Potential Barriers to Cottonwood Regeneration in the Big Gypsum Study Area

Rob Anderson

With Funding From: Colorado Water Conservation Board

Summary

- Goals of DRD science
- Background information on Riparian forests
  - Cottonwoods
    - Potential causes for a decline in CW forests
  - Tamarisk and its effect on soil salinity
- The Big Gypsum Study: A work in progress
- A Recent Study: Merritt and Poff 2010

Goals of the DRD science efforts

- To inform the efforts of the DRD to improve the downstream environment by providing scientific information and analysis, with a focus on four primary areas of investigation:
  - native warm water fisheries
  - cold water fisheries
  - river mechanics
  - riparian vegetation

- DRD Riparian Vegetation Objectives:
  - **Cottonwood seedling establishment.**
  - **Floodplain scour/deposition.**
  - **Floodplain saturation (nutrient cycling).**

Riparian Forests in The Southwest US

- Integral part of riverine ecosystems
  - High species diversity
    - Key habitat for native and non-native species
  - Nutrient and sediment dynamics
- Influenced greatly by hydrologic processes
- 70-90% loss of riparian vegetation
- Cottonwoods are often the dominant species in riparian habitats
  - Observable decline in CW forests

(Merritt et al 2010, Braatne 96, Coble)

Debate surrounding causes contributing to a decline in CW forests

- Proliferation of invasive species
  - tamarisk
  - russian olive
- Livestock over-grazing
  - poorly timed or lack of rotational grazing
- Displacement
  - domestic settlements
  - gravel mining
  - agricultural clearing
  - on-stream reservoirs
- River Damming and Water Diversion
  - Altered Flows
    - Reduced flooding
    - Stabilized flows
    - Reduced water availability
    - Interruption of natural sedimentation processes
    - Reduced meandering
    - Channelization

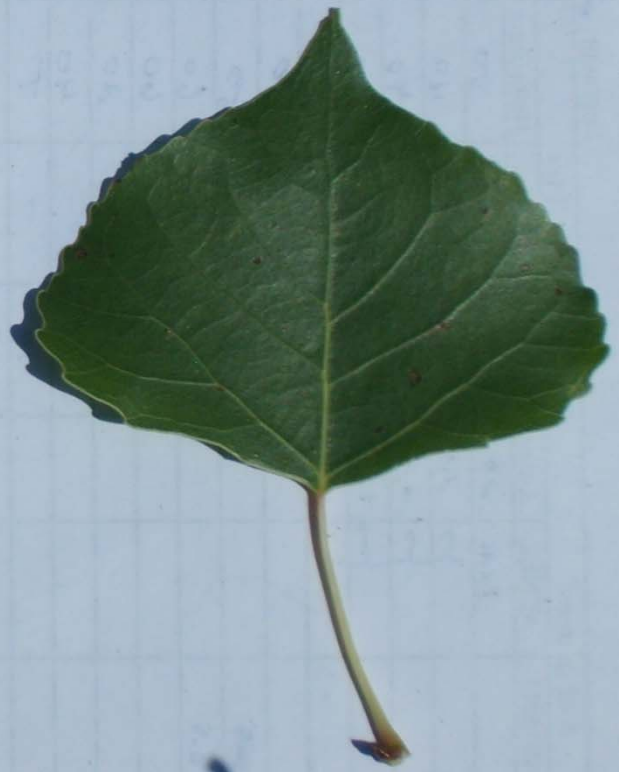
Stromberg 92, Braatne et al. 1996

Native Cottonwood species

Narrowleaf
(P. angustofolia)

Hybrid

Rio Grande
(P. fremontii)



Coble

Cottonwood Reproduction

- Sexual
  - Dioecious (male and female trees)
  - Flowering and pollination occur after spring peaks
  - Seeds dispersed by wind and water
  - Short life of seeds
    - Once mature, seeds are viable for 1-2 weeks
    - Once wet, 2-3 days
- Asexual reproduction
  - Roots
  - Fallen branches

