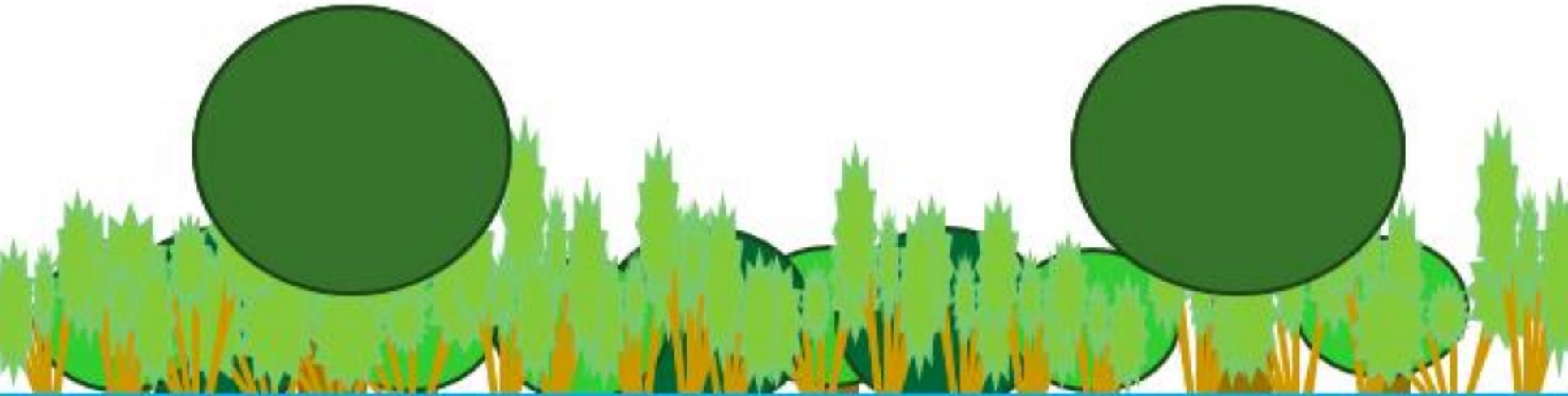


# Saltcedar Removal to Encourage Native Tree Establishment from Environmental Flows in the Colorado River Delta

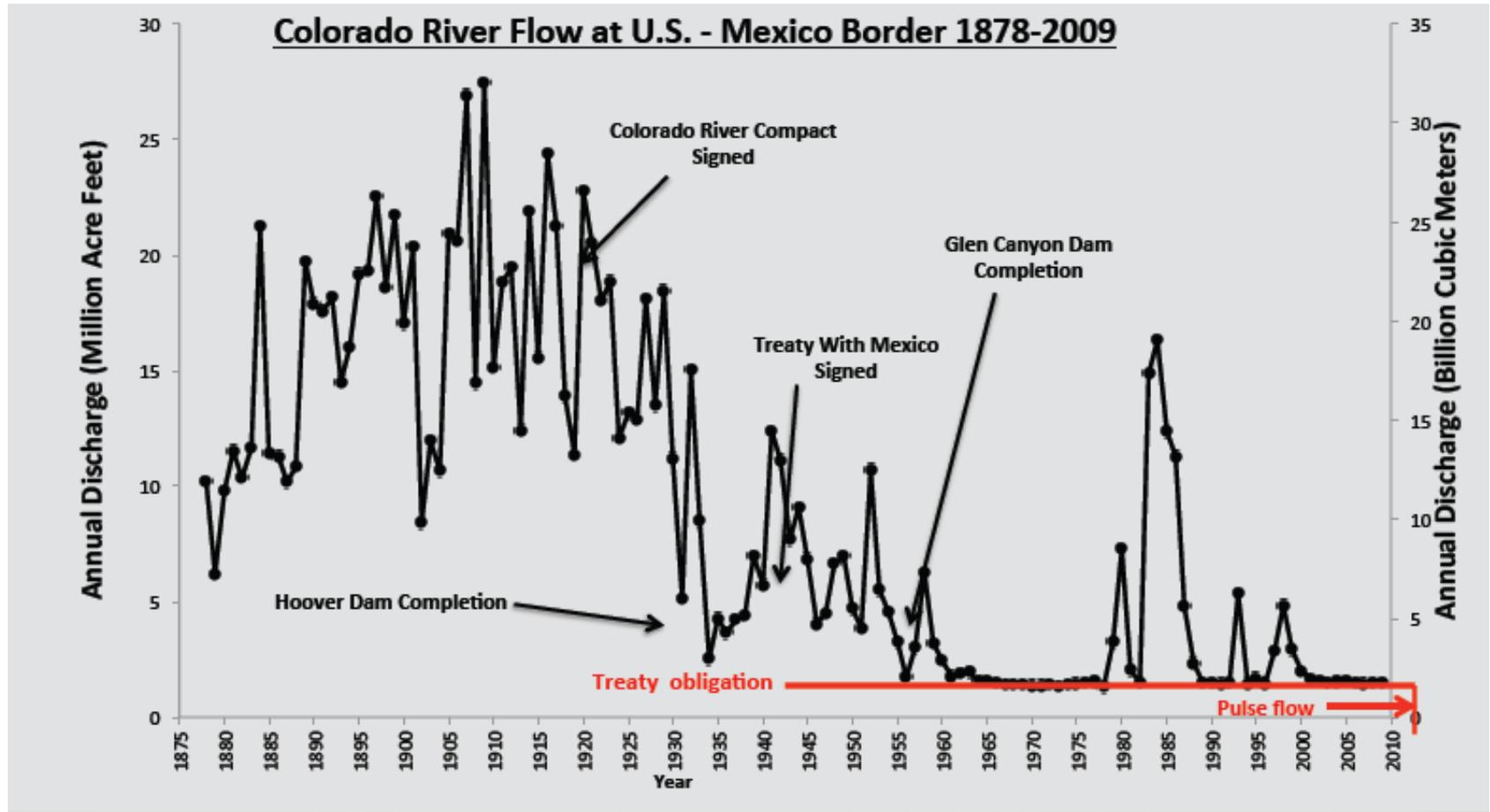
CRTR 2015

Matthew R. Grabau, Karen J. Schlatter, Chad  
McKenna, Miguel Sambrano, and Francisco Zamora

# Riparian Tree Establishment from Large Floods

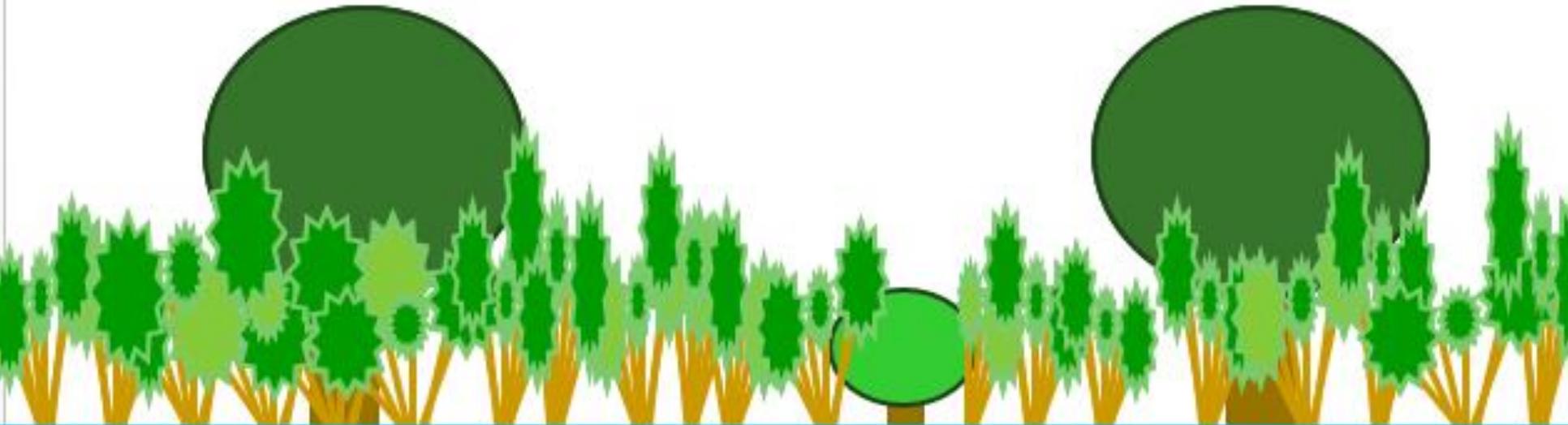


# Scale of Minute 319 Pulse Flow



Peak flow of 120 CMS/4,200 CFS

# Reach 4 Pulse Flow Response



Apr 9, 2013



# “Artificial Scour” Feb 17, 2014



Also, Several Recent Wildfires

# Pulse Flow (Image 5/28/2014)



feet |—————| 4000  
km |—————| 1



# Base Flow



# Revegetation Techniques

- Clearing and grading:
  - Allow natural seedfall in areas where seed source trees are nearby.
- Clearing plus hydroseeding:
  - Increase seed density.
  - First trial of bankline cottonwood-willow hydroseeding.
  - Small trial plots only.

