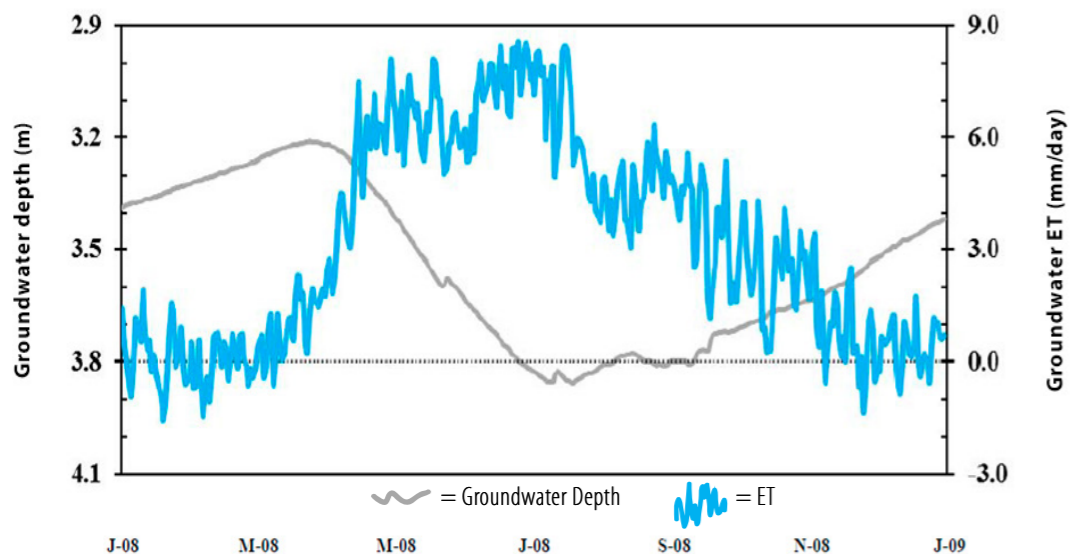


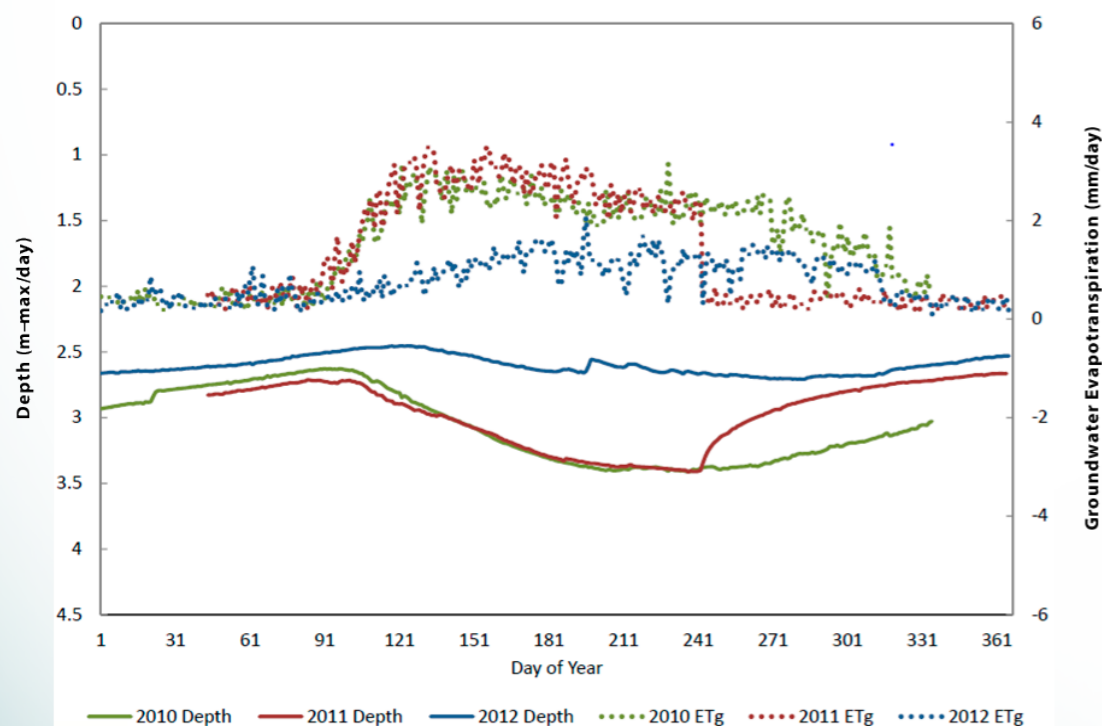
## ASSESSING THE POTENTIAL IMPACT OF INVASIVE SPECIES WATER USE ON THE LOWER COLORADO RIVER