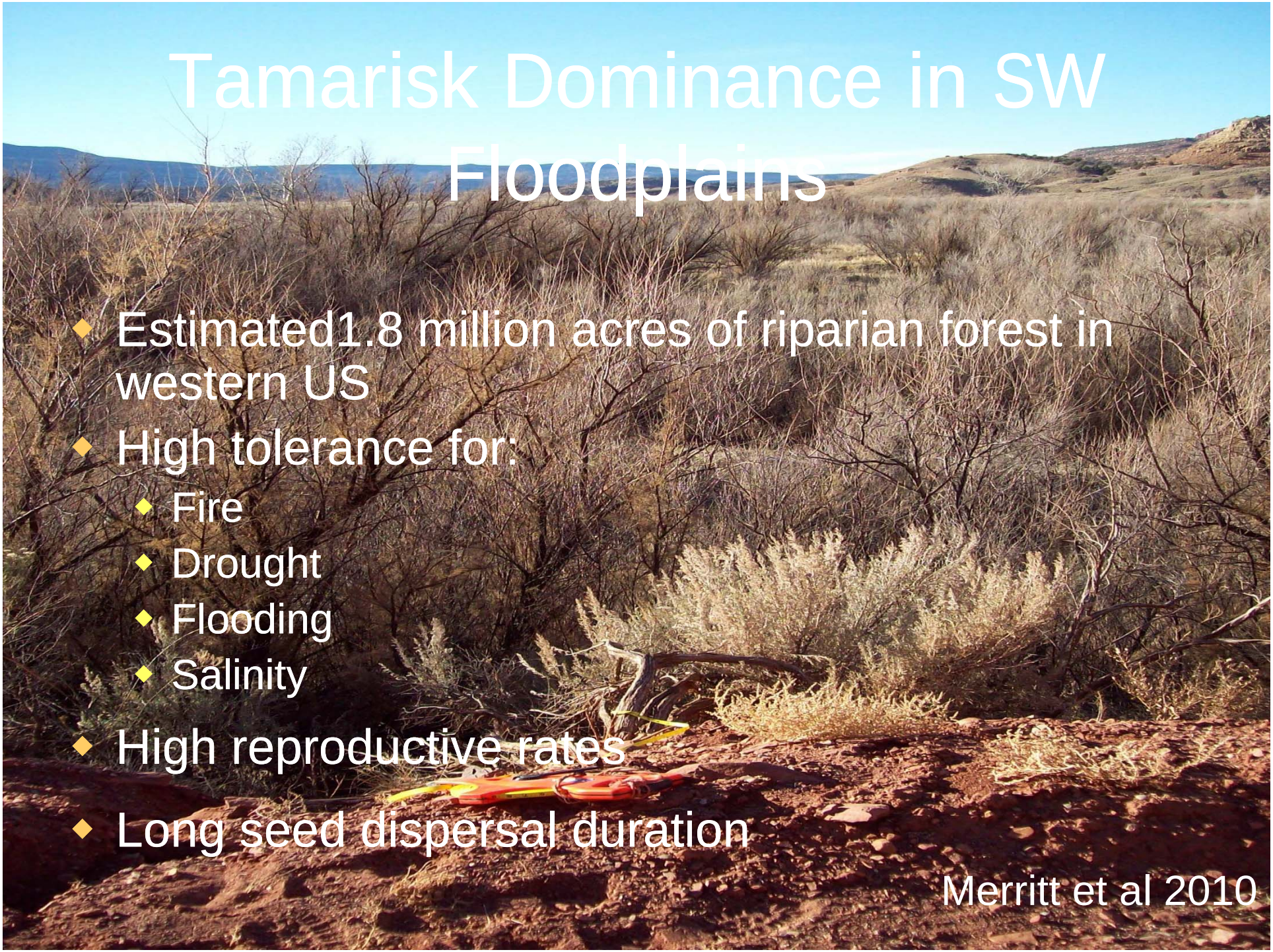
Ideal Conditions for Cottonwood Regeneration

- Bare, moist soils
  - Freshly deposited along point and gravel bars
  - Sandy to sandy loam soils: pH 5.0 - 5.8
- Low groundwater drawdown rates
- Low soil salinity
- High availability of soil moisture

Sher et al. 08, Braatne et al. 96


Coble

Tamarisk Dominance in SW Floodplains



- Estimated1.8 million acres of riparian forest in western US
- High tolerance for:
  - Fire
  - Drought
  - Flooding
  - Salinity
- High reproductive rates
- Long seed dispersal duration

