An Integrated Weed Management Approach to Saltcedar Control

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Introduction

Saltcedar (*Tamarix ramosissima*), a small tree native to Central Asia has invaded more than 1.9 million hectares in the western United States. Planted in the early 1800s as an ornamental and later for windbreaks and soil stabilization, it escaped cultivation, infesting riparian and adjacent communities.

In an effort to control saltcedar, the USDA-Agricultural Research Service investigated a number of potential control insects in the 1970s. By the 1990s a foreign leaf eating beetle (*Diorhabda carinulata* formerly *D. elongata*), was released by USDA.

Figure 1. Salt cedar bio-control release sites (A) Walker River and (B) Lovelock Nevada.

In 1999 we constructed three bio-control quarantine cages in North-western Nevada; **(Figure1)** Lovelock (40º01.219'N 118º31.389'E) Stillwater (39º31.493'N 118º30.823'E) Walker, (38º53.529'N 118º46.780'E). Beetle reproduction in the wild was to be observed in the cages before full release. Five other states also constructed cages. In 2001 the leaf beetle was released. At two of the three release sites (Walker and Lovelock) the beetle initially established.

Vegetation Monitoring

In May 2001 at each site, we began annual saltcedar measurements of plant morphology of 100 marked trees [e.g. height, diameter, densitometer (percent), foliage/stem status (green, defoliated (dead leaf /stem), re-growth, and flowering]. We measured nearest shrub and primary vegetation under the canopy along with presence or absence of beetles. These measurements were taken (last week in May) from 2001 through 2011. Vegetation monitoring was cancelled at the Stillwater site after a few years because of lack of beetle presence, likely due to a dense saltgrass (*Distichilis spicata)* understory and annual flooding which eliminate the habitat for soil over wintering for the beetle.

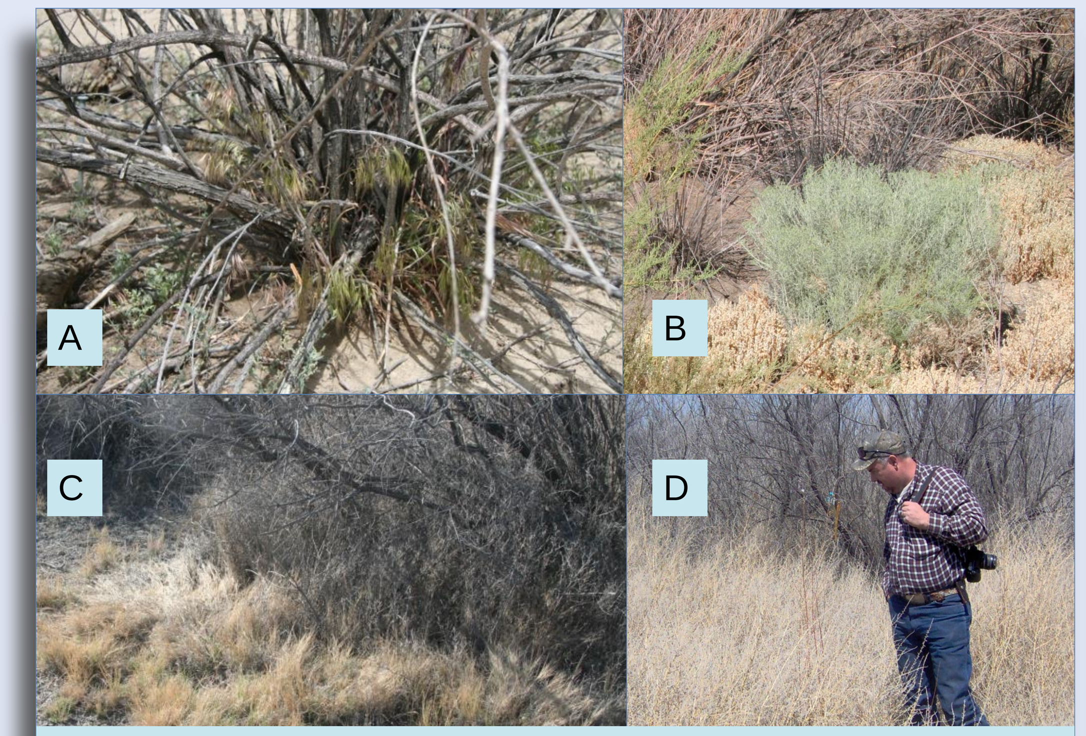

Figure3. Understory plants Walker River: (A) Cheatgrass (B) Rabbitbrush and at Lovelock site: (C) Saltgrass (D) Annual Kochia

Results

After measuring defoliation for a decade, complete defoliation (>96% tree) reached a high of 54% in 2004 at the Lovelock site and a high of 18% at the Walker site in 2007 **(Figure 2)**. By 2011, complete defoliation was recorded at 41% and 14%, respectfully.

