Tamarisk Biocontrol and Habitat Recovery

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Biocontrol Isn’t New: Routine in agricultural/dispersed production systems

e.g. Leafy spurge in Montana – Before/after *Aphthona* release

Biocontrol in Ecosystem Conservation

New Goals

- Suppress abundance/impact of invasive species in natural ecosystems
- Promote conservation and recovery of native vegetation and wildlife
- Restore ecosystem functioning

New clients & critics

- Wildlife/natural resource agencies
- Environmental organizations, etc.

Tamarisk biocontrol program hindered by many controversies

- Appearance of being TOO successful
- Speculative fears of consequences
- Possible non-target effects
- Demand for information before implementation

Controversy driven by Zero-Risk mentality rather than Risk-Benefit assessment

Concerns of Successful *Tamarix* Biocontrol: Single Species - SW Willow Flycatcher

- Biocontrol removes target too fast for native regeneration?
- Habitat too degraded for natives?
- Beetles may be toxic?

Empidonax traillii extimus

Approx. 1% of No. American *Tamarix* distribution is occupied by SWWF

Questions with *Tamarix* Biocontrol

- Does biocontrol with *Diorhabda* cause major mortality & removal of *Tamarix*?
- Can, or should, recovery of native vegetation be accelerated to replace it (restoration)?
- Will biocontrol simulation and response provide useful information for restoration?

Is Tamarisk Biocontrol Too Successful?

Good establishment at sites in Nevada, Colorado, Utah, Wyoming & Texas

Dramatic results announced by popular and USDA media

Humboldt Basin

Open release 2001

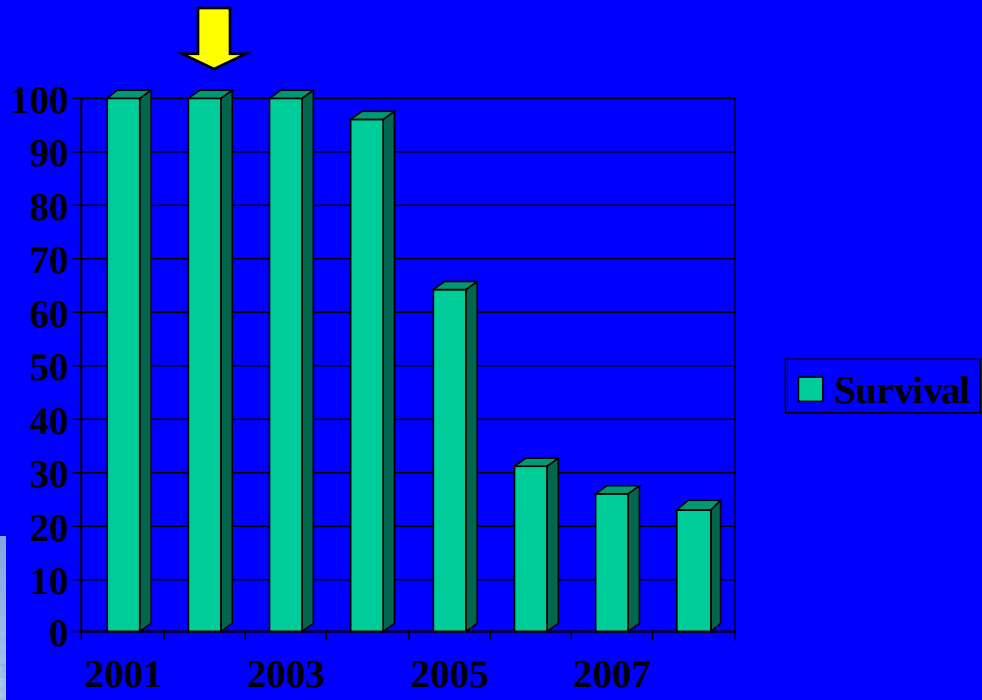
D. elongata carinulata
from China

Humboldt Defoliation

2003: 2 ha. expands to 200 ha.

