

# Russian olive invasion, removal and restoration along the Yellowstone River

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## Summary

Many areas on the Yellowstone River have converted to dense Russian olive stands, reducing agricultural and ecological value. Controlling Russian olive is a multi-year commitment, with stump resprouting occurring up to two years post-removal and massive recruitment from seed after that (Fig. 1). Restoration after Russian olive removal may take years to establish but can result in reduced weed abundance (Table 1). Area surveys indicate that shrubs may decrease invasibility in this landscape (Fig. 2).

## Methods

## Results

Restored plots did not have different seeded species cover than controls three years post restoration (Table 1). Cover of desirable (seeded) species was quite high by 2015.

Some seeded species were slow to establish: switchgrass (seeded in 2012) was observed in one plot in 2014, in 2015 it was present in 50% of the plots.

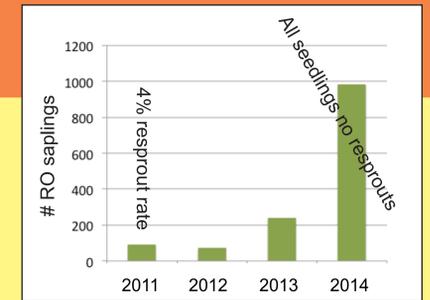


Figure 1. Number of Russian olive saplings treated over the 4.8 acre area. Even with yearly followup spraying, stumps resprouted up to two years post-removal. Cost per acre per year 3.3PH, 2.6 gal herbicide.

## Removal



Block 1: pre-removal May 2011



Block 1: post-removal May 2011



Russian olive trees cut with tree shear to ground level and immediately sprayed with 3:1 basal bark oil, triclopyr mix.

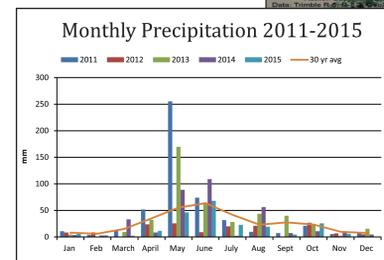
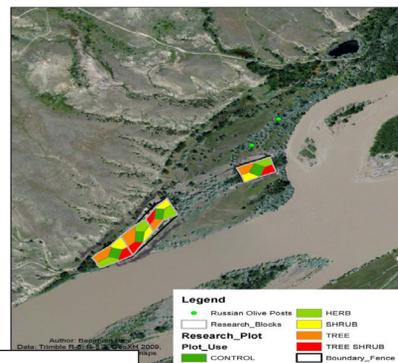
## Restoration

Herbaceous seeding mix planted in all plots except control consisted of four grass species and ten forb species.

**Woody species planted:**  
(% survivorship over first winter)

- Four TREE species:
- boxelder (50)
  - green ash (85)
  - narrowleaf cottonwood (25)
  - plains cottonwood (50)
- Four SHRUB species:
- buffaloberry (66)
  - chokecherry (63)
  - golden currant (50)
  - Woods' rose (92)

Location of study sites at USDA-ARS Fort Keogh Livestock and Range Research Laboratory



## Costs

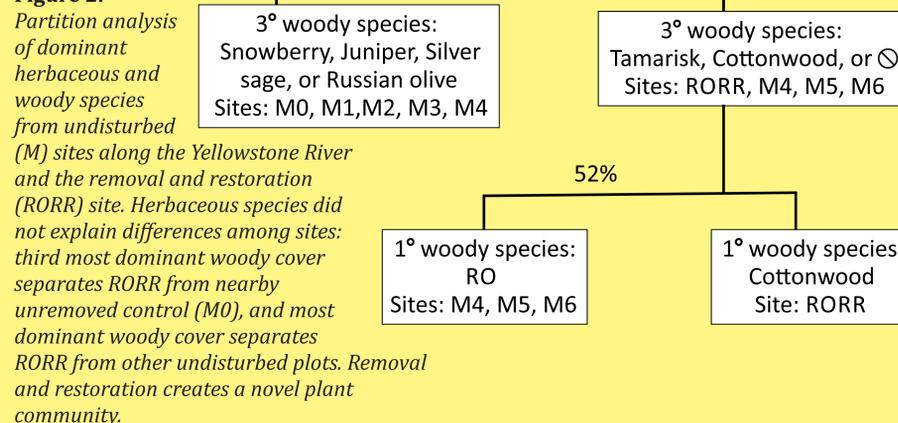
**Cost per acre of revegetation:**  
(excluding equipment)

- Prep spraying 4.1 person hours (PH)
- Glyphosate 0.67 gal (~\$17)
- Seeds \$263
- Harrowing/seeding 1.7 PH
- Trees and shrubs \$277
- Transplanting 37 PH
- Weed fabric \$83
- Fencing 5.2 PH, \$938 materials

Treatment / Year	Exotic Perennial Grass	Exotic Forb	Seeded Species	
CONTROL	2010	9 (9)	41 (31)	0 (0)
	2012	30 (31) §	16 (21)	8 (11)
	2015	33 (18) §	9 (6) A	26 (13)
HERB ONLY	2010	30 (32)	29 (36)	1 (3)
	2012	8 (22) §¶	20 (21)	5 (14)
	2015	12 (15) ¶	13 (15) §¶	40 (31)
SHRUB	2010	33 (35)	6 (8)	20 (38)
	2012	3 (8) ¶	12 (14)	10 (16)
	2015	6 (7) ¶	10 (12) ¶δ	62 (22)
TREE	2010	17 (22)	18 (25)	4 (9)
	2012	23 (35) §¶	11 (16)	3 (7)
	2015	19 (26) §¶	3 (4) §¶δ	47 (23)
TREE AND SHRUB	2010	20 (24)	7 (11)	4 (9)
	2012	3 (8) §¶	8 (16)	0 (0)
	2015	5 (4) ¶	20 (15) δ	40 (26)

Table 1. Percent cover (one standard deviation) of select functional groups by treatment through time. Seeded (desirable) species were present in plots at the start of the study. Statistical models were run on change from pre-removal cover because of wide variation among plots in initial conditions. Different symbols indicate significant change (Tukey's HSD  $p < 0.05$ ) from initial conditions with each year and functional group. Although cover of desirable species appears to increase with time, large variation results in no significant differences three years after planting. Active restoration reduced cover of exotic perennial grass species and sometimes exotic forb cover.

Figure 2. Partition analysis of dominant herbaceous and woody species from undisturbed (M) sites along the Yellowstone River and the removal and restoration (RORR) site.



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## Block 1 Shrub



Aug 2012



Aug 2013



May 2014



July 2015