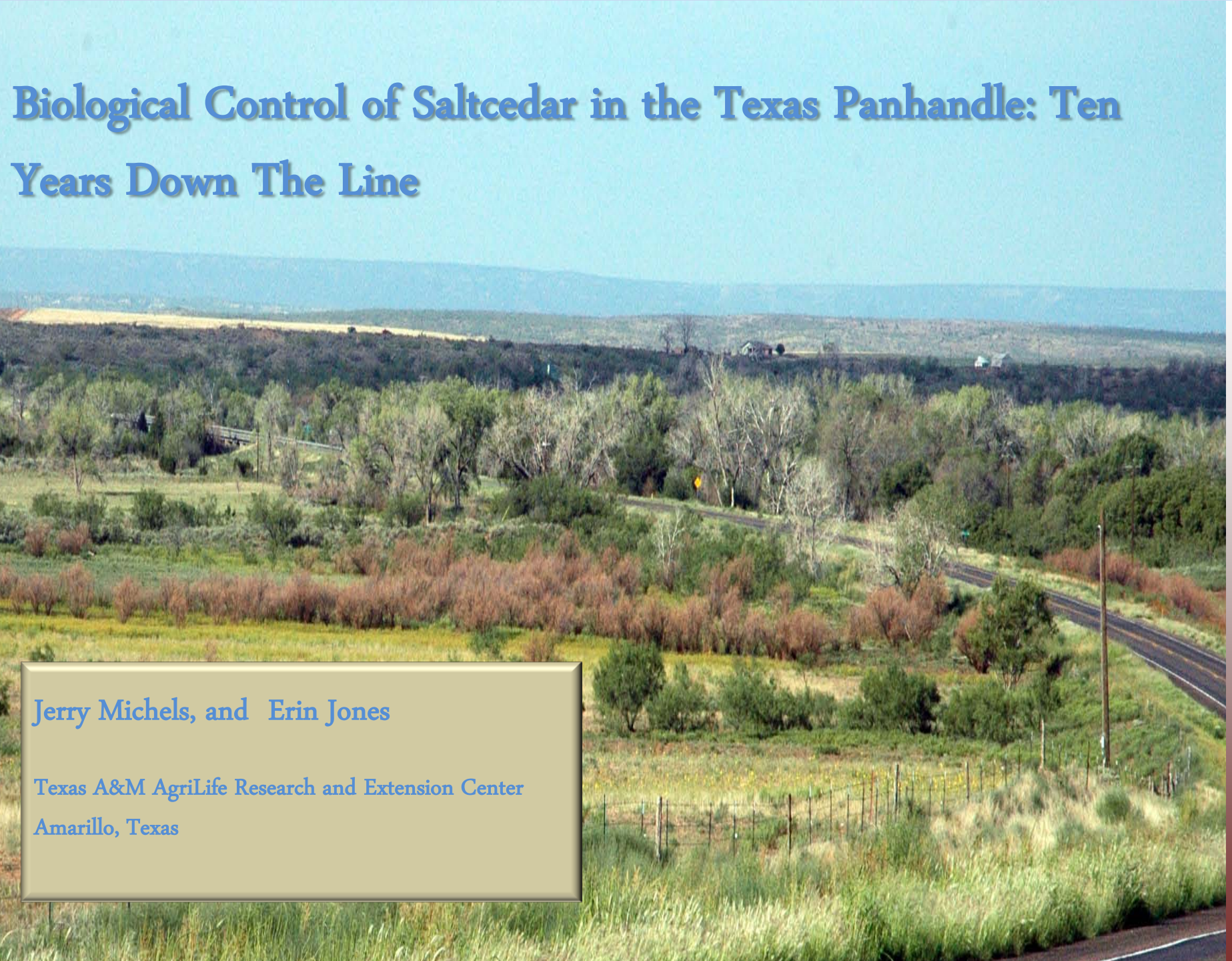
Biological Control of Saltcedar in the Texas Panhandle: Ten Years Down The Line



Jerry Michels, and Erin Jones

Texas A&M AgriLife Research and Extension Center

Amarillo, Texas

Texas A&M AgriLife Research

Panhandle Entomology

As you know, the High Plains of Texas are not always as flat as a board. River drainages form complex geological areas in which there are isolated riparian habitats that are crucial for wildlife and cattle production. This photo illustrates what could be called a 'natural state' along the Canadian River with small patches of native cottonwoods, willows, junipers and varied grasses and forbs.

Unfortunately, many areas are not as ecologically 'healthy.' These two photos of Blue West at Lake Meredith taken in 2008 and 2011 sadly illustrate that in addition to the almost total loss of surface water, saltcedar persists as a dominant plant.

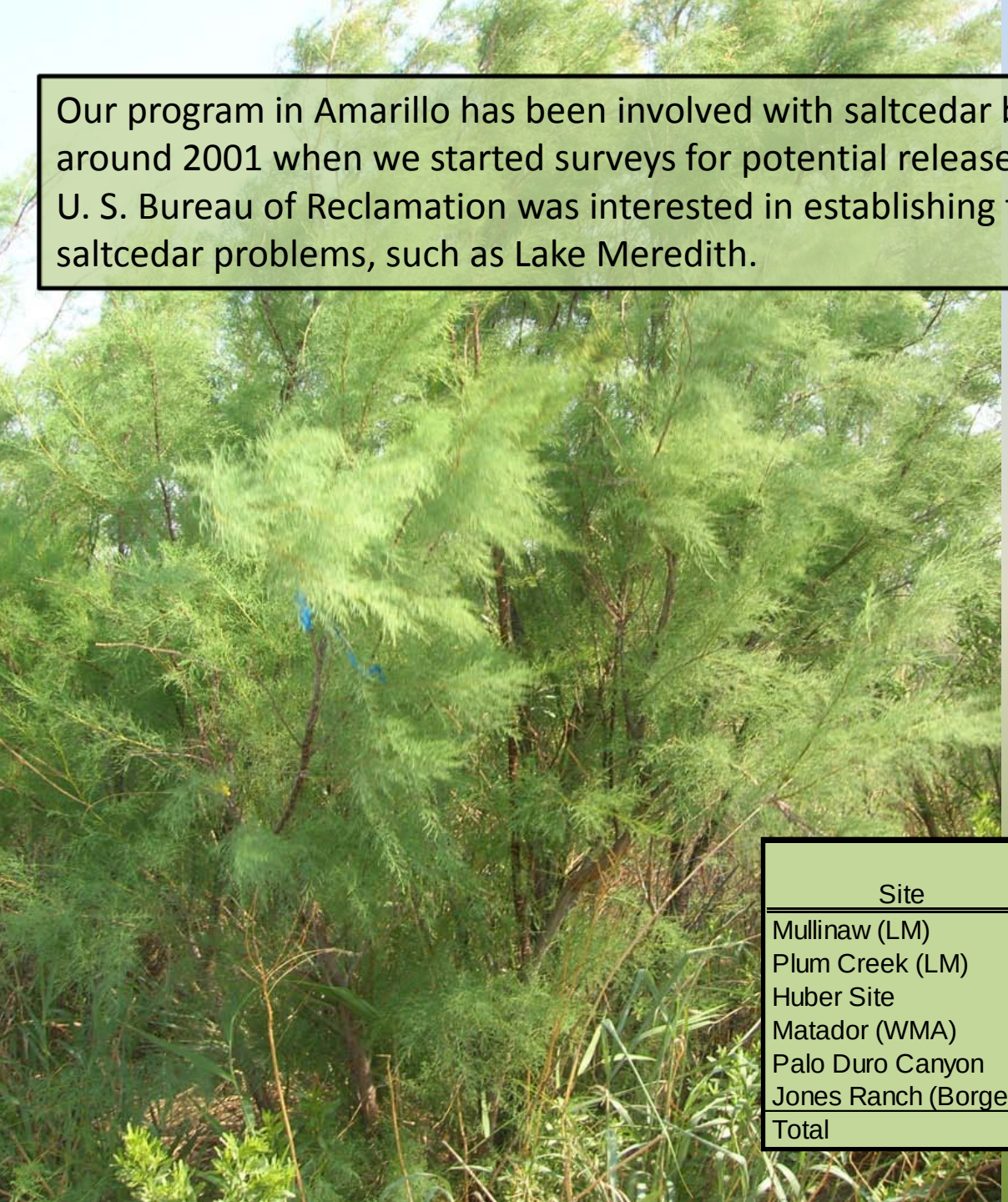
Today I want to describe our saltcedar biological program and the successes that began in the summer of 2012.