2001 vegetation understory cover was 10.51% **(Table1)(Figure 3)**. Saltgrass occurred in 47% of the quadrats with an average cover of 9.26%. Tall whitetop (*Lepidium latifolium*) was also present in 47% of the quadrats beneath the canopy with an average cover of 12.68%. By 2011 tall whitetop was not present in the quadrats and saltgrass had increased to a presence of 50% beneath the canopy with an average cover of 48.46%.

Primary Species	Year	% Presence		Ave. % Cover	
		Below	Edge	below	Edge
Saltgrass	2001	47	26	9	6
Tall Whitetop	2001	47	28	13	10
Annual Kochia	2001	2	3	6	4
Russian Knapweed	2001	1	3	5	16
Total all plots (n100)	**2001**	**62**	**46**	**10**	**6**
Saltgrass	2004	39	36	6	8
Tall Whitetop	2004	7	4	4	3
Annual Kochia	2004	1	0	2	0
Russian Knapweed	2004	0	7	0	4
Total all plots (n100)	**2004**	**43**	**42**	**3**	**3**
Saltgrass	2007	10	21	15	17
Tall Whitetop	2007	6	0	20	0
Annual Kochia	2007	86	82	82	81
Russian Knapweed	2007	2	1	40	1
Total all plots (n100)	**2007**	**93**	**89**	**76**	**71**
Saltgrass	2011	50	54	48	45
Tall Whitetop	2011	0	0	0	0
Annual Kochia	2011	36	40	28	21
Russian Knapweed	2011	7	5	11	16
Total all plots (n100)	**2011**	**59**	**66**	**35**	**33**

Table 1. Primary vegetation cover below and at the edge of saltcedar canopies at the Lovelock site from 2001 to 2011. * percent rounded to nearest whole number

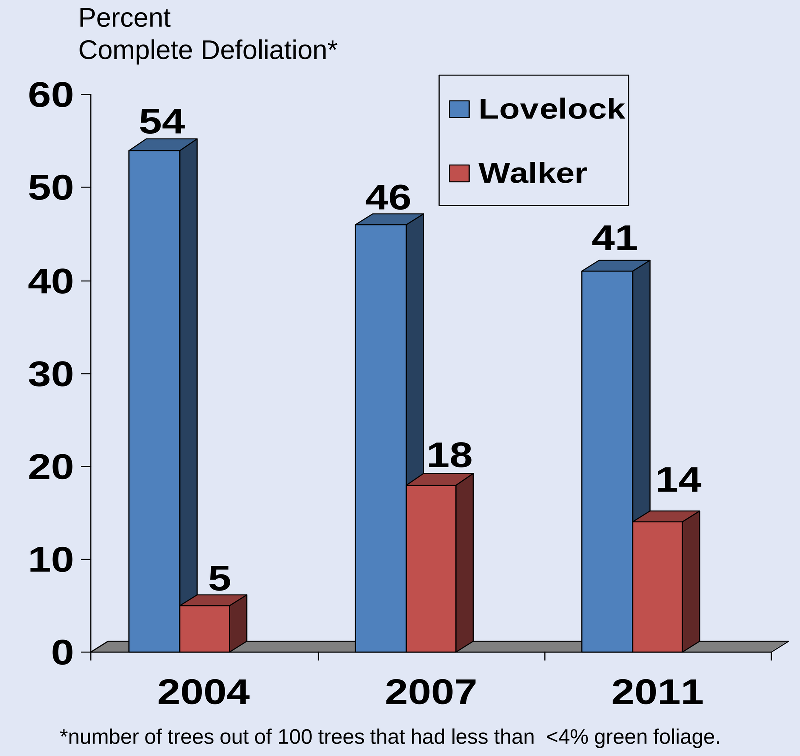

Figure 2. Saltcedar defoliation at both the Lovelock and Walker Lake sites for 2004, 2007 and 2011. Visual reference below of maximum defoliation.