Merritt et al 2010

Tamarisk and Soil Salinity

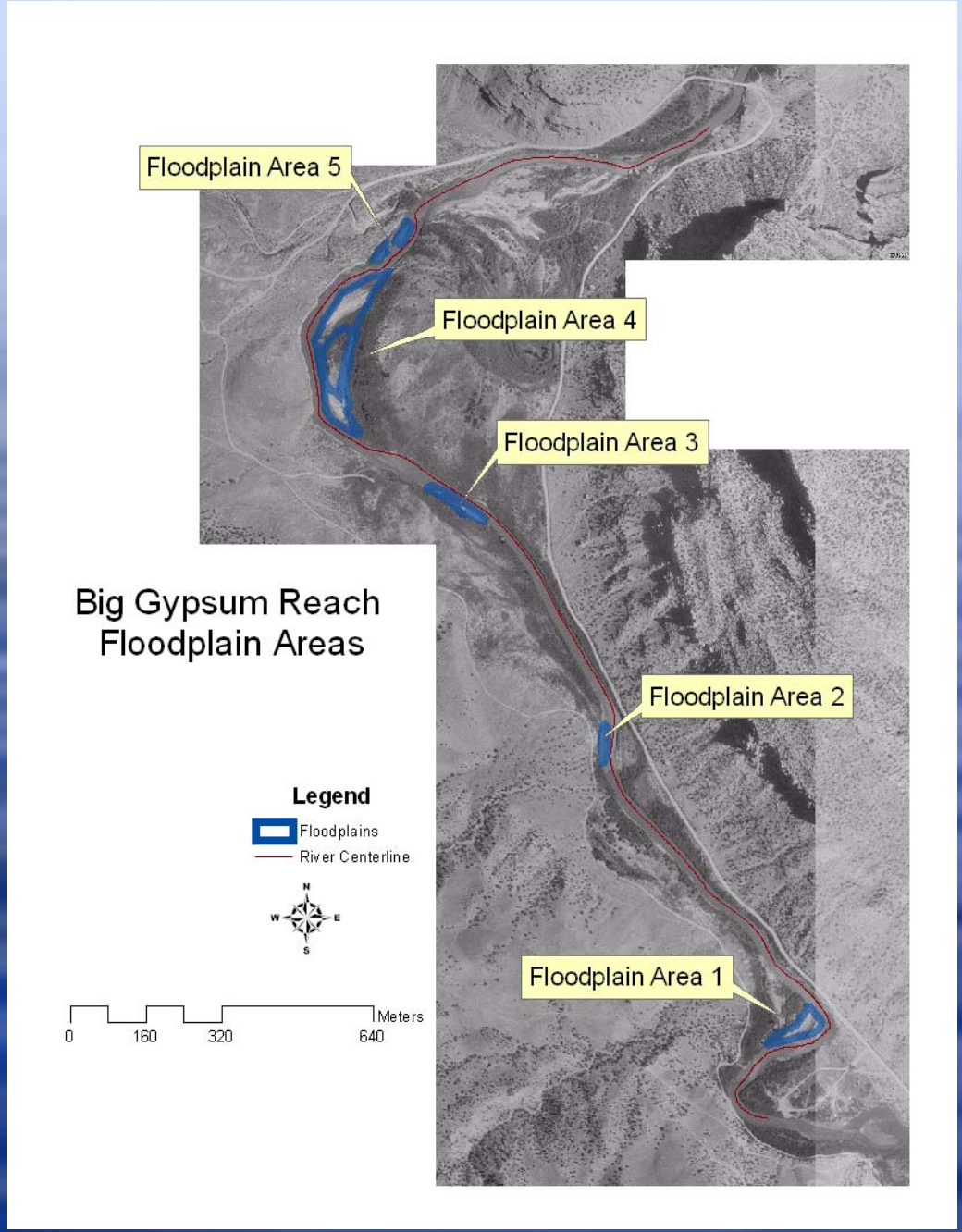
- Ability to absorb and utilize extremely saline water
- Deposit salty leaf litter on the soil surface
  - can create salinity levels that are toxic to native shrubs and trees

Big Gypsum Study: Goals

To establish baseline soil salinity data in the BGSA and monitor effects of the 2010 spill

To establish baseline hydrologic information in the BGSA, especially groundwater drawdown rates and soil moisture parameters

To establish permanent cross sections in the BGSA in order to monitor stream migration and channel formation