Baseline: Bowen Ratio at Slitherin



Source: Utah State University

Results: Fourier-White Method at Diablo Tower Well



Source: Utah State University

Note: Specific Yield = 0.09

### Results

Study of ET using three different methods

- Consistent results among methods
- Consistent behavior between sites pre- and post fire
- Diablo site (farther from river) lower ET
- Remote sensing of ET with ground truthing can work for large areas

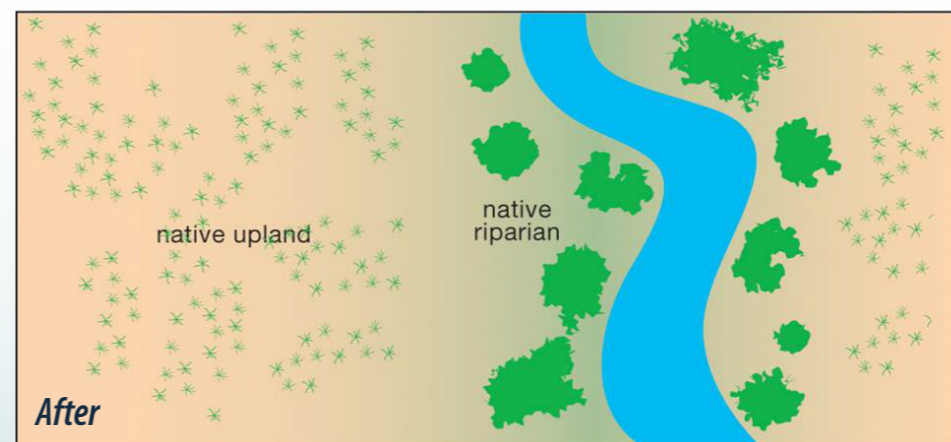
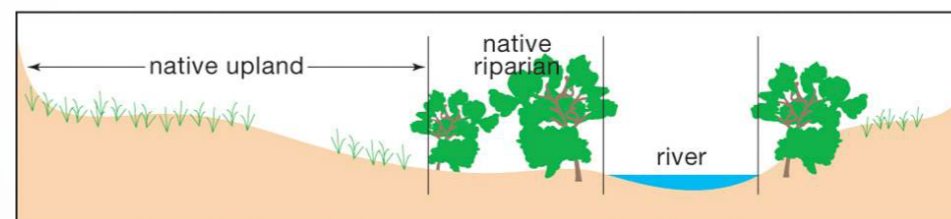
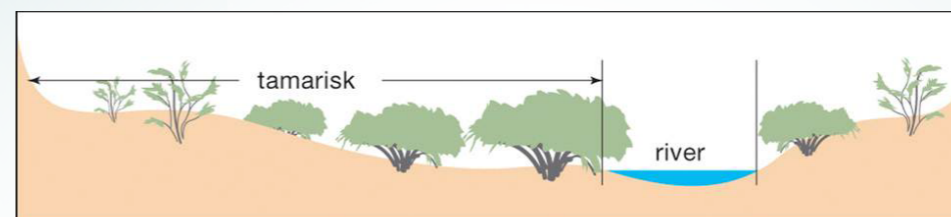
Basin States Question: Did groundwater respond?

- As ET decreased, groundwater rose
- Groundwater recovered to winter level within 60 days
- 2013 (2nd year post-fire) groundwater extraction also lower
- Diablo site (farther from river)
  - Higher pre-fire groundwater flux
  - Greater post-fire groundwater recovery

### Conclusions and Next Steps

- Need to factor in river stage
- Unaware of another study that demonstrates this connection
- Good site and extreme event was beneficial
- Sets the stage for future water balance work that would quantify the amount made available to system
- Discussing possible year two work

### Water Savings Approach



Source: Colorado River Basin Tamarisk Assessment

### Guidance from Colorado River Basin Tamarisk Assessment, December 2009

- Can water be saved by managing Tamarisk? –Yes
- Is controlling Tamarisk to save water cost-effective? –Yes
- Can saved water be recovered, i.e. will it appear in the river? –Not enough data