Figure 5. 2011 Imazapyr (*Habitat*) application (1%, 8 pints/acre), one year after a 2010 mowing treatment.

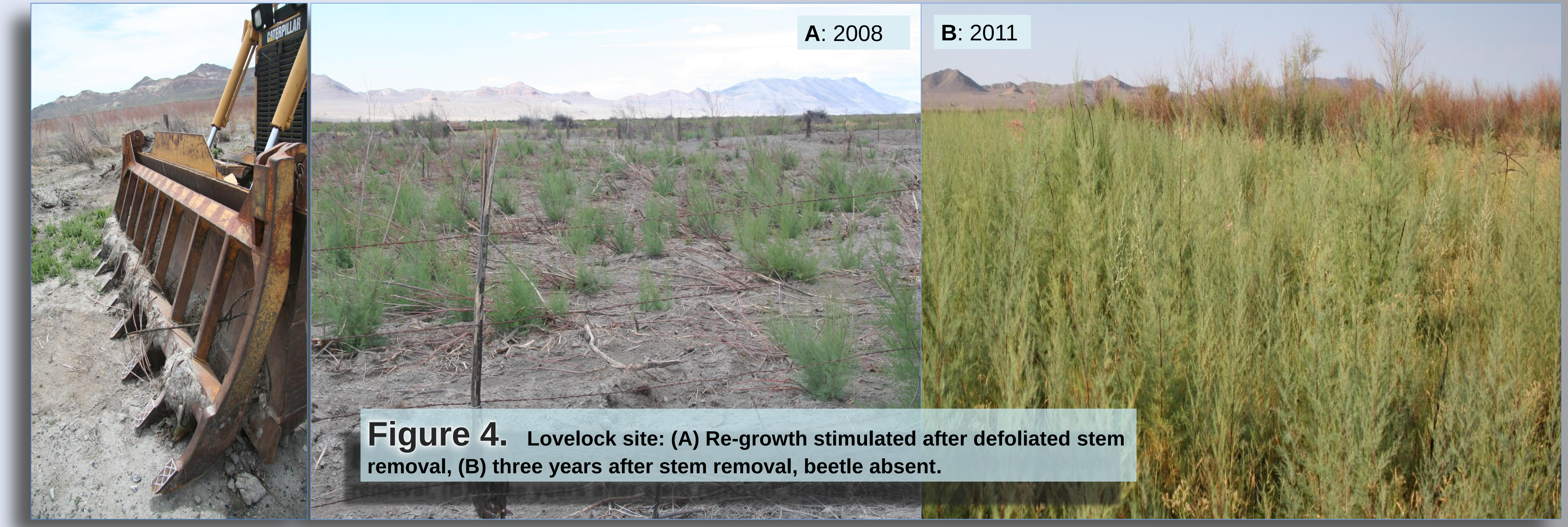

Figure 4. **Lovelock site: (A) Re-growth stimulated after defoliated stem removal, (B) three years after stem removal, beetle absent.**

Discussion

While defoliation from bio-control occurred, we observed a high percent of re-growth of near completely defoliated trees after removing the defoliated stem overstory **(Figure 4)**. In 2011 the beetle was absent, which along with the nature of salt cedar; deep rooted, re-spouting and long-lived, rendered bio-control ineffective.

In 2011 we began herbicide control trials **(Figure 5)**. Various rates of Imazapyr (*Habitat*), Triclopyr (*Garlon*) and Aminopyralid (*Milestone*) were used in combination with mowing treatments. Preliminary results indicate Triclopyr and Aminopyralid do not provide adequate kill rates. Imazapyr did provide high kill rates however with drought conditions (2012) understory damage occurred (saltgrass *Distichilis spicata* and creeping rye-*Leymus triticoides*) **(Figure 6)**. These sites are very difficult to revegetate due to salinity and droughty soil conditions. Imazapyr is the most effective for control but not ideal because of understory damage. In 2013 understory root propagative species (Poverty weed -*Iva axillaris*, saltgrass and creeping rye) did return **(Figure 6)**.