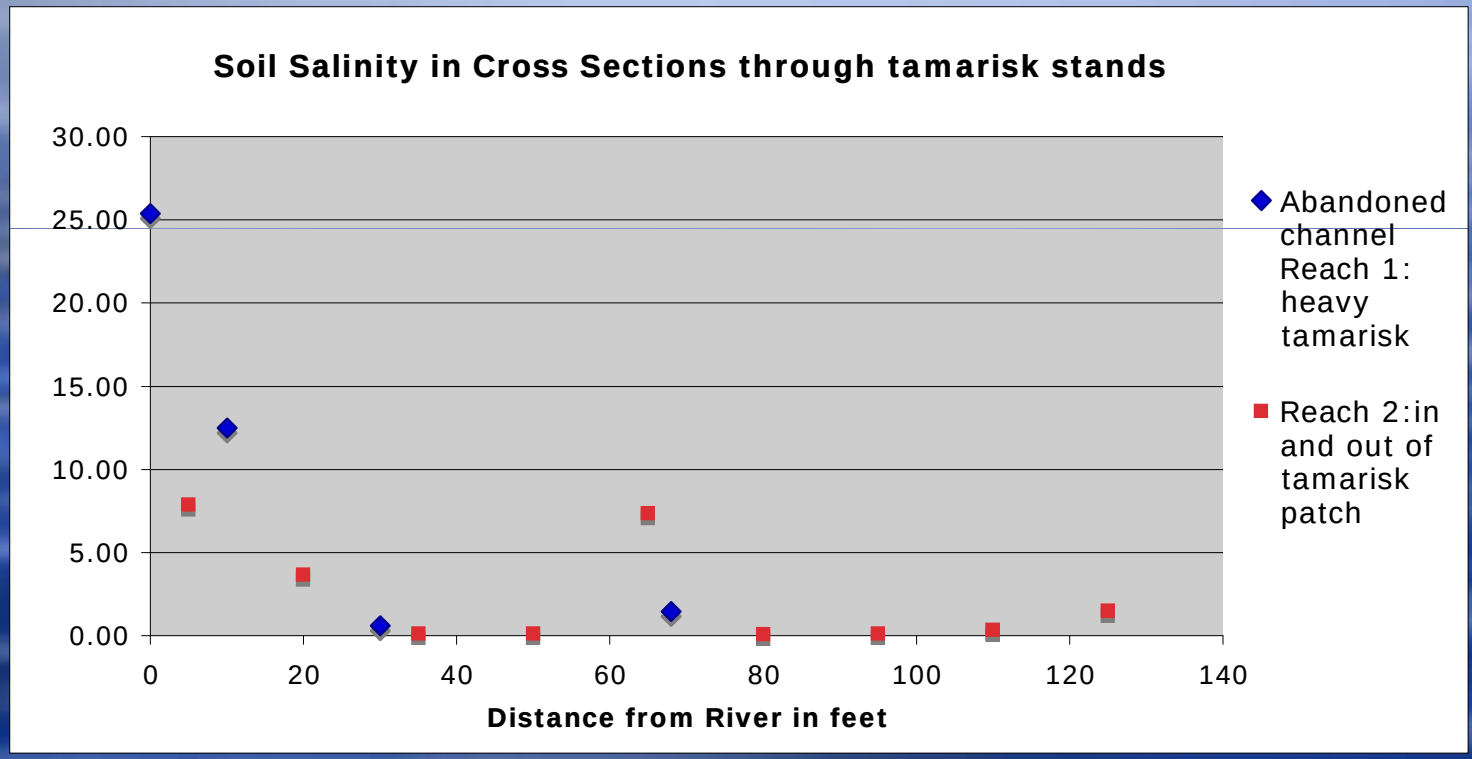


Gigi Richard

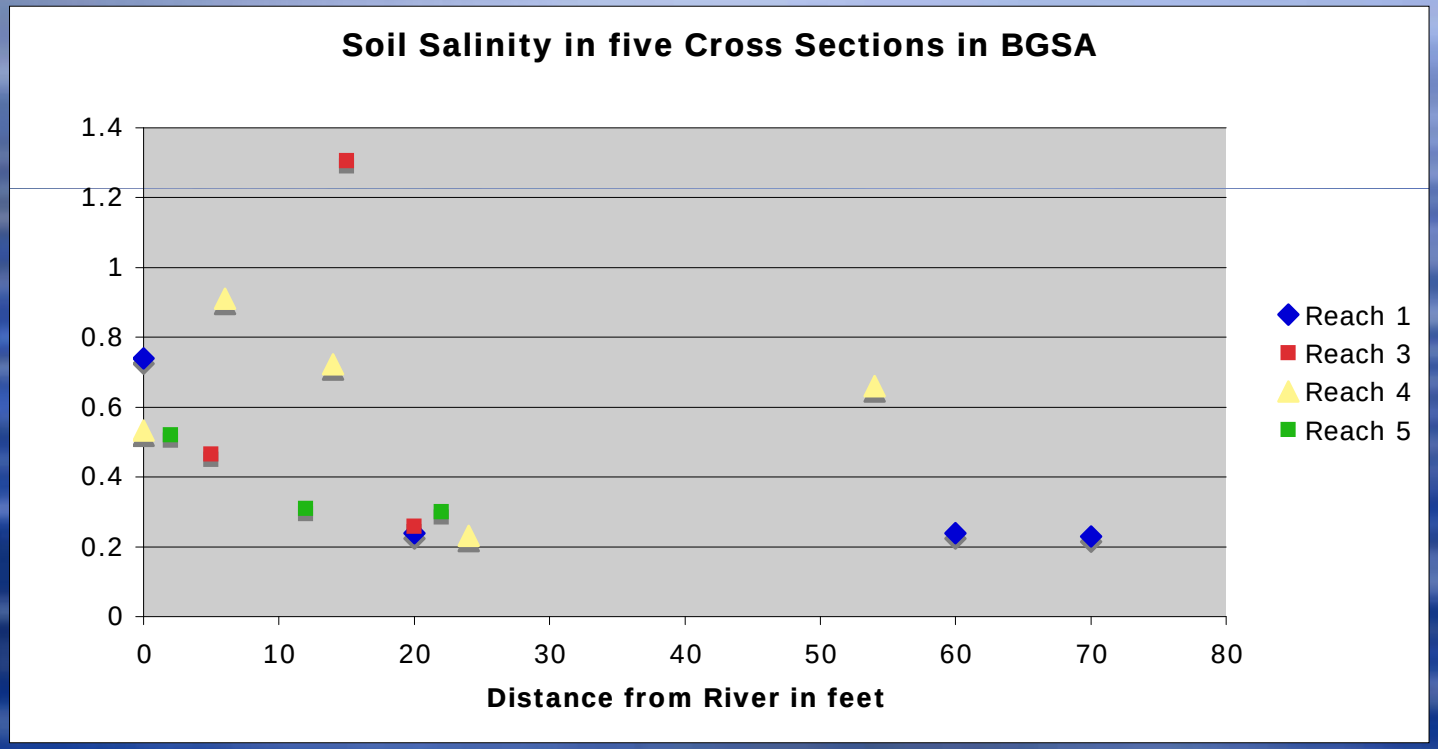
Soil salinity monitoring

- Measure soil salinity using a electric conductivity (EC) probe
  - EC units: mmhos/cm
- Sampling
  - three depths (0-2, 2-6, 6-10cm)
  - periodically along established XS's of varied composition

Preliminary Salinity Analysis



Preliminary Salinity Analysis



“Shifting Dominance of Riparian *Populus* and *Tamarix* along Gradients of Flow alteration in Western North American Rivers”

Merritt and Poff 2010

Merritt and Poff, 2010

- Project Goal: To better understand the relationships between flow regulation, tamarisk spread and cottonwood decline

- What'd they do?
  - regional analyses including 13 Southwestern rivers with different degrees of flow alterations.