# Pulse Flow at Laguna Grande



April 9, 2014

May 17, 2014



April 21, 2014

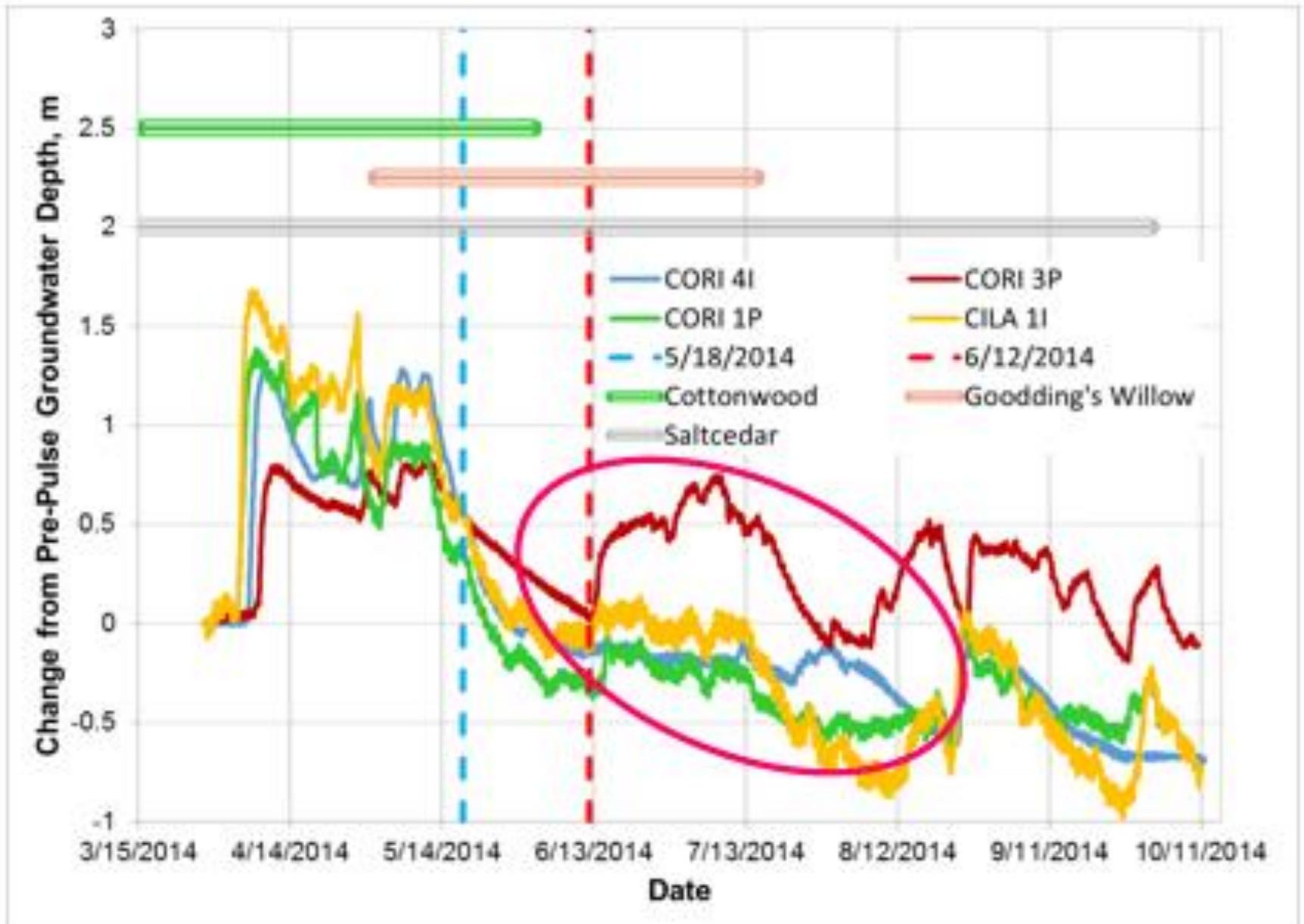
CORI-1P



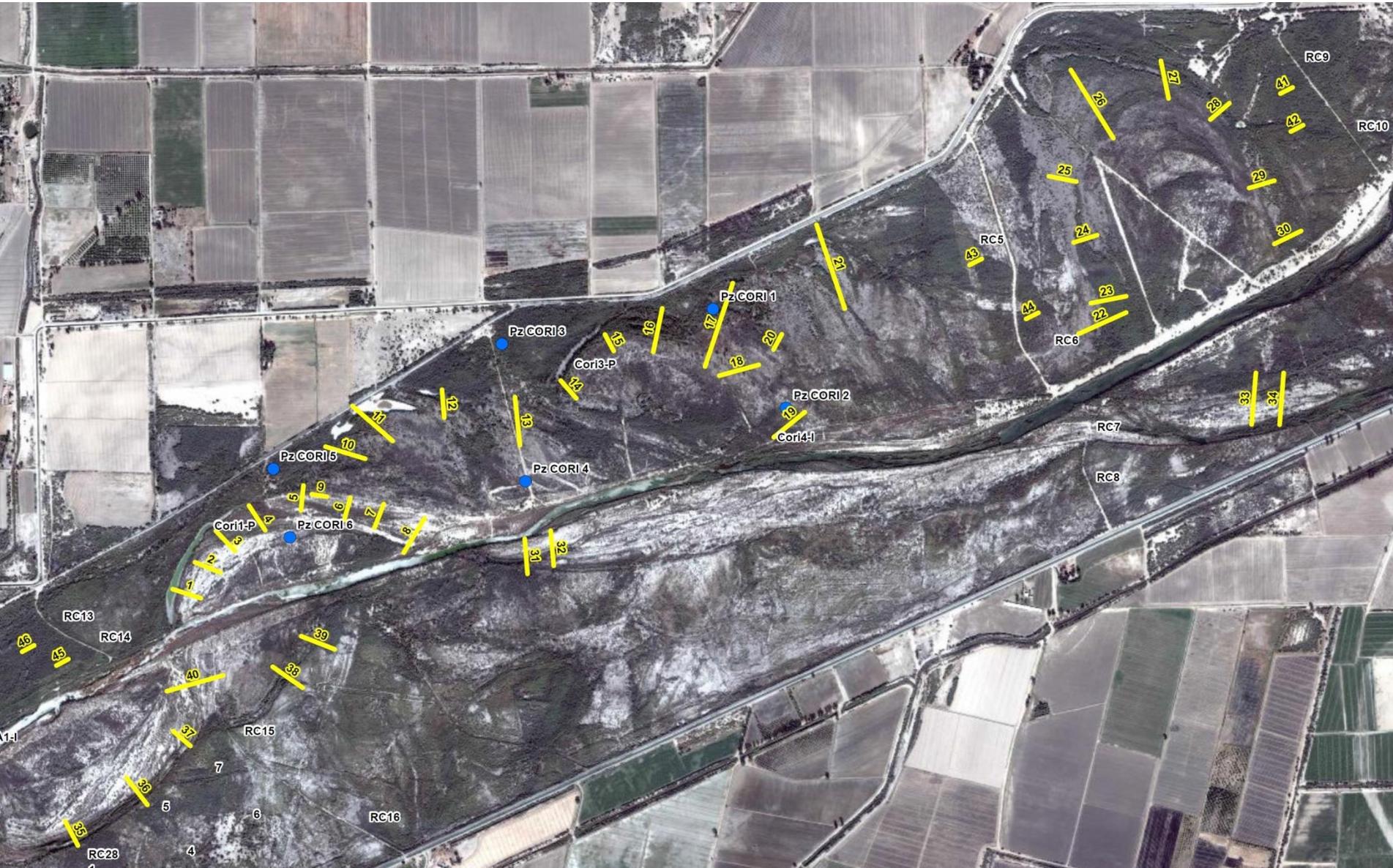
# Pulse and Base Flow Response Monitoring at Laguna Grande

- Pre- and post-pulse salinity mapping.
- Piezometers and soil moisture sensors at select locations.
- Post-pulse vegetation monitoring transects—  
August and October, 2014.