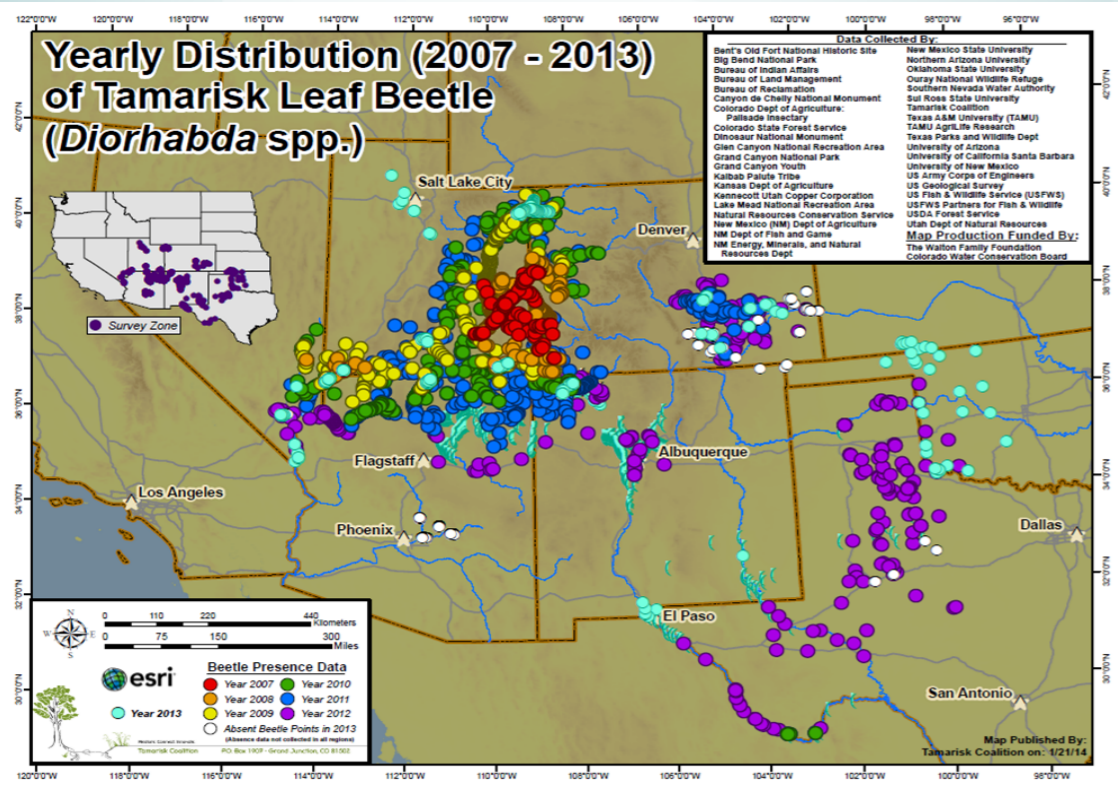


Source: Tamarisk Coalition

### Findings

- Basis for further expenditures to begin demonstration project
- Savings from ET reduction
  - 1 AF per 1.85 acre managed (.54 AF/acre)
- Cost per AF
  - 6 of 7 methods <\$400/AF
- Water will be saved, amount which might appear in river cannot be predicted
- **Next step – Study at Cibola National Wildlife Refuge**

**Migration of *Diorhabda* spp.**



Source: Tamarisk Coalition



Source: Tamarisk Coalition

**Study of Evapotranspiration at the Cibola NWR – Revised**

- Basin States Question - Does groundwater respond to massive change in ET of surface vegetation?
- Baseline well and ET data
- The fire is a proxy for the anticipated beetle migration
- Consideration of river stage
- Water balance for the area

**Instrumentation – Slitherin Site**



Source: Utah State University



**Study of Evapotranspiration (ET) using three different methods “Proof of Concept”**

- USBR collecting baseline data since 2006
  - Three sites at Cibola National Wildlife Refuge
- Objective
  - Identify a signal in changed conditions

**Study of Evapotranspiration at the Cibola NWR**

- Background
  - Basin States Assessment
  - Migration of *Diorhabda* spp.
  - Contribute funds to ongoing academic study of ET fluxes over tamarisk forest
  - Baseline data
- **August 2011 fire in the Island Unit**

**Study Area**



Source: Utah State University

**Study Tasks**

- Spatial ET
  - Aerial / remote sensing, energy balance
- ET and water consumption estimates
  - Flux towers, monitoring wells, water quality
  - Products and deliverables

**Methods & Tools**

- Eddy covariance and Bowen ratio
- Scintillometer
- Airborne multispectral/thermal IR system
- LANDSAT 5
- LiDAR
- MODTRAN algorithm
- Two-source energy balance model
- SEBAL
- Model of groundwater