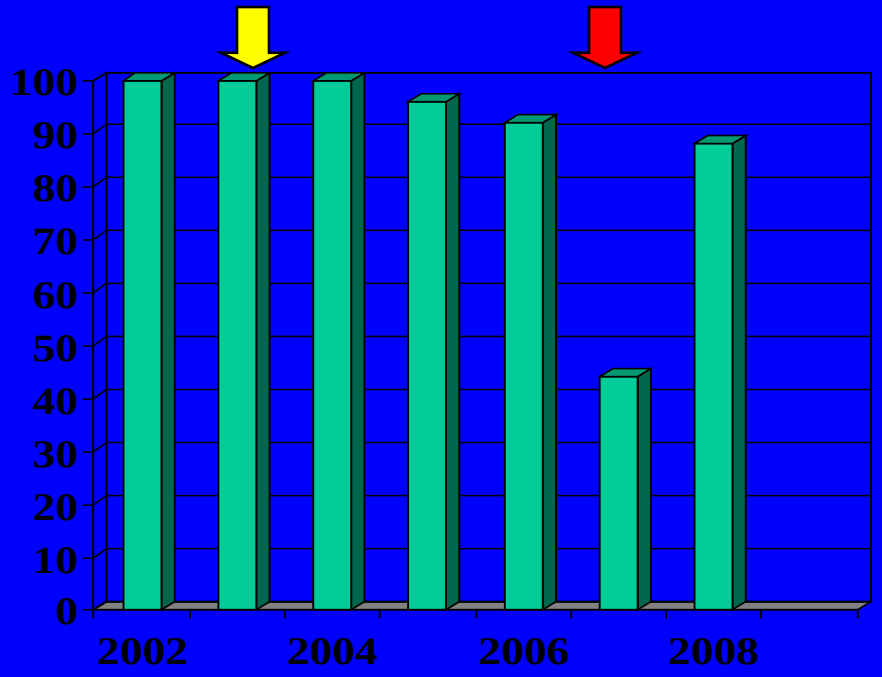
2004: >10,000 ha. expansion

Dieback and Mortality at Release Site



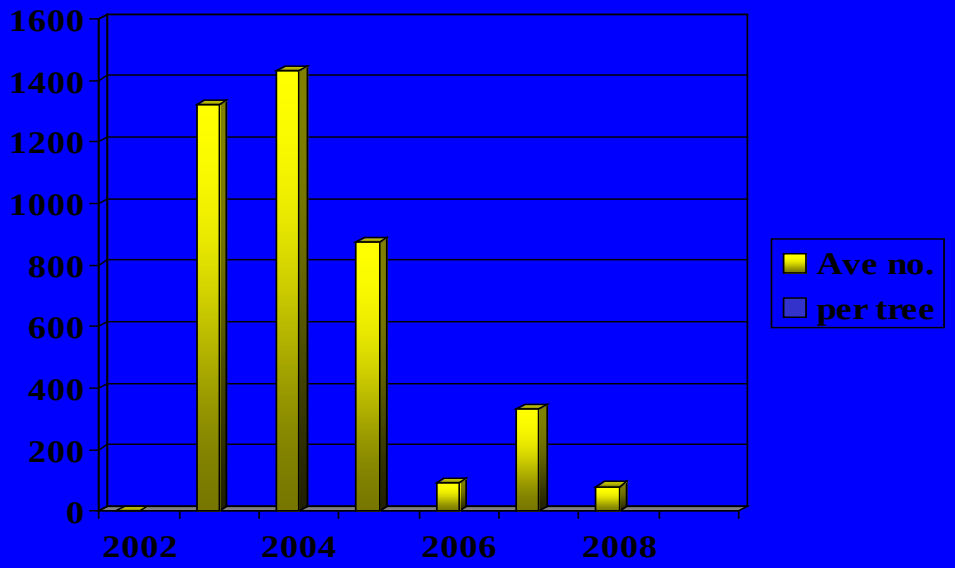
Approximately 75% *Tamarix* mortality at Ground Zero