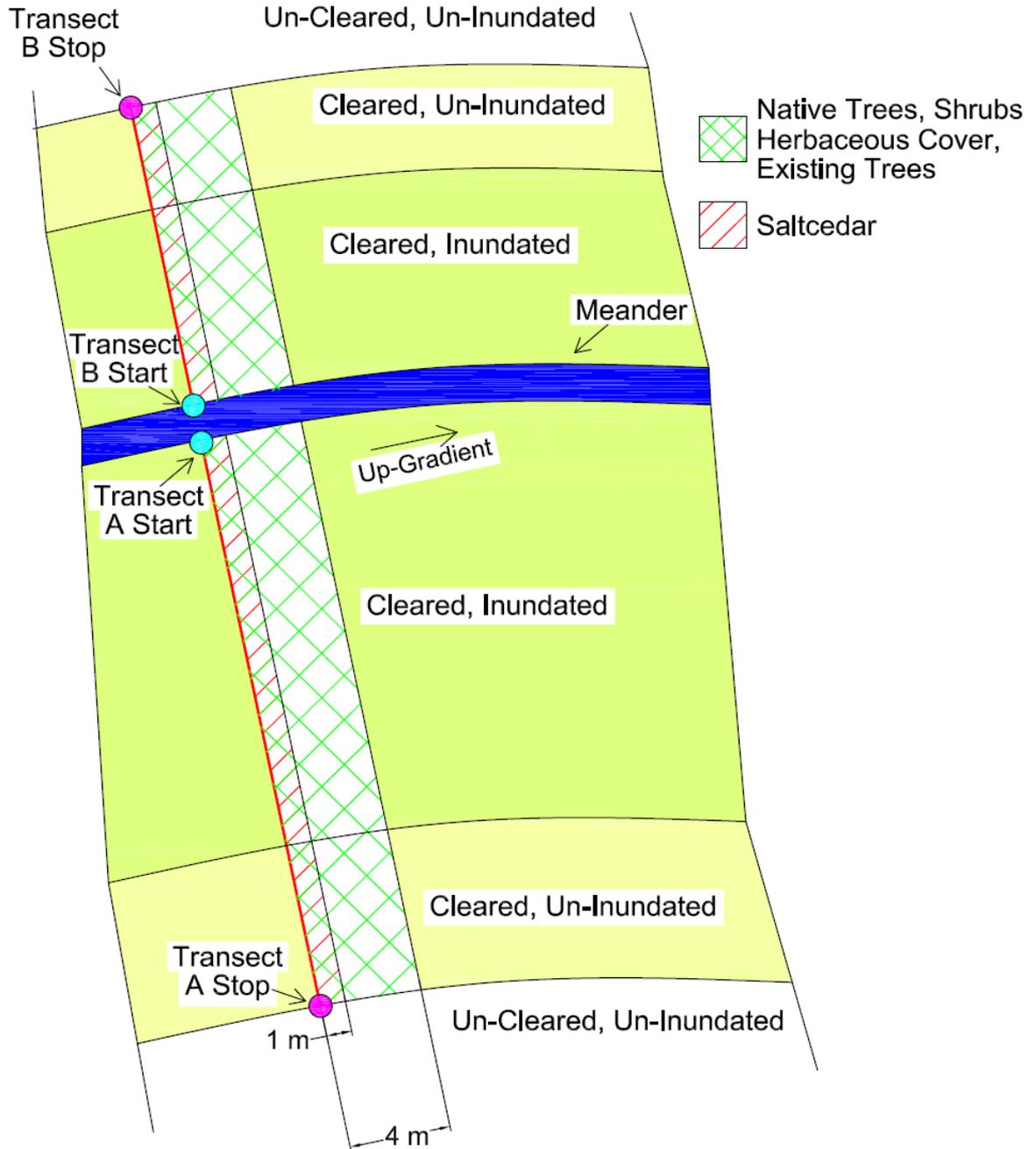
# Groundwater Response at Laguna Grande



# Belt Transect Distribution