  - quantified tamarisk and cottonwood recruitment and abundance

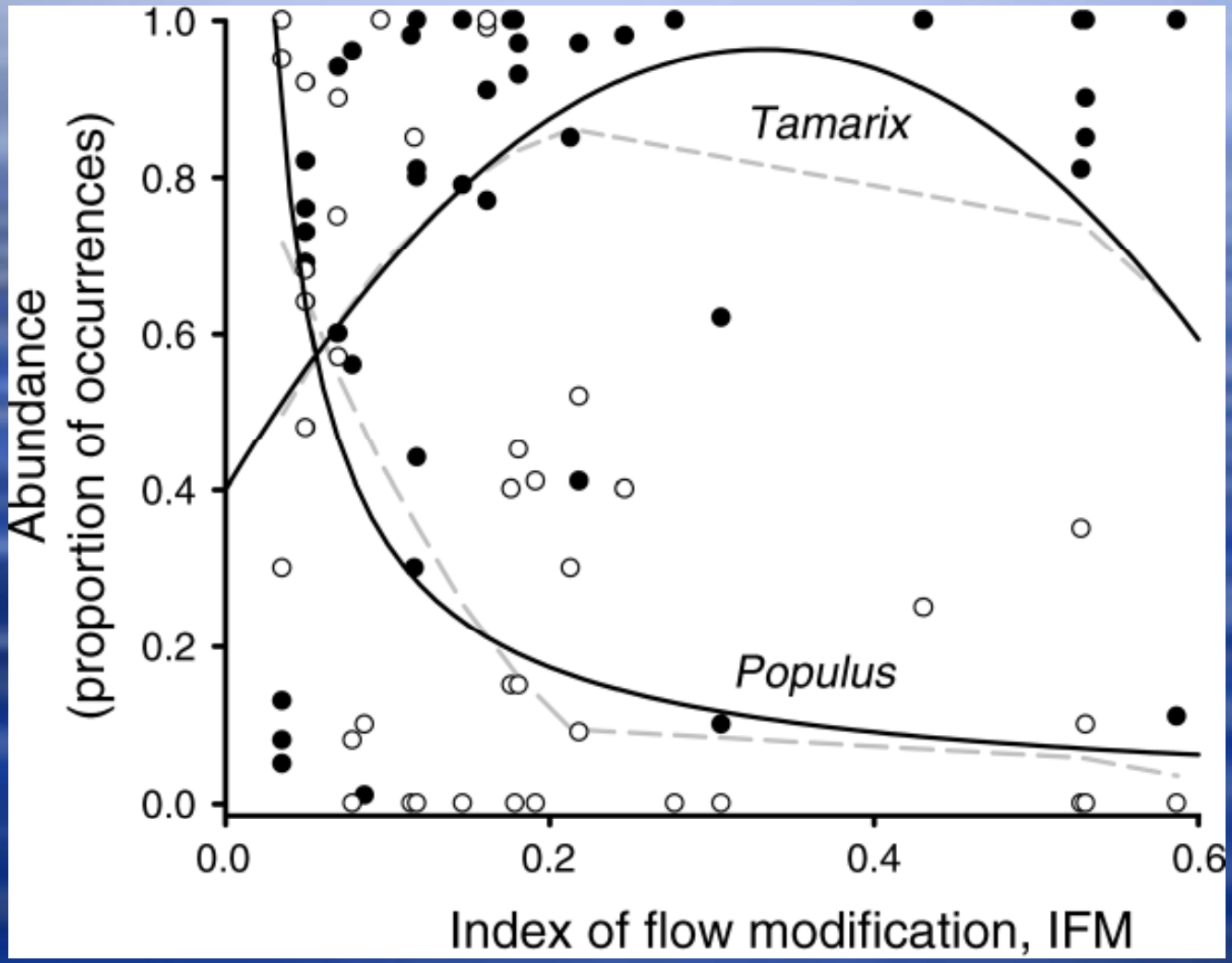
Index of Flow Modification (IFM)

- Eight variables considered to characterize alterations associated with river regulation--
  - Percent change between regulated and unregulated conditions
    - magnitude and frequency of high and low flows
      - spring
      - summer
      - low flow
    - peak flows of the 2-, 10-, and 25-year floods
    - timing variables
      - number of days minimum and maximum flows shifted
  - Calculated as a value between 0 and 1.0