A "New Morning"

The star of our project is the saltcedar beetle (*Diorhabda* sp.). A Chrysomelid beetle similar to the elm leaf beetle and corn rootworm. The origin of saltcedar biocontrol lies with Dr. Jack DeLoach of the USDA-ARS in Temple, Texas. He was responsible for the original foreign explorations to find insects that fed on saltcedar. At first, everyone thought various ecotypes of *Diorhabda elongata* had been imported. However, this was not the case. James Tracy and Tom Robbins determined that four species had been released.

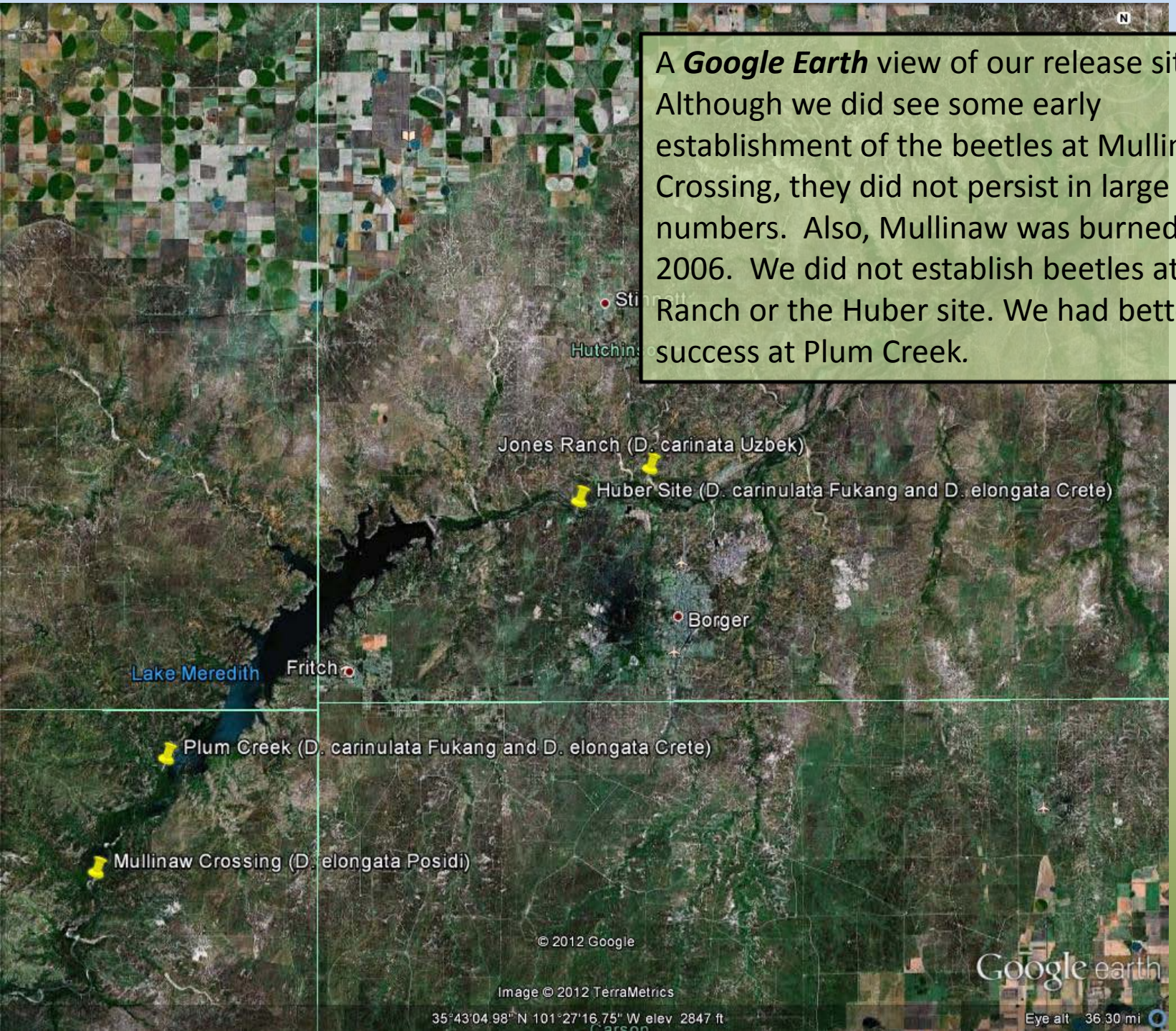
Diorhabda carinata Larger tamarisk beetle (Uzbekistan ecotype)
Diorhabda carinulata Northern tamarisk beetle (Fukang & Turpan ecotypes)
Diorhabda elongata Mediterranean tamarisk beetle (Crete & Posidi ecotypes)
Diorhabda sublineata Subtropical tamarisk beetle (Tunisia)

Our program in Amarillo has been involved with saltcedar biological control since around 2001 when we started surveys for potential release sites in the Panhandle. The U. S. Bureau of Reclamation was interested in establishing the beetles in areas that had saltcedar problems, such as Lake Meredith.