Tamarix Mortality – 1.5 km distant



Apparent mortality mostly related to fire during winter

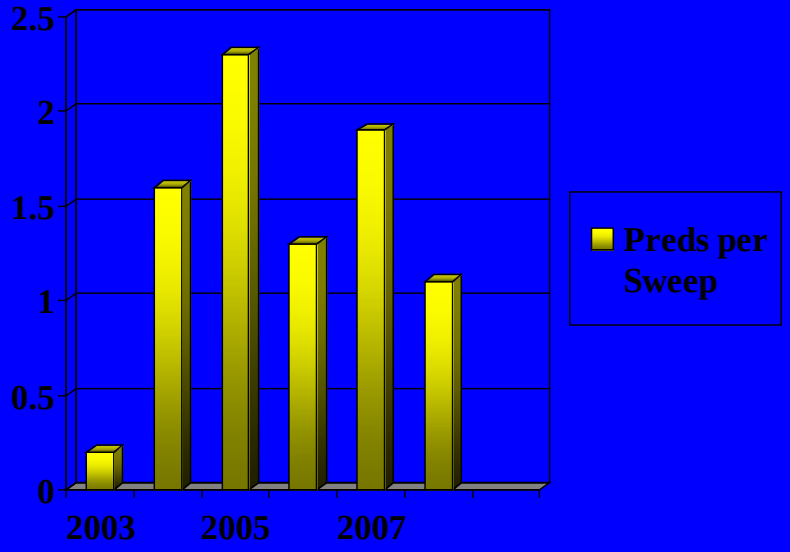
Diorhabda population declines by 2006



Mortality: Floods inhibit pupation

Higher Trophic Level Response

Predators per Sweep Sample

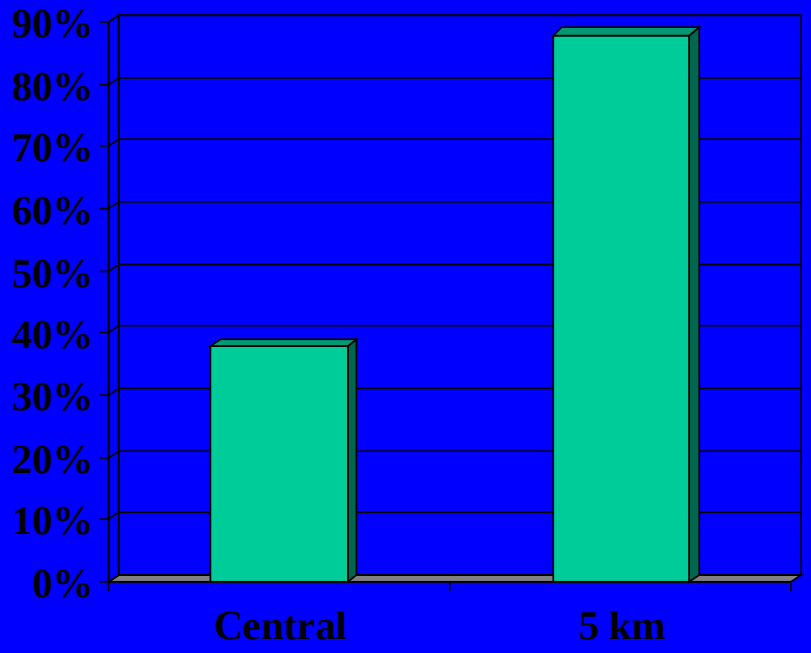


Early Success may primarily be related to low predation impact

Tamarix Mortality – 4 km distant