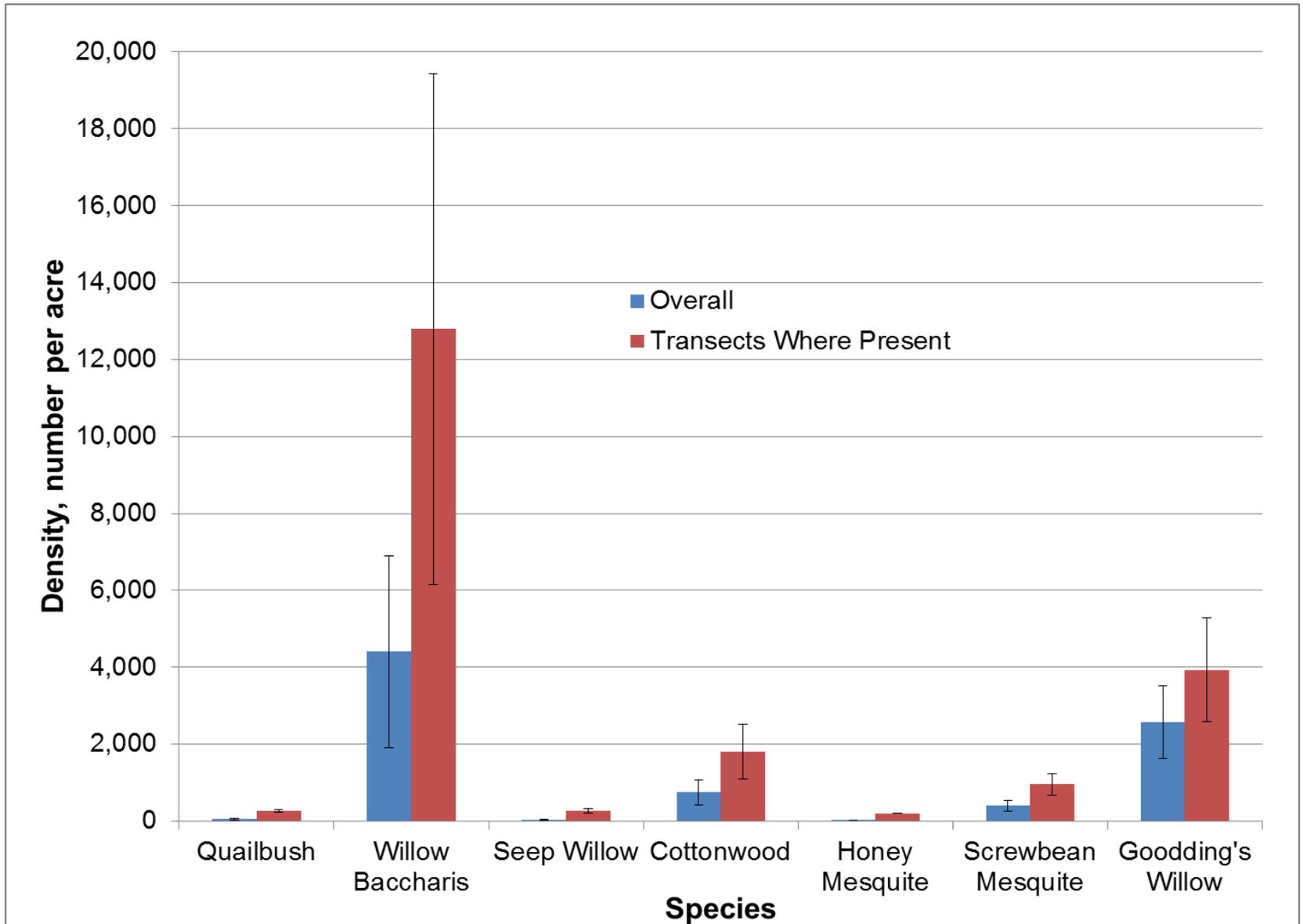
# Belt Transect Monitoring



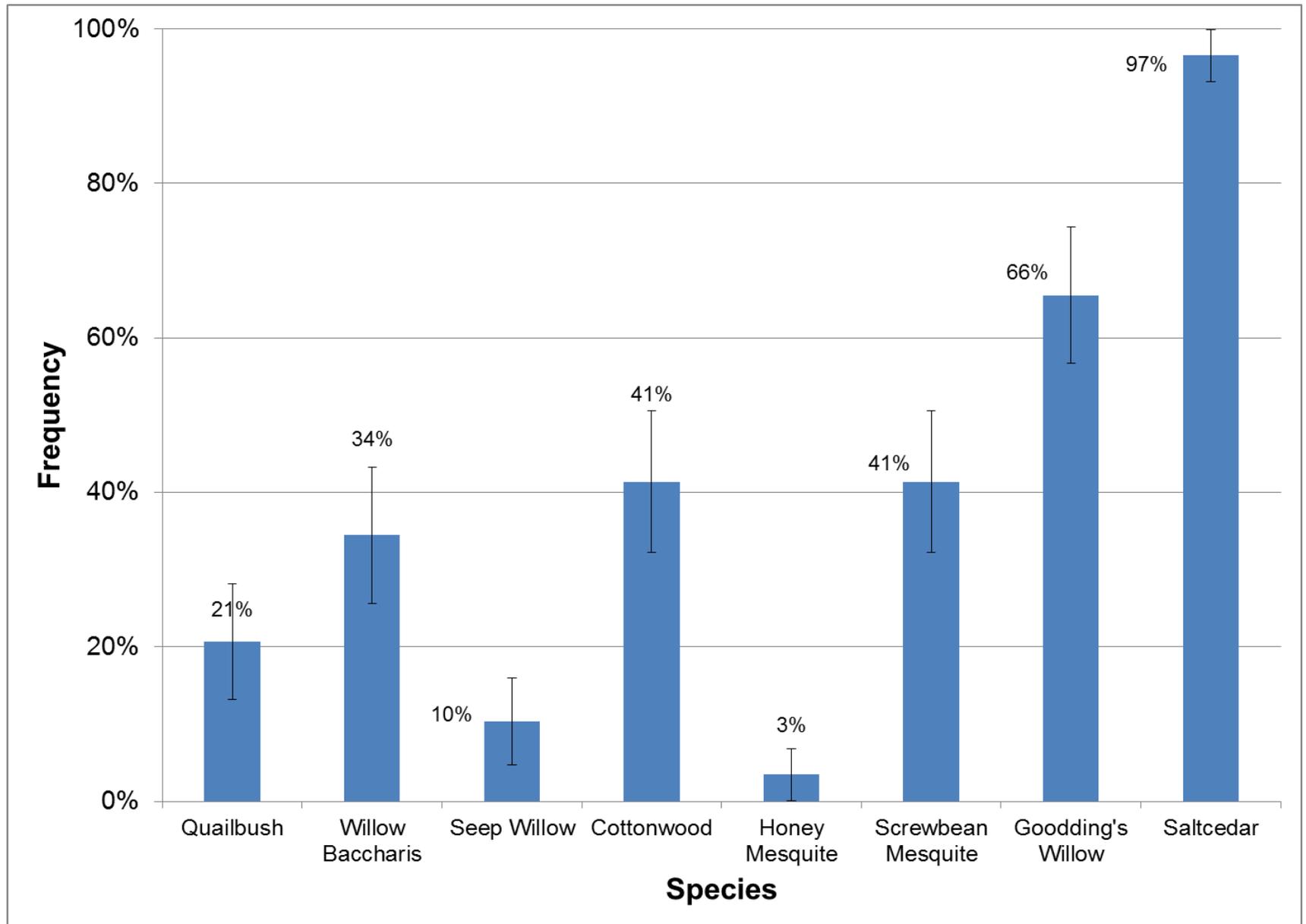