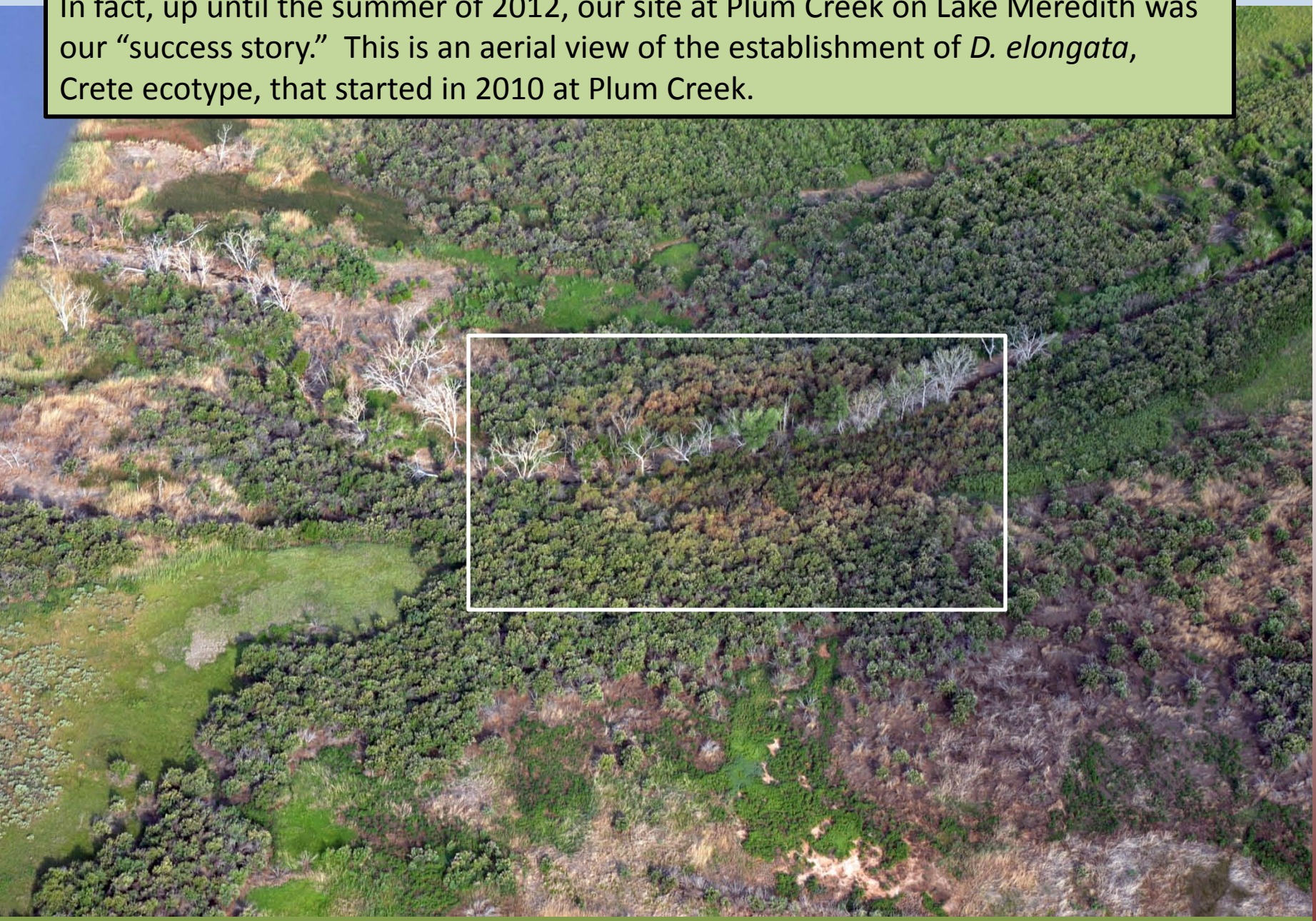


We made our first releases in 2004 at sites selected by the USBOR, National Park Service, and the Canadian River Municipal Water Authority. From 2004-2010 we released around 29,000 insects of three species at six sites.

Site	Species		
	D. elongata	*D. carinulata*	*D. carinata*
Mullinaw (LM)	2,490		
Plum Creek (LM)	8,130	1,639	
Huber Site	4,000	1,525	
Matador (WMA)	8,350		719
Palo Duro Canyon			1,900
Jones Ranch (Borger)			200
Total	22,970	3,164	2,819


A ***Google Earth*** view of our release sites. Although we did see some early establishment of the beetles at Mullinaw Crossing, they did not persist in large numbers. Also, Mullinaw was burned in 2006. We did not establish beetles at Jones Ranch or the Huber site. We had better success at Plum Creek.
Jones Ranch (D. carinata Uzbek)
Huber Site (D. carinulata Fukang and D. elongata Crete)
Borger
Lake Meredith
Fritch
Plum Creek (D. carinulata Fukang and D. elongata Crete)
Mullinaw Crossing (D. elongata Posidi)
© 2012 Google
Image © 2012 TerraMetrics
35°43'04.98" N 101°27'16.75" W elev 2847 ft
Eye alt 36.30 mi
Google earth

In fact, up until the summer of 2012, our site at Plum Creek on Lake Meredith was our “success story.” This is an aerial view of the establishment of *D. elongata*, Crete ecotype, that started in 2010 at Plum Creek.



Here is a ground-level view of defoliation caused by *D. elongata* at Plum Creek.

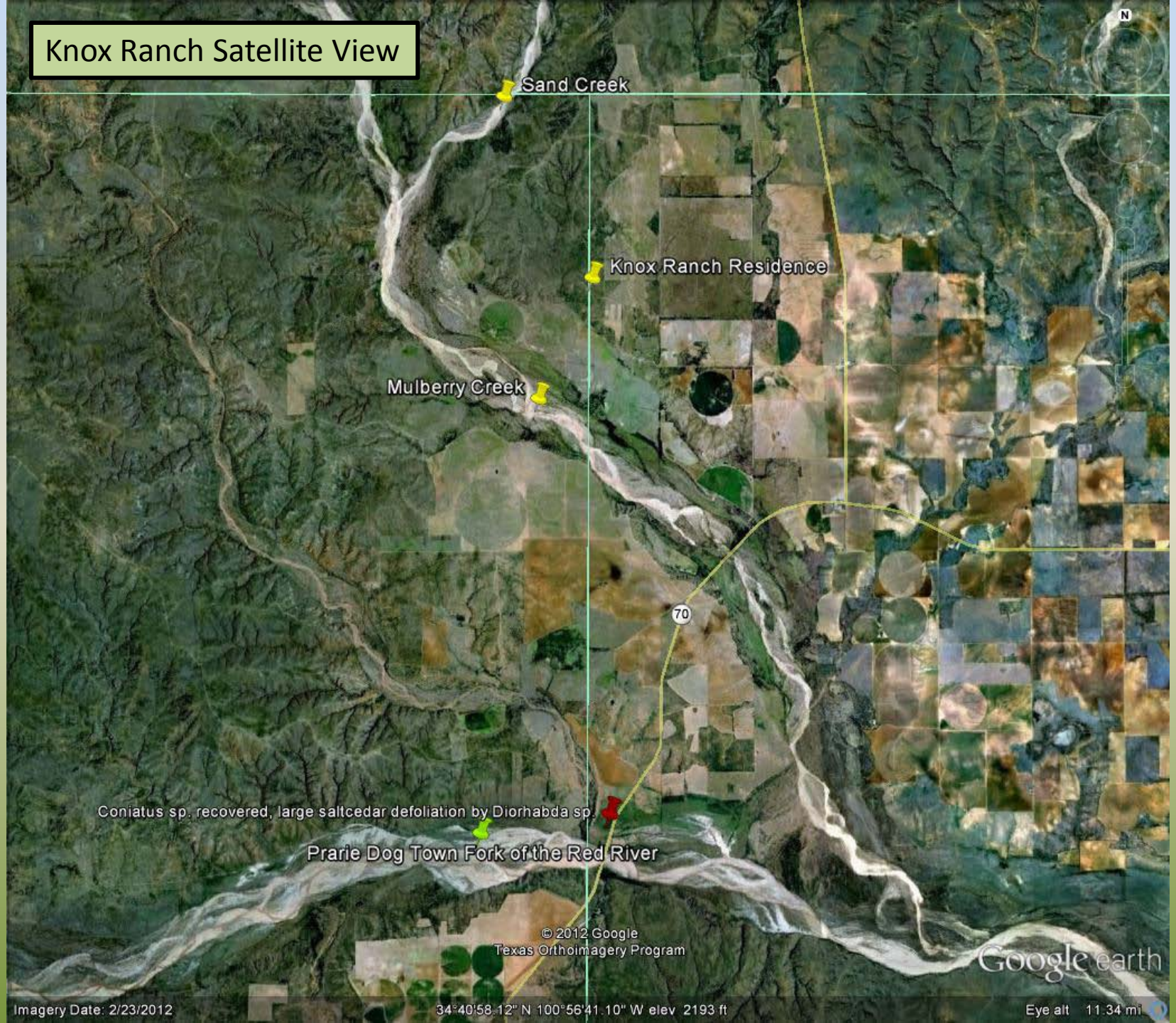
The Good Stuff Starts!