Mortality low - lesser re-defoliation from surrounding area

Delta, UT Research Site

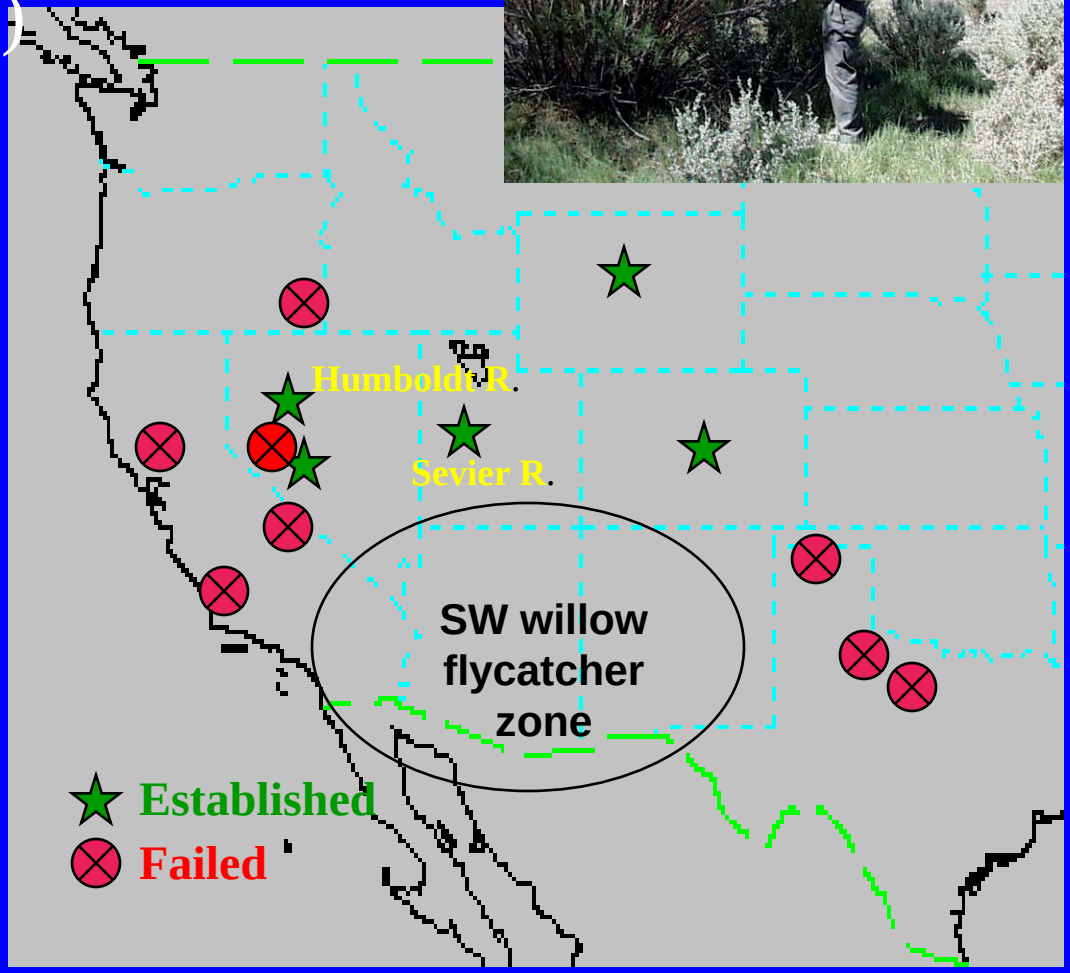


Released 2001
Established 2003
Sampled 2007

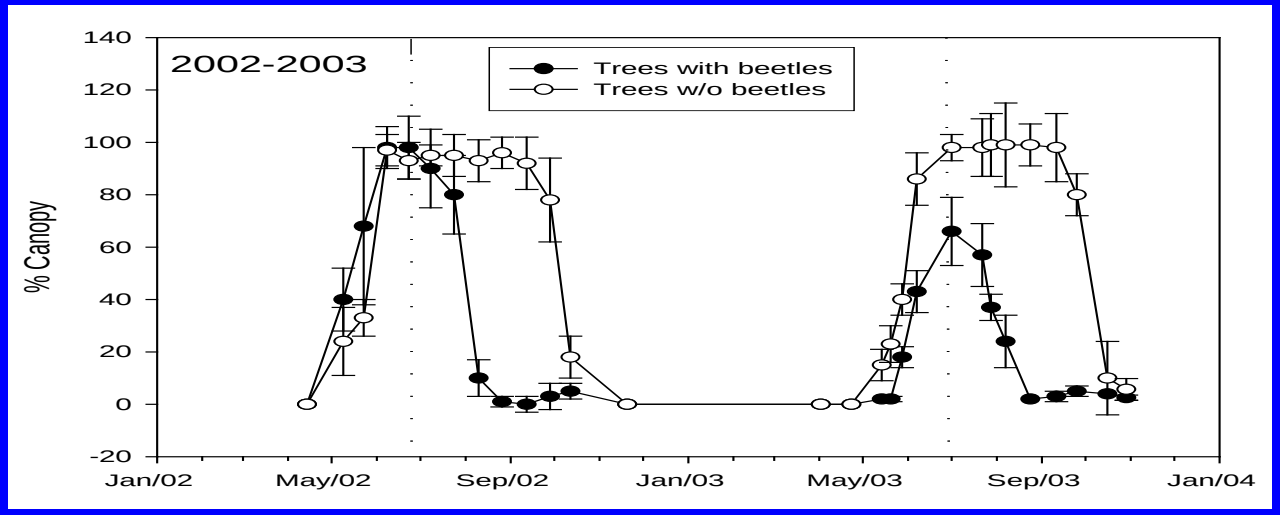
Most releases fail – several causes:

1. Developmental mismatching - latitude/ daylength response
2. Predation (**ants**, arachnids, hemipterans, birds, etc.)
3. Insufficient host plant abundance
4. Unsuitable host species

