olive establishment pattern

- Narrowing reach 2; channel narrows additional 50% by 2010
- Existing cw canopies expand; new R-o establish 1° in 1981 channel
- Narrow 2010 channel (green) flanked with R-o (crown area in aqua)
Interpretation—Escalante River

After: Friedman et al. 2015; GSA Bulletin
Channel simplification: less dynamic channel erosion and deposition; loss of habitat diversity for some aquatic species.
Conclusions

• Narrowing: late 1940s – early 1950s
• Russian-olive introduced/established in Boulder and Escalante in early 1950s
• Scattered establishment mid 1950s - 1970s; likely spread by birds and water
• Rapid establishment in mid-1980s - mid-1990s; streamflow & climate?; facilitated by cottonwood?
• Russian olive invasion further narrowed and simplified channel; limiting aquatic habitat
• New questions: e.g., factors controlling 30 yr lag in invasion; will removal restore channel form?
Conclusions

• Narrowing: late 1940s – early 1950s
• Russian olive introduced/established in Boulder and Escalante in early 1950s
• Scattered establishment along river mid 1950s – 1970s; likely spread by birds and water
• Exponential establishment in mid-1980s and mid-1990s; spread by floods; facilitated by cottonwood?
• Russian olive invasion further narrowed and simplified channel; limiting aquatic habitat

New questions: e.g., factors controlling 30 yr lag in invasion; will removal restore channel form?

Removal — making a difference?

Removal/debris piles — making a difference?

deposition
erosion
Tracking debris piles—channel change?
Monitoring—channel & vegetation change

Channel realignment 2017

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroFlux, IGN, and the GIS User Community
The future?

- Monitoring:
  - Control reinvasion
  - Utilize Resource Database
  - Was the control effort successful?
  - Do debris piles work?
  - Document channel and vegetation response to removal of Russian olive
  - Inform future control efforts