2012 started off as a pretty routine year. We had the Plum Creek site to monitor and we were considering redistribution to other large saltcedar infestations along the Canadian. Publicity was good with several interviews completed by mid-June.

Then things changed dramatically. Dr. Ed Bynum (Extension Entomologist at Amarillo) received a phone call from Chris Knox, a rancher south of Clarendon, TX, who said he had beetles on his saltcedar. We visited his ranch on June 26th and found a large infestation of *Diorhabda* on most of his property along Mulberry Creek. The same day, we took a look at the Prairie Dog Town Fork of the Red River, about 10 miles further south, and found most of the saltcedar along the river near the Texas Highway 70 bridge to be defoliated, and large numbers of *Diorhabda* in all stages.

We collected specimens and sent them to James Tracy (Texas A&M) for identification. He confirmed that they were *D. carinata* on July 9th.

We were also quite surprised to find *Coniatus splendidulus* (the splendid tamarisk weevil) at the site. This was the first recovery of this weevil in the Texas Panhandle.

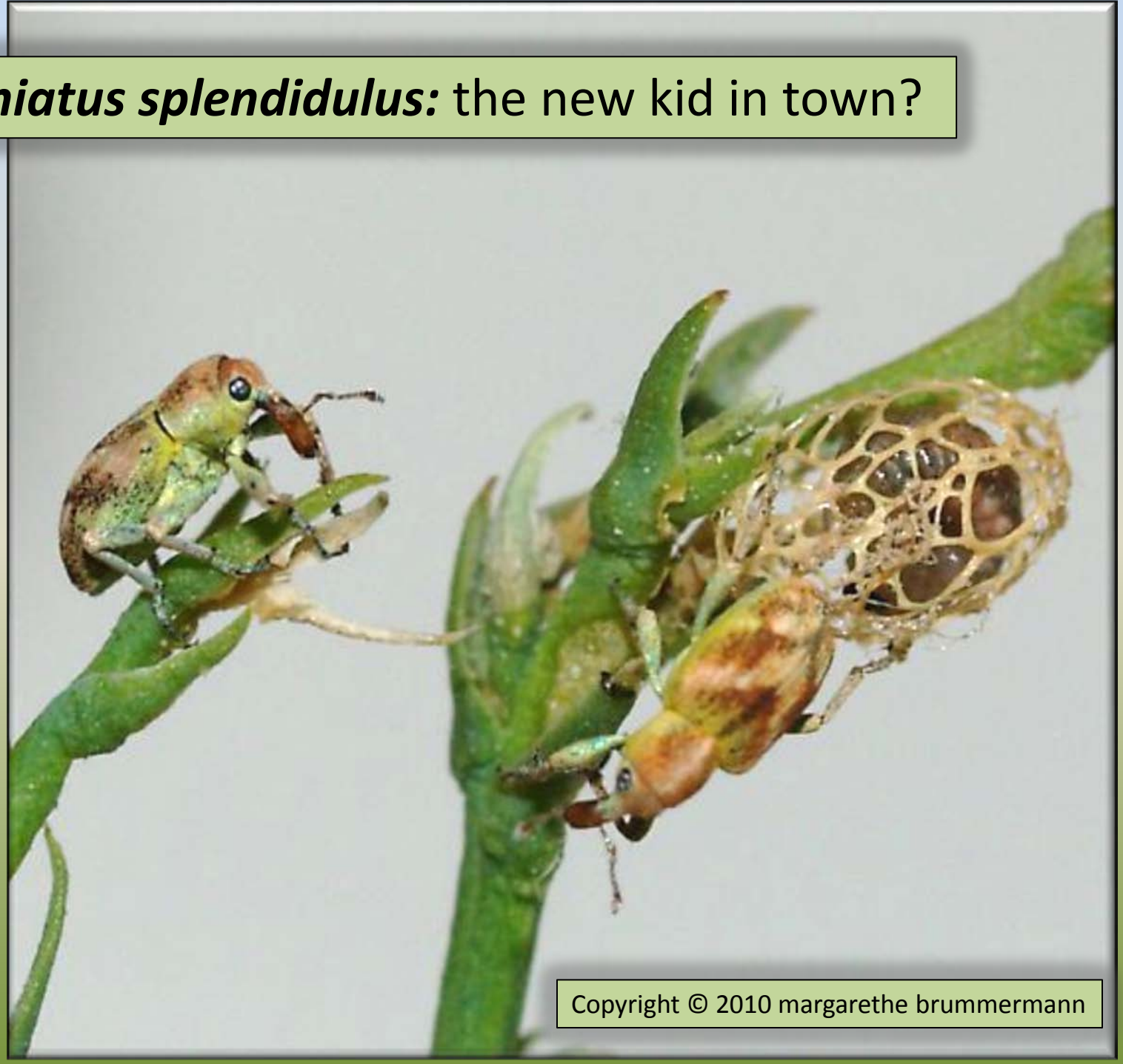

Knox Ranch Satellite View
Sand Creek
Knox Ranch Residence
Mulberry Creek
70
Coniatus sp. recovered, large saltcedar defoliation by Diorhabda sp.
Prarie Dog Town Fork of the Red River
© 2012 Google
Texas Orthoimagery Program
Google earth
Imagery Date: 2/23/2012
34°40'58.12" N 100°56'41.10" W elev 2193 ft
Eye alt 11.34 mi