>50% of Implementation releases also fail

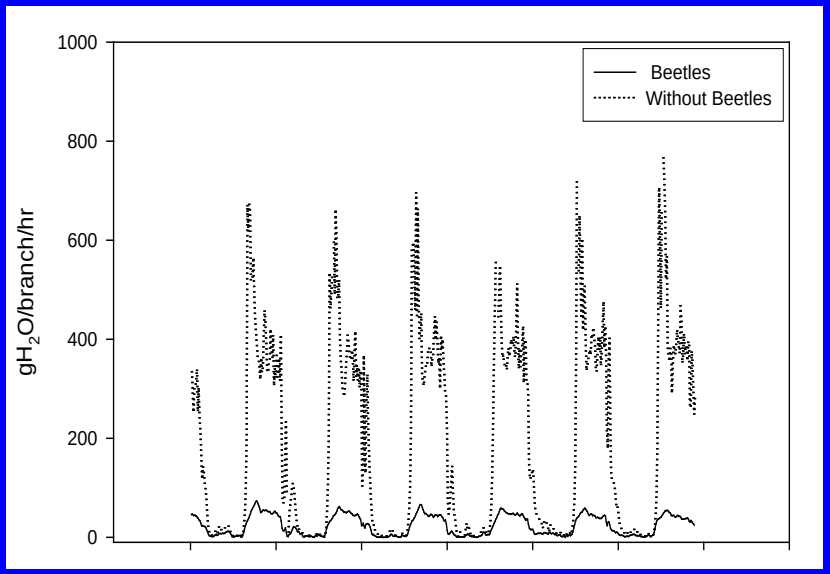


Establishment isn't Easy & Establishment ≠ Eradication



Still Benefits of Biocontrol

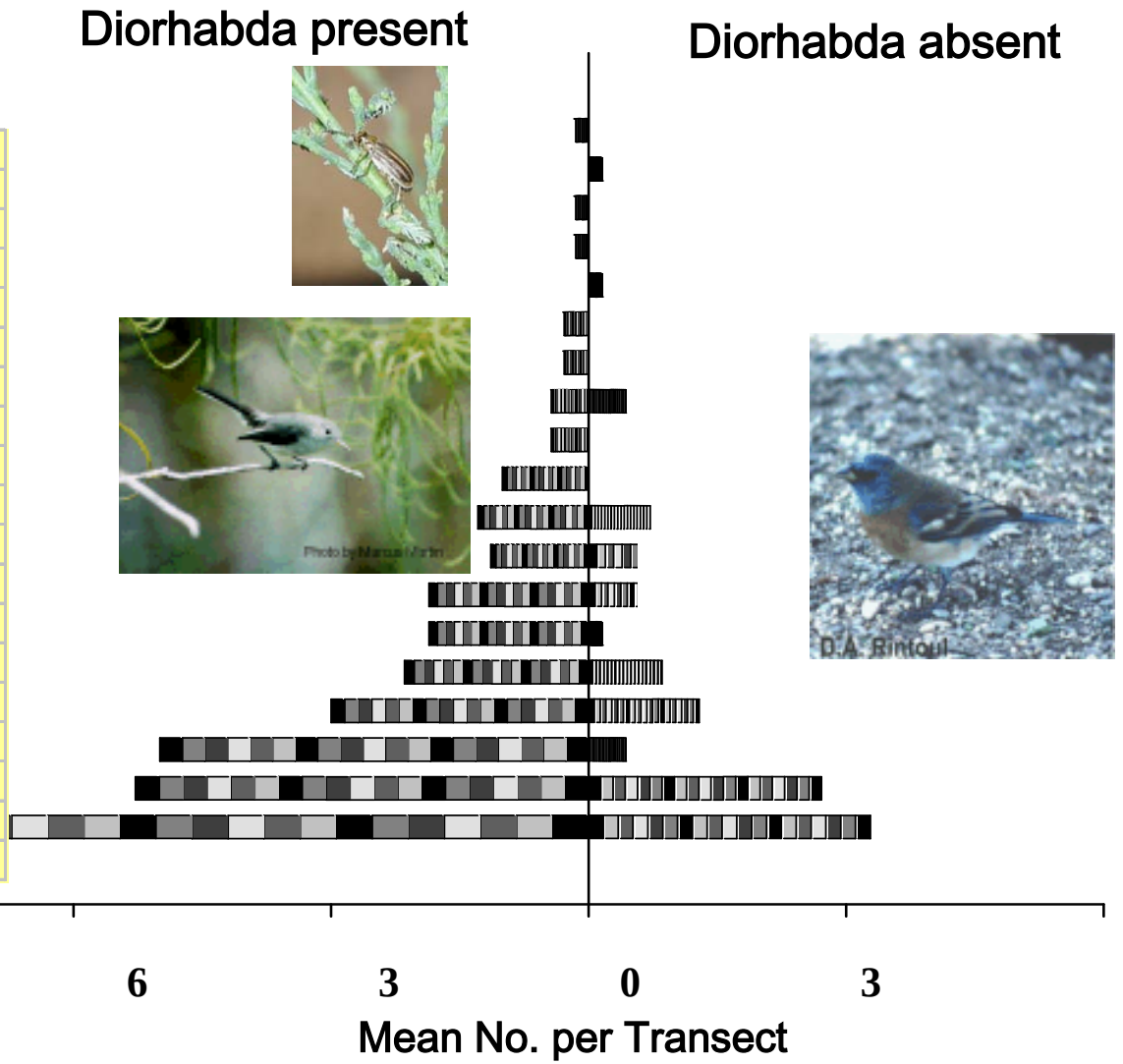
Canopy % cover decline



Seasonal Evapotranspiration

Water loss reduced ca. 65% in Yr 1, >90% Yr 2 (Pattison et al.)

Birds and *Diorhabda* in *Tamarix* (Hitchcock et al.)



Status of *Tamarix* BioControl

- *D. elongata* can suppress *T. ramosissima* growth and population size
- Initial Epidemic impacts dramatic -- Endemic impacts moderate as ecological factors regulate *Diorhabda* populations