# Seedling Transect Results

*August 2014*

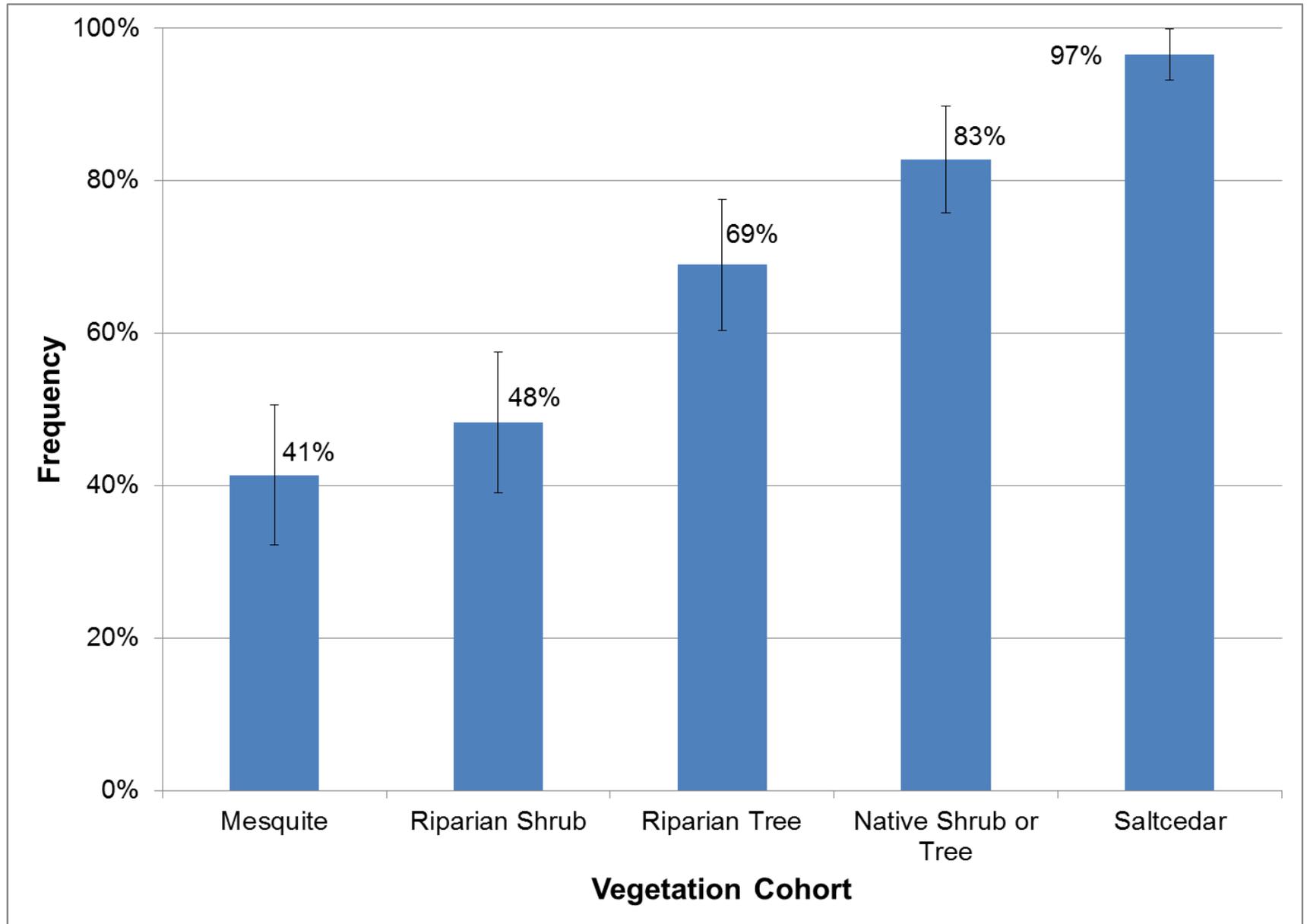
# August Results: Native Tree and Shrub Density