Chris Knox and saltcedar 6/26/12

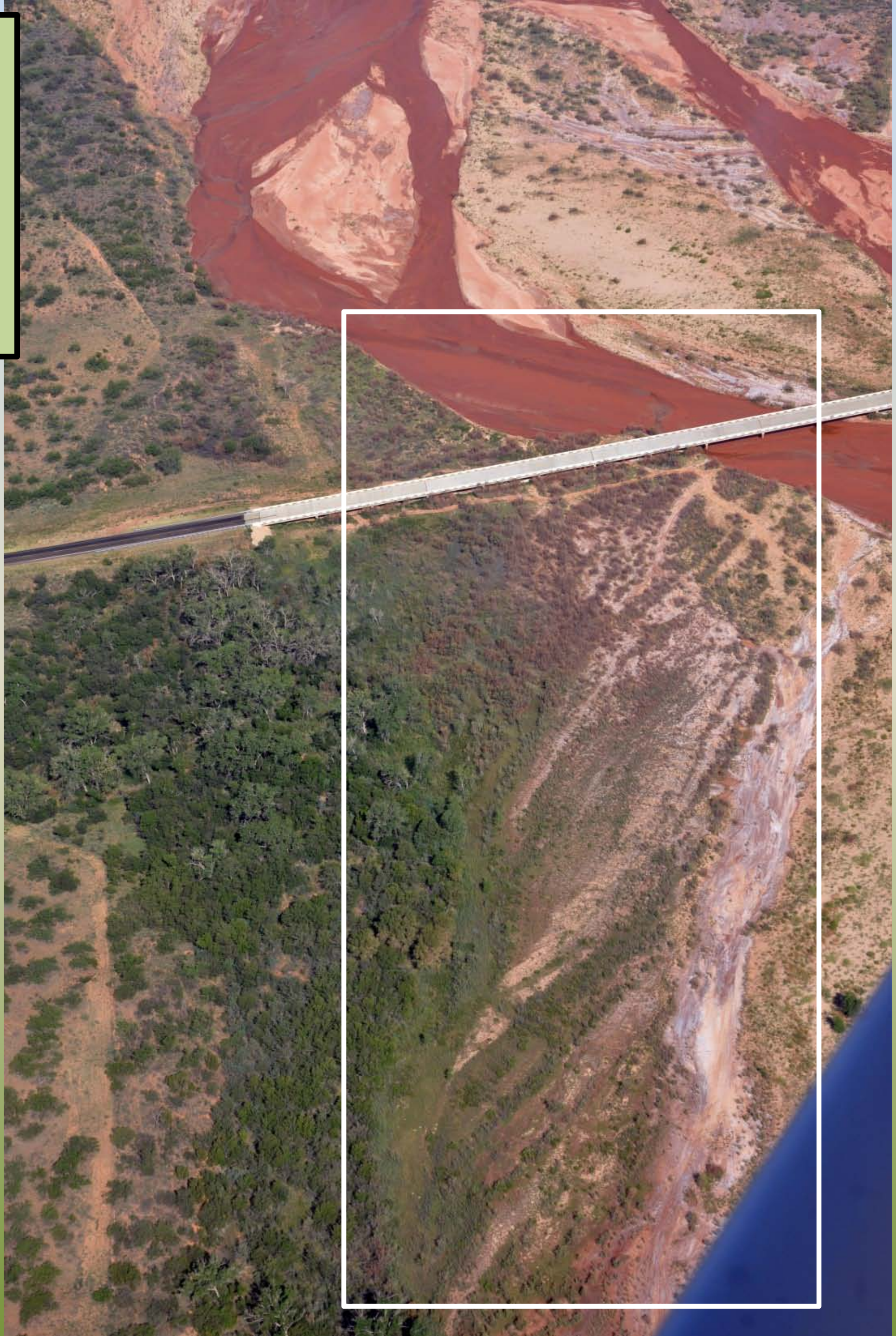
Rachel Lange, Erin Jones and Jackie Brazille sampling saltcedar at Knox Ranch 6/26/12

Heavy *Diorhabda* infestation and saltcedar defoliation at the Prairie Dog Town Fork of the Red. The first record of *Coniatus splendidulus*, the Splendid Tamarisk Weevil, came from this site on 6/26/12

Coniatus splendidulus: the new kid in town?



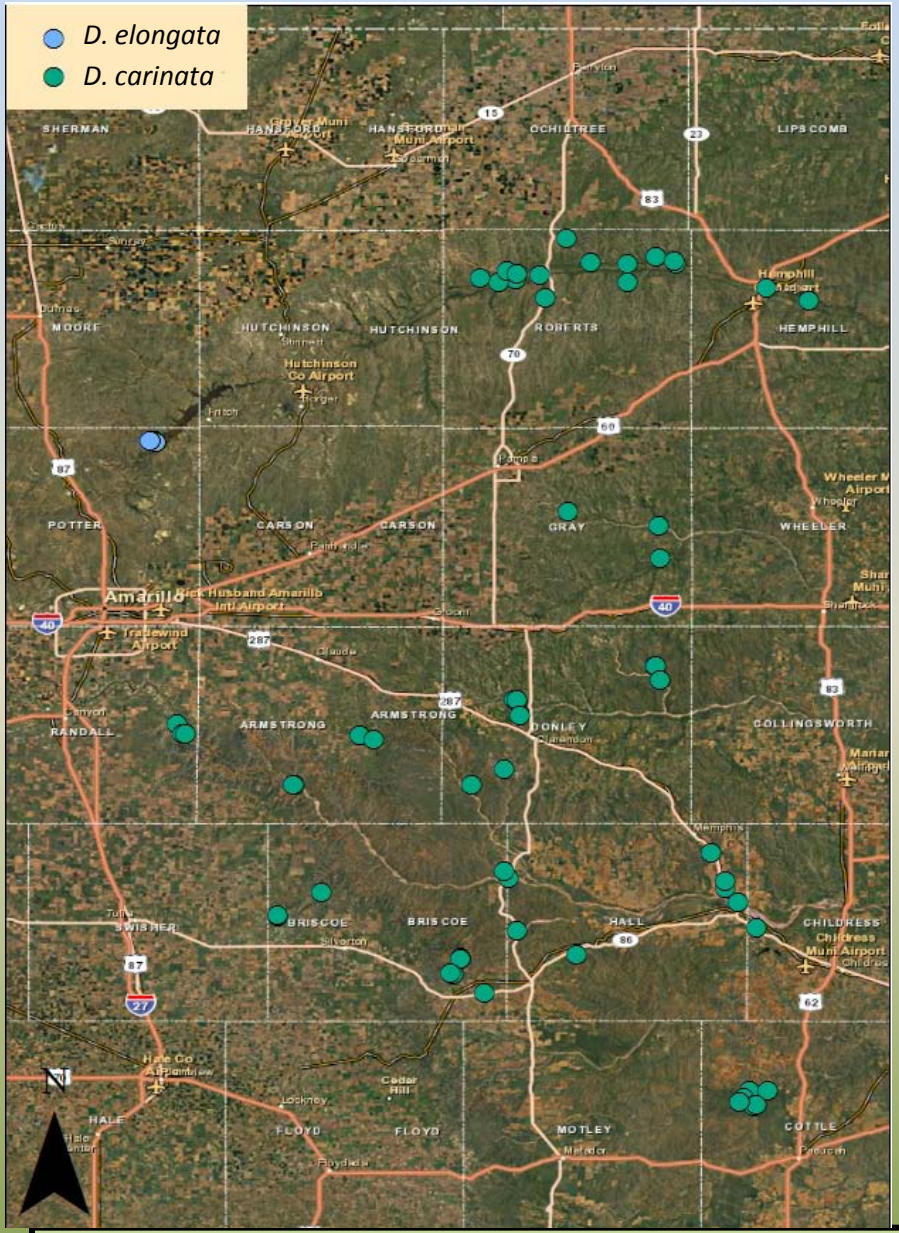
Aerial view of *Diorhabda* infestation at Prairie Dog Town Fork of the Red River and Texas Highway 70, 7/12/12.