- 'Economic' control may not be common and massive mortality unlikely -- may require other agents (Research phase NOT done)

But, Restoration may still be useful in some locations with inadequate native vegetation

Simulated Defoliation – Test Responses Prior to *Diorhabda* Establishment

Study site: Virgin River (Utah/Ariz/Nev)

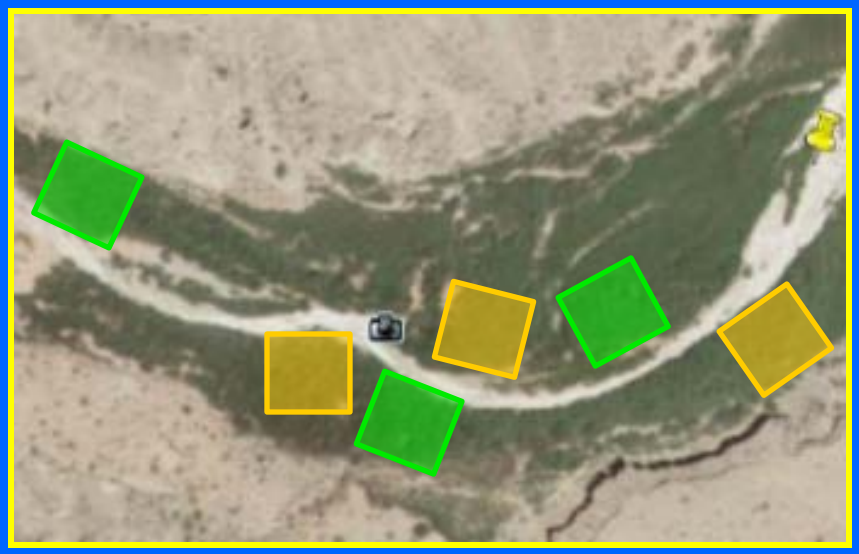
Simulated Defoliation: Clark Co. MS-HCP

Low-dose herbicide to cause defoliation w/out foliage loss or mortality

Proposed for Summer 2006 – Prior to Release

Delayed to Fall 2008 (by FWS project approval, & Concurrence to spray 0.1 acre patches)