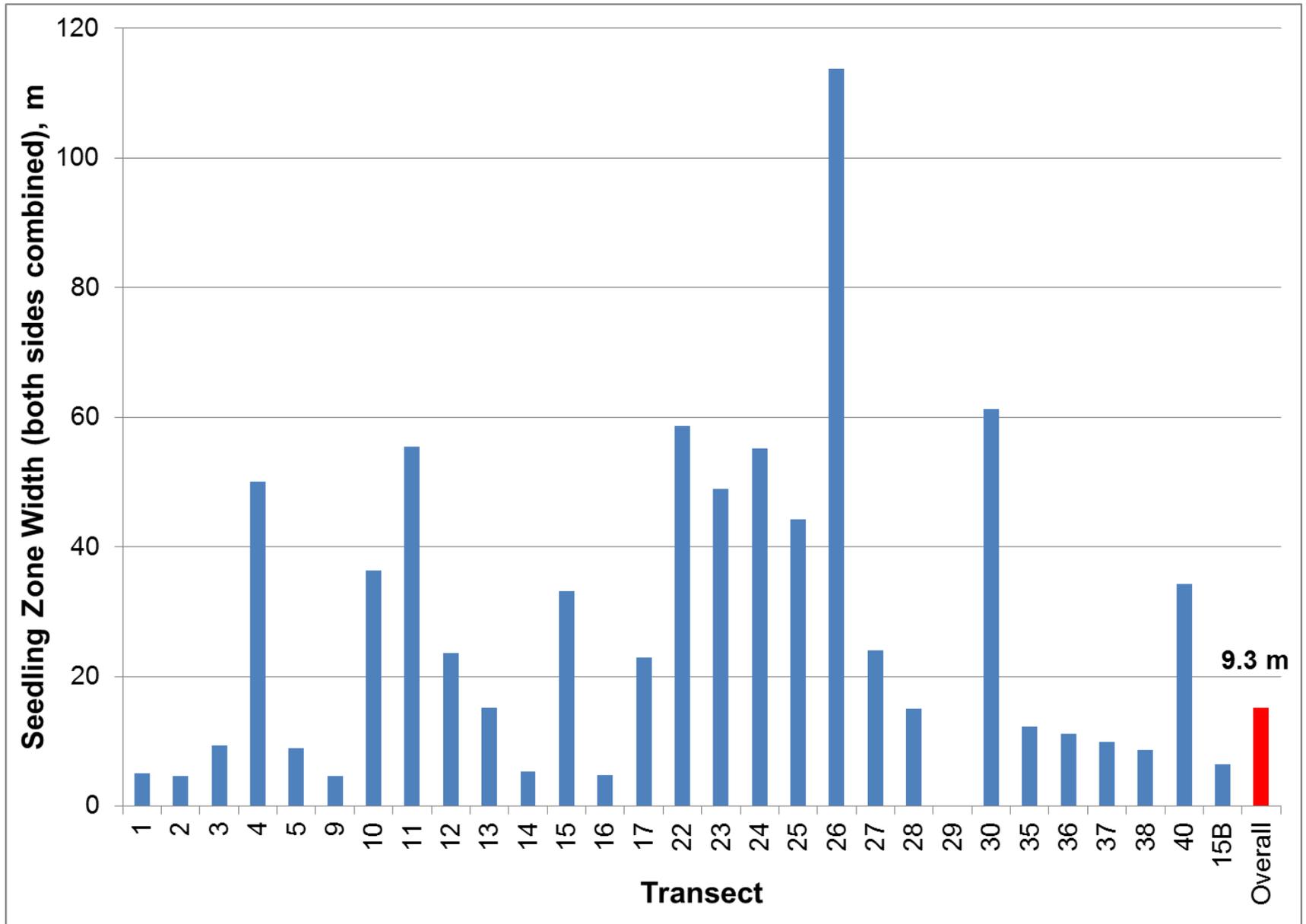
# Results: Species Frequency



# Results: Tree and Shrub Cohort Frequency



# Breadth of Seedling Establishment



Aug 19, 2014



Aug 21, 2014





**Legend**

Density (trees per acre)

1 - 500	2,000 - 5,000
500 - 2,000	>5,000
0	

500 250 0 500 Meters



Feb 18, 2014



10/13/2015



Oct 13, 2014 (Hydroseed Area)



# Key Results and Lessons Learned

- Clearing of vegetation before the pulse flow promoted seedling establishment.
- Bankline sloping increased the breadth of establishment.
- Seedlings established even in very saline soils.
- Management of water levels is critical after the initial flow.
  - Rate of decline.
  - Preventing secondary inundation.

# Continued Analysis

- October 2014 monitoring data analysis (includes “control” transects).
- 2015 surveys to determine overwinter survival.
- Salinity effects on establishment.

# 2015 Restoration Approach

- Little additional passive establishment expected.
- Additional active restoration where establishment was poor.
- Use October 2014 salinity mapping, groundwater levels, and soil texture to guide design.

Oct 13, 2014

## ■ Acknowledgments:

- Sonoran Institute Field Staff
- Michelle Ferman