Status of Biological Control of Saltcedar in Texas

Allen Knutson,
Professor and Extension Entomologist
Texas A&M AgriLife Extension Service,
Texas A&M AgriLife Research and Extension Center
Dallas, TX

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Saltcedar: *Tamarix* species

- Native to Asia and Mediterranean Region
- Introduced into the US as an ornamental.
- In 1870s, planted for erosion control along stream banks in the southwest.
- Naturalized and now infests 2 million acres from Mexico to Montana.
Impacts of *Tamarix* Invasion

- Loss of ground water due to transpiration from dense, extensive thickets.

- Estimates of 1-2 acre feet of water lost per acre of saltcedar.

- Loss of grazing.

- Displacement of native plant communities

- Flooding and alteration to stream hydrology
Saltcedar infests about 450,000 acres in Texas.
Methods for Controlling Saltcedar

- Mechanical
- Chemical
- Biological
Saltcedar Leaf Beetles, *Diorhabda* spp.- Life Cycle

- **Eggs**
- **Larva**
- **Pupa**
- **Adult or Beetle**
Saltcedar Leaf Beetles - *Diorhabda* species, imported and released in the US

- *Diorhabda carinulata* (Fukang, China/Chilik, Kazakhstan ecotype released May 2001)
- *Diorhabda elongata* (Crete/Posidi, Greece ecotypes released August 2003)
- *Diorhabda carinata* (Qarshi, Uzbekistan ecotype released July 2006)
- *Diorhabda sublineata* (Sfax, Tunisia ecotype released July 2005)
2 years of defoliation

5 years of defoliation, canopy cover reduced by 90%, about 20% of trees are dead
Branch Dieback, Epicormic Growth.

Above: White River Lake, Aug 2012. Third year of defoliation
How Beetles Impact Saltcedar Trees.

- Larvae eat leaves and tender bark. 3-5 generations per year.
- Stored carbohydrates are depleted due to lack of leaves and re-growth of leaves.
- Stress results in branch die back, reduced canopy.
- Flower and seed production is greatly reduced.
- Trees slowly starve to death
- Without saltcedar, beetles starve.
Trees defoliated along 20-25 miles of Beals Creek in Howard County and Mustang Draw into Martin County.
Vegetation Recovery.
Big Spring, TX.
(Beatles 1st released 2004)
Benefits of Defoliation by Leaf Beetles

- Few or no blooms = fewer seeds
- Less water use due to lack of leaves.
- More sunlight allows other vegetation to recover.
- With repeated defoliation, some saltcedar trees die due to starvation after 4-5 years.
Beetle Redistribution Program.
The Challenge: Establish Beetles Across the Saltcedar Infested River Basins of West Texas.

Distribution of saltcedar, *Tamarix* spp, along major rivers and streams.

Beetle Round-Up

- Beat bucket to collect adults
- Transfer beetles to paper bags, folded and stapled, and held in cooler in the field.
- Collect when adults are emerging. Look for aggregation trees.
Treat release site with Maxforce ant bait.

Release 20,000 or more adults in July and again in August.

Concentrate releases on adjacent trees.

Establishment defined as adults overwintering and increasing to sufficient densities to defoliate trees without further releases.
<table>
<thead>
<tr>
<th>Year</th>
<th>No. Crete Beetles Released</th>
<th>Sites Crete species Established</th>
<th>No. Tunisian Beetles Released</th>
<th>Sites Tunisian species Established</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>20,300</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2007</td>
<td>6,200</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2008</td>
<td>5,700</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2009</td>
<td>300,000</td>
<td>3</td>
<td>14,300</td>
<td>0</td>
</tr>
<tr>
<td>2010</td>
<td>354,000</td>
<td>11</td>
<td>47,000</td>
<td>1</td>
</tr>
<tr>
<td>2011</td>
<td>0</td>
<td>4</td>
<td>84,000</td>
<td>3</td>
</tr>
<tr>
<td>2012</td>
<td>0</td>
<td>6</td>
<td>234,600</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td>686,200</td>
<td></td>
<td>379,900</td>
<td></td>
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</tbody>
</table>

Following late spring freeze in 2011, D. elongata disappeared from 60% of the sites, while D. sublineata established at nine sites.
Where are beetles today?
Distribution of the Saltcedar Leaf Beetles, Tunisian species, in the Rio Grande and Pecos River Watersheds
Distribution of the Saltcedar Leaf Beetles, Crete species, in the Colorado River Watershed
Distribution of the Saltcedar Leaf Beetles, Uzbek species, in the Canadian, Red and Brazos River Watersheds
South Wichita River, King Co. Aug 2012.
Defoliated saltcedar along 8 miles of river
## Are we making progress?