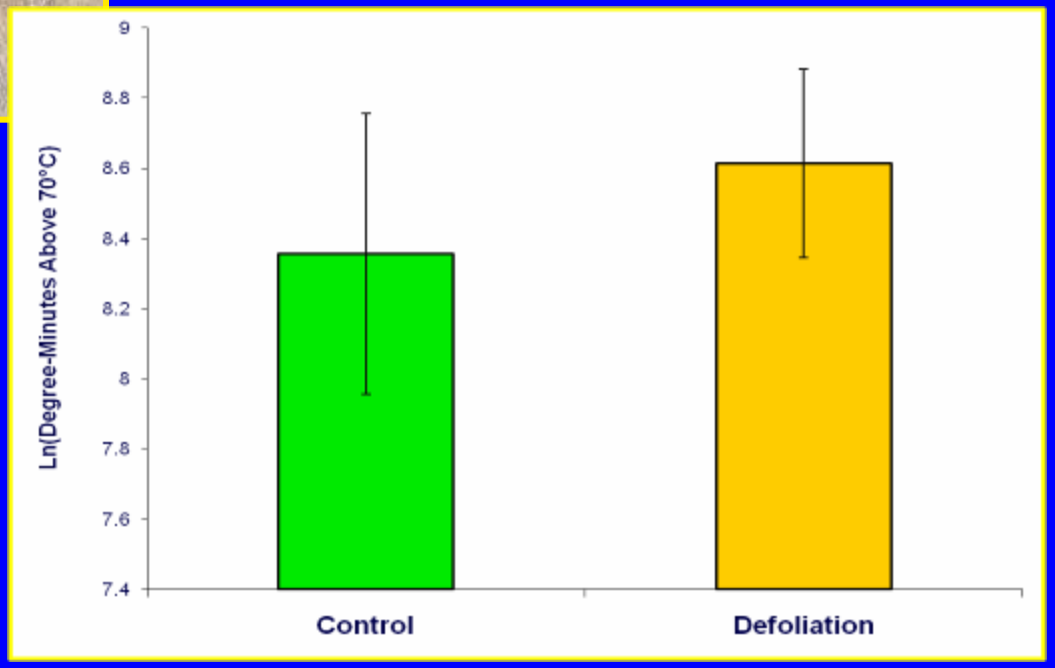
Experimental Design – Fall 2008



- **Treatment**
  - **Herbicide (DefSim)**
    - **10% Glyphosate foliar spray**
  - **Control (No herbicide)**
- **Plot set-up**
  - **30 x 30 m/plot**
  - **3 plots/treatment**
  - **9 trees/plot TC**
  - **12 trees/plot litter**

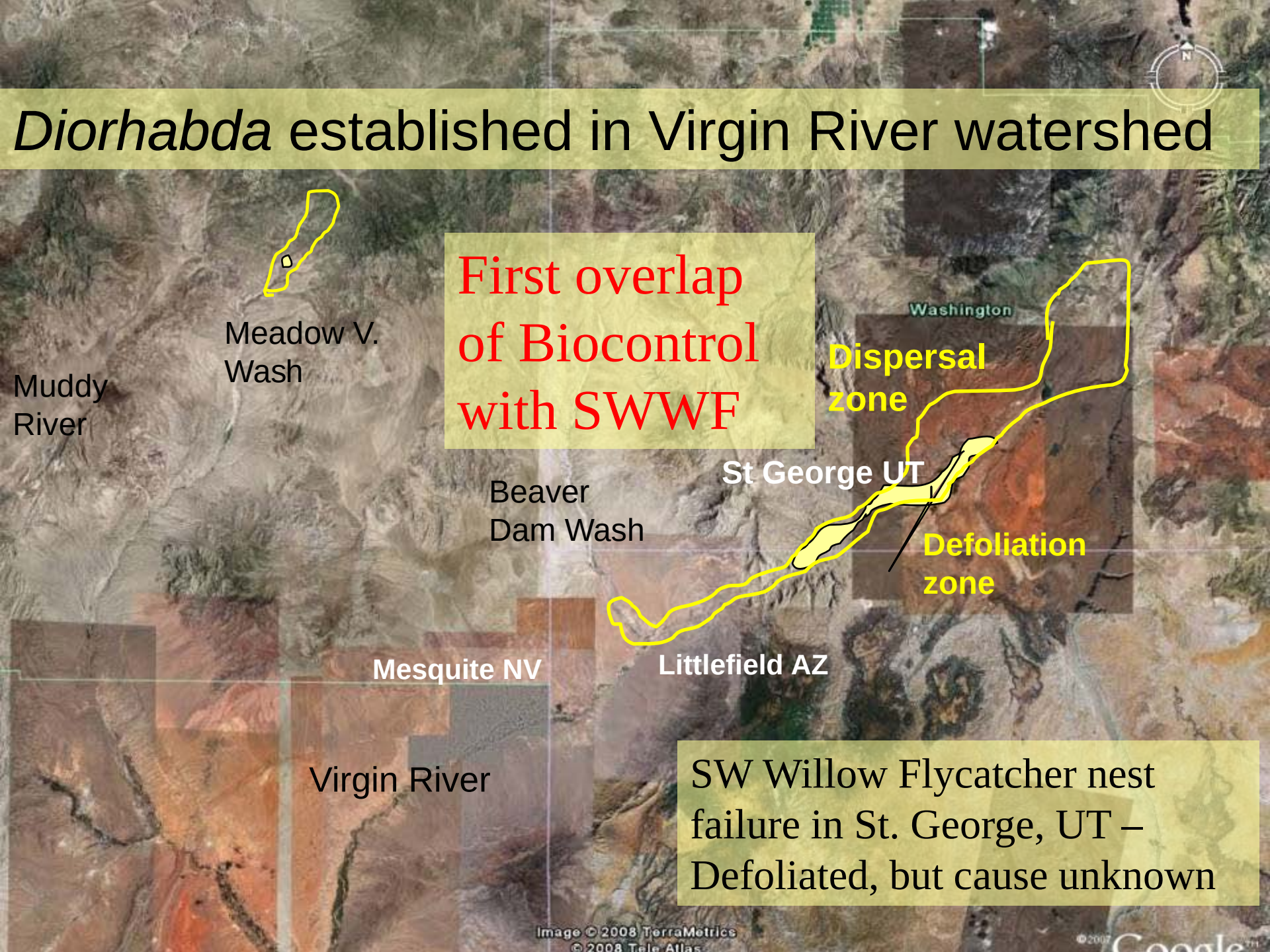
Results: Too early to tell.