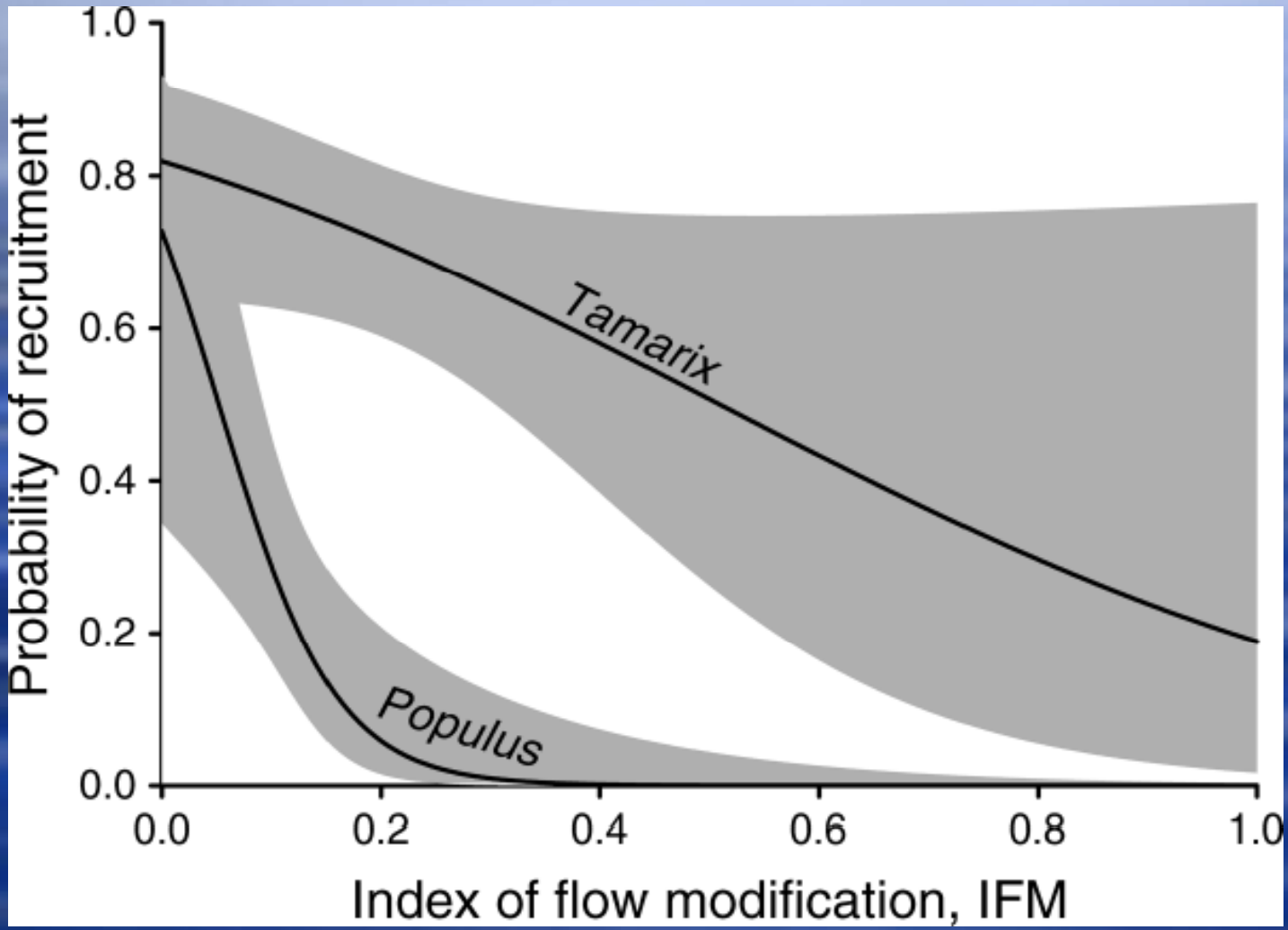
Flow modification index of included reaches

River	IFM
Yampa	0.04
San Miguel	0.07
Colorado	0.18
Gunnision	0.18
Dolores	0.21
Verde	0.22
San Juan	0.29
Truckee	0.31
Pecos	0.53
Little Corado	0.59
Bill Williams	0.99

Abundance of Tamarisk and Cottonwood as a function of IFM



Tamarisk and Cottonwood recruitment as a function of IFM



Next Steps

- Big Gypsum Study
  - post spill soil salinity
  - Install and monitor groundwater wells
  - Quantify cottonwood recruitment in 2010
  - Re-measure cross sections

- Continue to research relevant studies and monitor potential barriers to cottonwood forests and present those findings to the DRD


Thank You!
Suckla Family
Colorado Water Conservation Board
MVIC
Jim Siscoe
Science committee members