<table>
<thead>
<tr>
<th>River and Tributaries</th>
<th>River Miles with Saltcedar</th>
<th>% of miles with Beetles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canadian</td>
<td>268</td>
<td>10</td>
</tr>
<tr>
<td>Red River</td>
<td>759</td>
<td>56</td>
</tr>
<tr>
<td>Brazos</td>
<td>485</td>
<td>11</td>
</tr>
<tr>
<td>Colorado</td>
<td>210</td>
<td>24</td>
</tr>
<tr>
<td>Pecos</td>
<td>435</td>
<td>89</td>
</tr>
<tr>
<td>Rio Grande</td>
<td>540</td>
<td>63</td>
</tr>
<tr>
<td>Lower Rio Grande</td>
<td>240</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2937</strong></td>
<td><strong>44%</strong></td>
</tr>
</tbody>
</table>

River miles estimated from Google Earth using map in Robinson 1965
2013 Focus: Lake Spence (7,000 acres) and Lake Ivie (9,000 + acres). Reservoirs on the Colorado River.
During 2010-2013, 170,000 leaf beetles have been released at Lake Ivie, but no establishment to date.

Research suggests red imported fire ants are preying on beetles.

Is an exotic ant from Brazil preventing an exotic insect from North Africa from controlling an exotic shrub from Southern Europe in West Central Texas?
Saltcedar beetle populations are well established and defoliating saltcedar in all of the watersheds of west Texas.

Leaf beetles are present on an estimated 40% of the saltcedar infested rivers miles in Texas.

Flowering and seed production is greatly reduced, limiting re-invasion, branch dieback and canopy reduction is occurring, and tree death is anticipated.

Biological control is slow, but is an inexpensive, sustainable, target specific approach to saltcedar management.

Efforts continue to establish beetles at Lake Spence and Lake Ivie. International efforts needed to initiate releases in Lower Rio Grande.
Texas AgriLife Saltnet Cedar Biological Control Implementation Program

Organization and Partners

- **Texas A&M AgriLife Extension**: Coordinate implementation program, applied research, technical assistance and educational programs.
- **Agricultural Research Service**, Temple and Weslaco.
- **Texas A&M AgriLife Research**, Amarillo.
- **Biology Dept. Sul Ross University**, Alpine.
- **Natural Resource Conservation Service** and Soil and Water Conservation Districts. Local assistance.
- **Colorado River Municipal Water District** and other water and irrigation districts. Local assistance and Financial support.
- **Pecos River Restoration Project**, Tx Soil and Water Conservation Board and Texas Water Resources Institute.
- **Tamarisk Coalition**, Colorado.
Grant Support for this project provided to Texas A&M AgriLife Extension by:

- Colorado River Municipal Water District
- Rio Grande Basin Initiative
- Texas Soil and Water Conservation Board
- Wal-Mart Stores, Inc.
- Texas Parks and Wildlife Foundation.
- Natural Resource Conservation Service
Implementation Program: Saltcedar Biological Control.

More information:
- http://bc4weeds.tamu.edu
- “Beetle-mania” Newsletter
- a-knutson@tamu.edu

Questions?
Questions ?
Biological Control of Weeds

 Use of a living organism (a natural enemy) to reduce the economic loss resulting from a pest species.

 Re-establishes the “balance of nature” when exotic pests arrive without their natural enemies.

 Once established, the natural enemy is usually self-sustaining.

 It is not Eradication
Yearly Distribution (2007 - 2012) of Tamarisk Leaf Beetle (Diorhabda spp.)

Data Collected By:
- Bent’s Old Fort National Historic Site
- Bureau of Land Management
- Bureau of Indian Affairs
- Canyon de Chelly National Monument
- Colorado Department of Agriculture: Palisade Insectary
- Colorado State Forest Service
- Dinosaur National Monument
- Glen Canyon National Recreation Area
- Grand Canyon National Park
- Grand Canyon Youth
- Kaibab Paiute Tribe
- Lake Mead National Recreation Area
- Natural Resources Conservation Service
- US Army Corps of Engineers
- US Fish & Wildlife Service
- Partners for Fish & Wildlife Program

Map Production Funded By:
The Walton Family Foundation
Colorado Water Conservation Board

Map Published By:
Tamarisk Coalition on: 11/08/12

Survey Zone

Beetle Presence Data
- Year 2007
- Year 2008
- Year 2009
- Year 2010
- Year 2011
- Year 2012