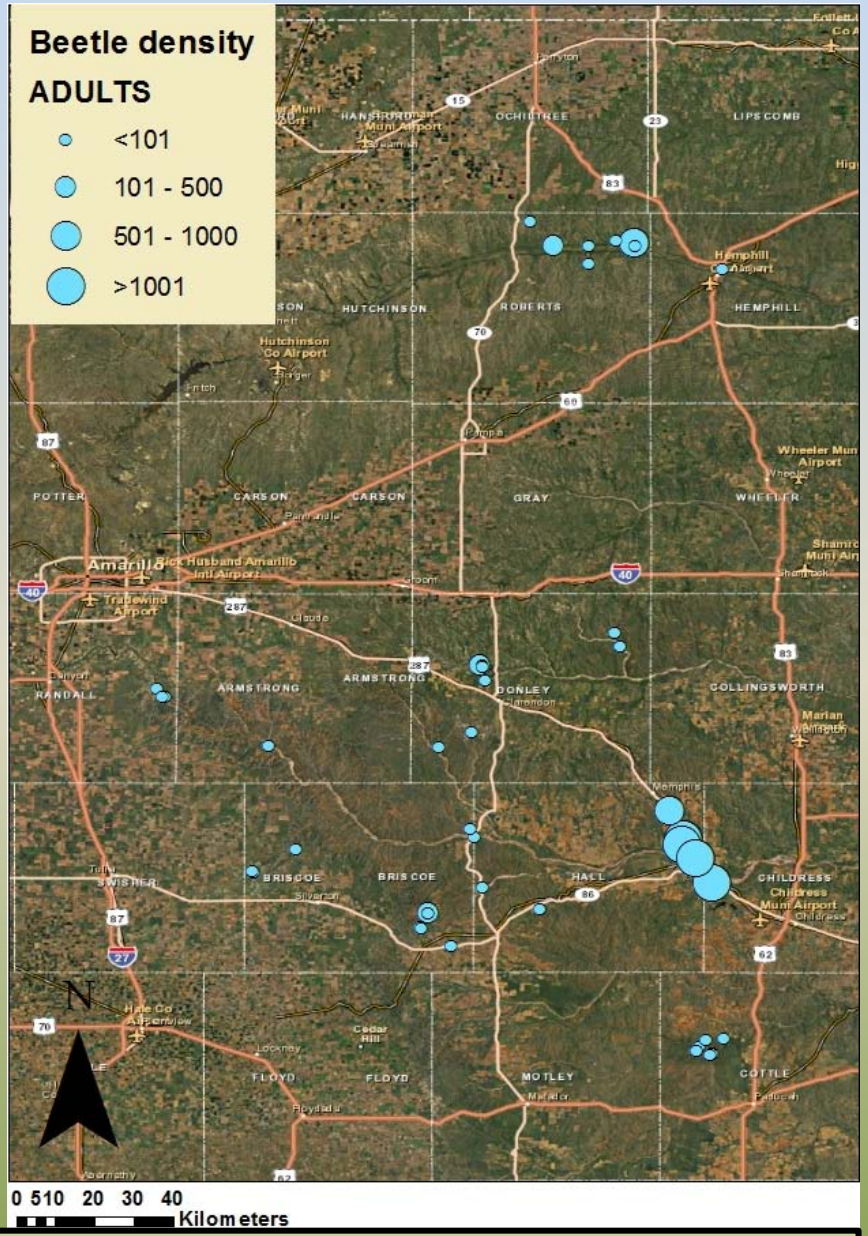


Since the summer of 2010 there has been a moratorium on transporting *Diorhabda* across state lines. The story behind the moratorium is too long to detail today, but suffice it to say that it is illegal to transport beetles from Texas to Oklahoma, even if they are separated by a shallow river.

But, nature kind of worked this out on its own. Tom Royer (OSU Extension Service) and I surveyed the Texas/Oklahoma border on 7/27/12, and found *D. carinata* in Harmon County. This photo is from a good *D. carinata* infestation at Estelline, Texas, success in Oklahoma came later that day.

We continued looking for the beetles through the rest of the summer and fall of 2012.





By the end of 2012, this was the extent of saltcedar sites infested with *Diorhabda*. The map on the left highlights all the infested sites. On the right is an approximation of the density of the infestations, which seemed to be higher in the south. This may be due to the time at which the data were collected.

County	Date	Latitude	Longitude	*Diorhabda* *carinata*	*Diorhabda* *elongata*	Hybrid [1]	*Coniatus* *splendidulus*
Oklahoma							
Beckham	7/27/12	35.29648	-99.87032			A [2]	
Greer	7/27/12	35.07333	-99.36892			A	
Harmon	7/27/12	34.58043	-99.95878			A	
Jackson	7/27/12	34.58038	-99.95870			A	
Roger Mills	7/27/12	34.41752	-99.73407			A	
Texas							
Armstrong	9/5/12			B			
Briscoe	7/20/12	34.44343	-101.07231	A			
Childress	7/27/12	34.56865	-100.19386	B		A	
Collingsworth	9/26/12			B			
Cottle	7/2/12	34.15949	-100.37387			A	B
Donley	7/11/12	34.99773	-100.89420	A			
Gray	8/3/12			B			
Hall	6/26/12	34.62672	-100.94207	A			B
Hardemann	9/26/12			B			
Hemphill	7/26/12	35.93584	-100.37110	A			
King	8/9/12	33.60420	-100.32090	B		A	
Motley				B			
Potter	4/8/12				B		
Randall	7/6/12	34.96515	-101.67140			A	B
Roberts	8/16/12			B			
Stonewall	8/9/12	33.33322	-100.23883	B		A	
Wheeler				B			
Wichita	9/26/12			B			
Willbarger	9/26/12			B			

[1] Hybrids of *D . carinata* and *elongata* .

[2] A- determined by J. L. Tracy through dissections, B - field identification.

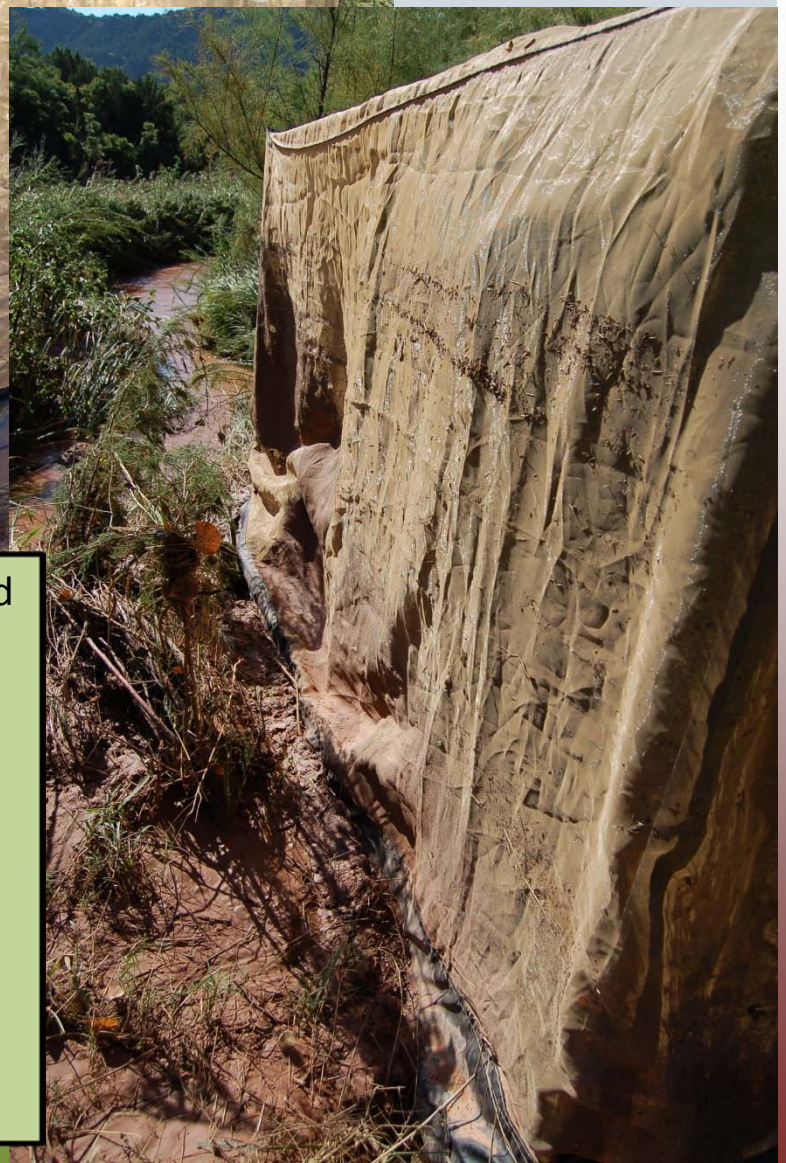
A good number of the beetles for counties in which *Diorhabda* was recovered were hybrids of *D. carinata* and *D. elongata*. Which adds additional questions about their origins. But we can say that *Diorhabda* spp. was recovered in 19 Texas and five Oklahoma counties and *Coniatus* in three Texas counties in 2012.