Using integrated weed management, including mechanical and herbicide application, saltcedar control can be achieved.

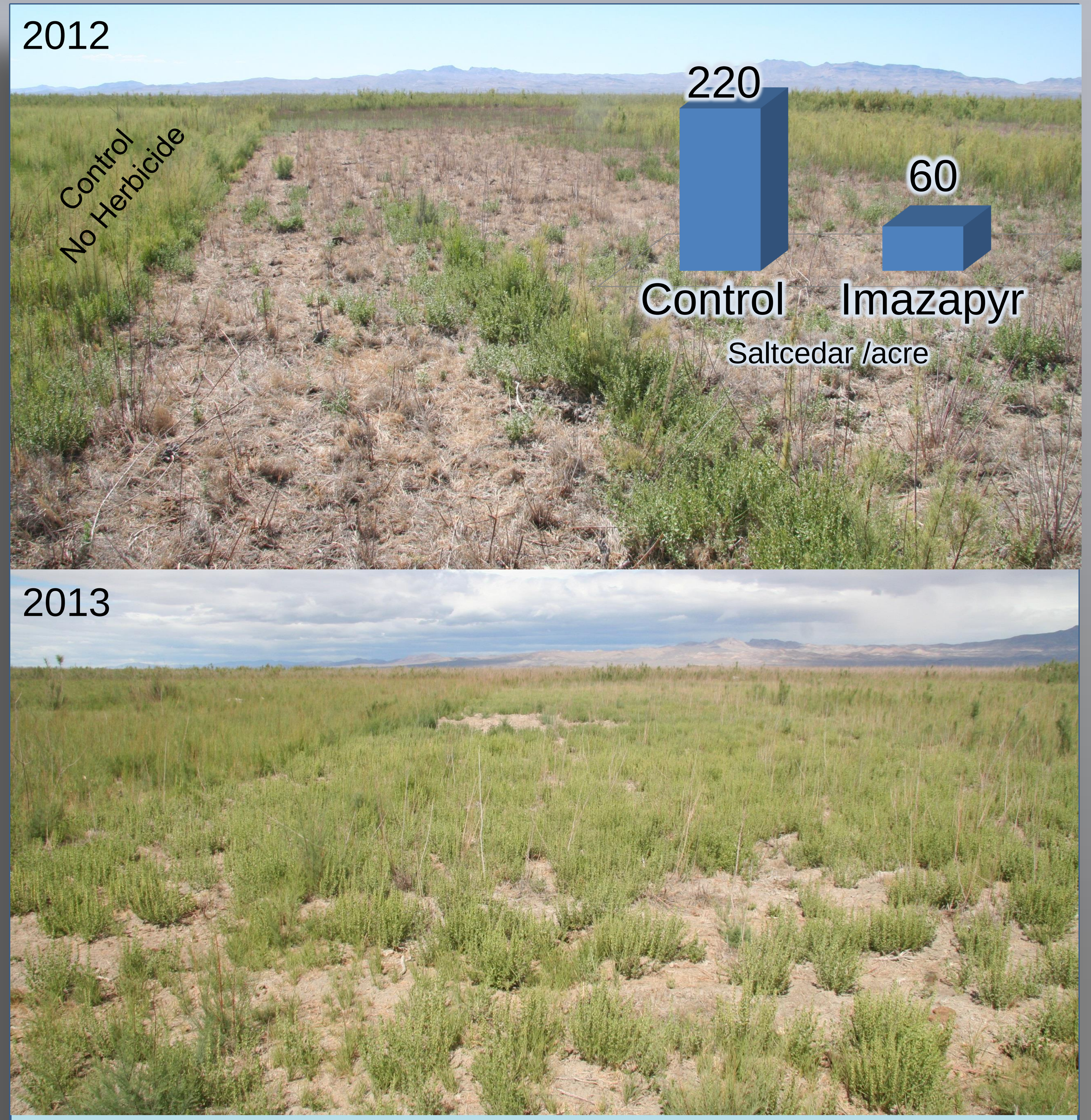

Figure 6. Understory damage (Imazapyr) 1 year after spraying and return of root propagating plants (poverty weed).