Simulated Defoliation and Flammability



Defoliated or Not, tamarisk-fueled wildfire remains major threat to biodiversity

Diorhabda established in Virgin River watershed



Modified 2008-2011 Program to Study Impacts and Recovery

(UCSB, USGS, NPS, Colo. DOA, NAU, ASU, Clark Co.)

- Monitor *Diorhabda* dispersal, abundance & life cycle
- Assess target impacts & associated assemblage responses (Plants, Inverts, Birds, Herptiles)
- Test ecosystem restoration approaches and assess native propagule status

Tamarix spp. dominate but natives present, may be recruitment-limited

Experimental planting to jump-start restoration
Cottonwood/willow &
Mesquite (honey, screwbean)

Goal: Promote propagule sources to sustain recovery

Restoration Experimental Methods

UCSB - M. Taylor, G. Drus, USGS - M. Brooks, S. Ostoja, BLM - N. Caplette, NPS - C. Deuser, Harvey Assoc/BOR - K. Lair

Populus, *Salix*, *Prosopis*, *Acacia* & understory spp.

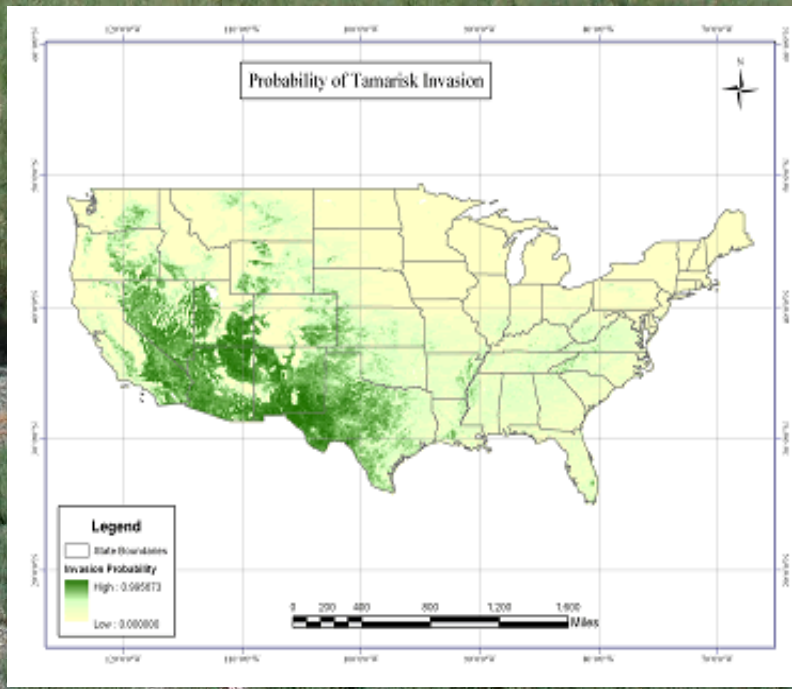
Methods include:
Pole cuttings
Container – shallow & deep
Horiz. Willow wattles
Nurse plant protection
Zeolite water columns

Goal: Create habitat islands and propagule sources for short-term habitat and long-term riparian restoration

For landscape-level invasive species, biocontrol may be the ONLY feasible weed management approach…

Does undocumented risk in small area outweigh benefits across the West?

(Humboldt R., NV)



Colorado River, USA

Xinjiang, China

Colorado Basin Riparian Restoration Project – Tamarisk Coalition

Biocontrol monitoring and experimental restoration in 6 demonstration watersheds