So, the big question in our mind is why did the large outbreak occur in 2012 where and when it did?

There is no doubt that *D. carinata* or hybrids of *D. carinata* and *D. elongata* are the dominant species, but *D. carinata* was only released in large numbers at the Matador Wildlife Management Area and Palo Duro Canyon State Park.

From research done in Colorado and Utah, it seems that the beetles tend to spread upstream, attacking saltcedar stands as they go. Therefore it may be that beetles spread north from Matador into the lower part of the Prairie Dog Town Fork of the Red and the Red River itself.

The beetles are good fliers, and could spread long distances on strong southwesterly winds.



An intriguing possibility is that a “fortunate accident” played a role. We infested a cage at Palo Duro Canyon State Park with 1,900 *D. carinata* on July 5th, 2007. A flash flood on August 9th, 2007, destroyed the cage and the beetles were most likely swept downstream.

Did the establishment of *D. carinata* on the upper part of the Prairie Dog Town Fork of the Red begin when the beetles from the cage were washed downstream, remained in small numbers and “exploded” in 2012? A case of “Xtreme Redistribution?”

Maybe. But regardless of the theories, *D. carinata* and the hybrids seem here to stay.

These two aerial photos were taken in July of 2012 and August of 2013 of the Jones Ranch site, just north of Borger, TX.

The red and blue stars are congruent points in the photos.

In 2012 there was no evidence of *Diorhabda* in the area.

By 2013, the majority of the trees had significant defoliation and the beetles were widespread.

This type of massive defoliation occurred throughout the Canadian River drainage, Lake Meredith and on west, perhaps to the New Mexico state line.

Summing it up.

The project is successful, but it has not been an easy road. The main obstacles have been difficulties getting stakeholder buy-in to the project and then "keeping faith" as the years went by.

Biological control projects are not "cookbook" projects. The timeline to establish, colonize and redistribute a biological control agent is roughly six years, if all the parameters are favorable at the start. A biological control project is similar to the development of a new herbicide. Patience is required.

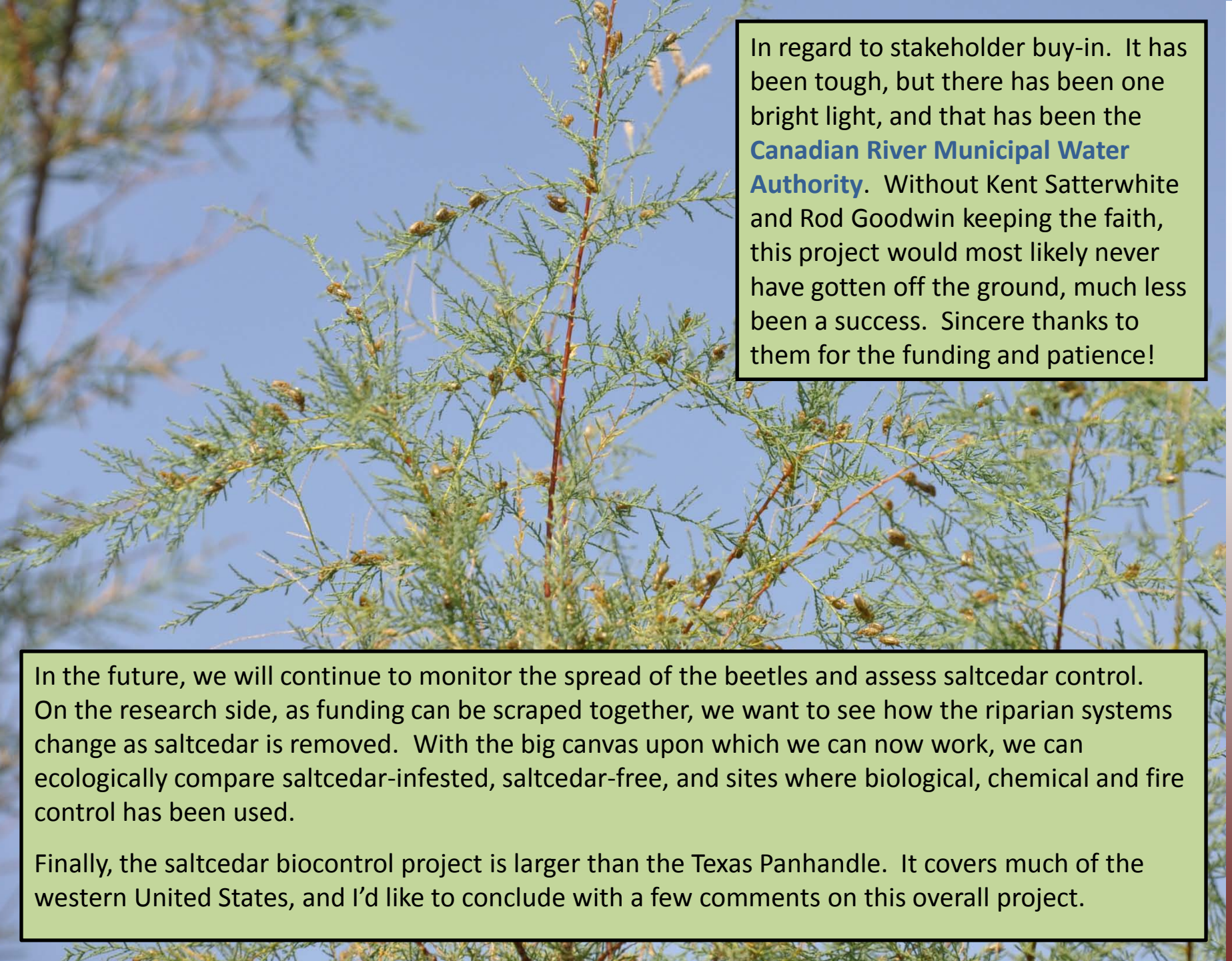
2007 was probably the low point of the project when it received some pretty bad comments in the press.

Amarillo Globe News 10/11/2007 – "A plan to use beetles from Uzbekistan to eat the trees **is not going as planned**."
http://www.amarillo.com/stories/101107/new_8666258.shtml

The Pampa News 10/13/2007 - "While the spraying of salt cedar has been successful, the bugs that have been imported to eat the shrubbery have not. Over the past several years, different bugs, primarily from China or the Mediterranean, have been imported to try to control the trees. Such measures in other areas, most notably Colorado, have proven an effective tool in salt cedar control, but they **have failed miserably** to date at Lake Meredith."
http://www.thepampanews.com/articles/2007/10/13/news/1news.txt

The other major problem has been funding. As of 2010, $3,100,000 had been spent on herbicial control of saltcedar along the Canadian and $75,000 on the biocontrol project. Roughly two cents on biological control for every dollar spent on chemical control. What might have happened if that proportion had been a dime for a dollar?

These days it is impossible to find a source to invest substantive funds in a project that may have results 10 years down the road. But an investment of $7,500/year doesn't buy much gas and pays few wages. We were able to "bootleg" funds from our other projects to keep this one going to the point where we had success. Therefore **implementation** of saltcedar biocontrol succeeded. However, **scientifically**, from the aspect of understanding how this process worked, much was lost and can never be regained.

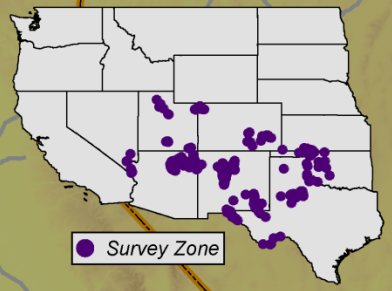


In regard to stakeholder buy-in. It has been tough, but there has been one bright light, and that has been the **Canadian River Municipal Water Authority**. Without Kent Satterwhite and Rod Goodwin keeping the faith, this project would most likely never have gotten off the ground, much less been a success. Sincere thanks to them for the funding and patience!

In the future, we will continue to monitor the spread of the beetles and assess saltcedar control. On the research side, as funding can be scraped together, we want to see how the riparian systems change as saltcedar is removed. With the big canvas upon which we can now work, we can ecologically compare saltcedar-infested, saltcedar-free, and sites where biological, chemical and fire control has been used.

Finally, the saltcedar biocontrol project is larger than the Texas Panhandle. It covers much of the western United States, and I'd like to conclude with a few comments on this overall project.

Yearly Distribution (2007 - 2013) of Tamarisk Leaf Beetle (*Diorhabda* spp.)



Data Collected By:

- Bent's Old Fort National Historic Site
- Big Bend National Park
- Bureau of Indian Affairs
- Bureau of Land Management
- Bureau of Reclamation
- Canyon de Chelly National Monument
- Colorado Dept 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
- Kansas Dept of Agriculture
- Kennecott Utah Copper Corporation
- Lake Mead National Recreation Area
- Natural Resources Conservation Service
- New Mexico (NM) Dept of Agriculture
- NM Dept of Fish and Game
- NM Energy, Minerals, and Natural Resources Dept
- New Mexico State University
- Northern Arizona University
- Oklahoma State University
- Ouray National Wildlife Refuge
- Southern Nevada Water Authority
- Sul Ross State University
- Tamarisk Coalition
- Texas A&M University (TAMU)
- TAMU AgriLife Research
- Texas Parks and Wildlife Dept
- University of Arizona
- University of California Santa Barbara
- US Army Corps of Engineers
- US Geological Survey
- US Fish & Wildlife Service (USFWS)
- USFWS Partners for Fish & Wildlife
- USDA Forest Service
- Utah Dept of Natural Resources

Map Production Funded By:

The Walton Family Foundation
Colorado Water Conservation Board

Salt Lake City
Denver
Flagstaff
Albuquerque
Los Angeles
Phoenix
Dallas
El Paso
San Antonio

0 112.5 225 450 Kilometers
0 75 150 300 Miles

esri

Beetle Presence Data

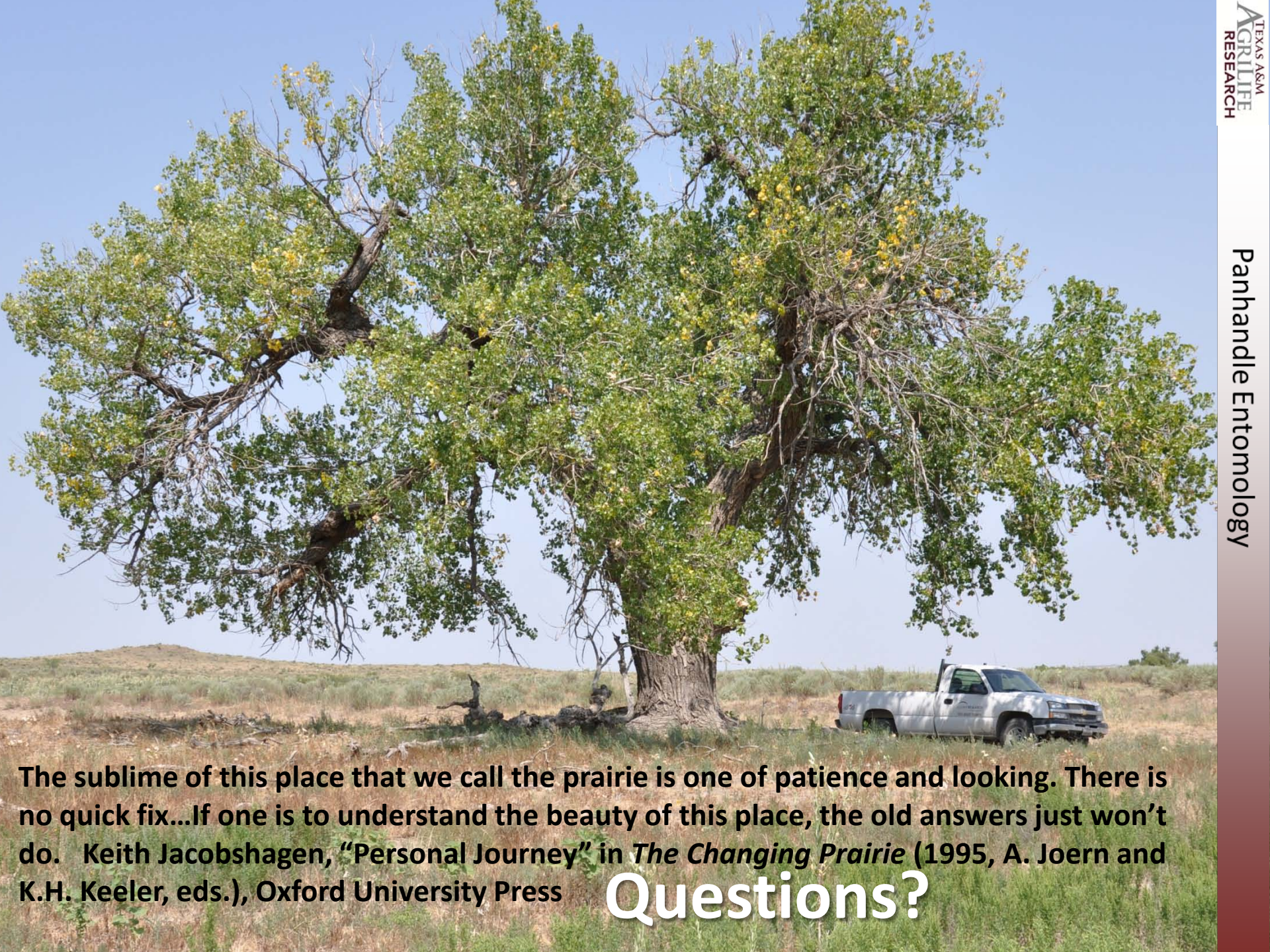
- Year 2007
- Year 2008
- Year 2009
- Year 2010
- Year 2011
- Year 2012
- Year 2013
- Absent Beetle Points in 2013 (Absence data not collected in all regions)

Restore. Connect. Innovate.
Tamarisk Coalition
P.O. Box 1907 · Grand Junction, CO 81502

Map Published By:
Tamarisk Coalition on: 1/21/14

Texas A&M AgriLife Research

Panhandle Entomology



Texas A&M AgriLife Research

Panhandle Entomology

The sublime of this place that we call the prairie is one of patience and looking. There is no quick fix…If one is to understand the beauty of this place, the old answers just won't do. Keith Jacobshagen, "Personal Journey" in *The Changing Prairie* (1995, A. Joern and K.H. Keeler, eds.), Oxford University Press

Questions?