ILLINOIS NATURAL HISTORY SURVEY

TECHNICAL REPORT

CROWN VETCH (*Coronilla varia*) CONTROL STRATEGY FOR LOST MOUND SAND PRAIRIE

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Prepared for: U.S. Fish and Wildlife Service

INHS Technical Report 2008 (40)
Date of issue: 08 November 2008

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Introduction

Crown vetch (*Coronilla varia*) is an aggressive non-native legume species that forms dense monospecific mats and crowds out native grasses, forbs, and even shrubs. It is the most serious invasive species threat in the sand prairies at the former Savanna Army Depot (hereafter Lost Mound) and has high potential to fundamentally alter the sand prairie plant communities. Crown vetch may cause declines of some of the 13 state-listed plants species, reductions of other native plants, and diminished habitat quality for grassland birds. In addition, crown vetch is a nitrogen-fixing plant and alters soil properties by increasing nitrogen availability and facilitating the growth of nitrogen-limited plant species including many other non-native species. Because crown vetch is widespread at Lost Mound and herbicides are expensive, we undertook this project to examine the effectiveness of three different chemicals for killing crown vetch in order to develop a more efficient control strategy.

Original objectives:

1. Test three herbicides
    a. Roundup
    b. Garlon 3A
    c. 2,4-D Amine
2. Apply at two times
    a. September 2007– fall growing season
    b. May 2008 - early growing season
3. Burn sites before spring herbicide treatment.
4. Monitor sites before and after treatment to determine effectiveness of each combination of treatments.
5. Control new seedlings in treated patches with handheld infrared weeder.

Methods

We located 30 discrete patches of crown vetch in the E-area ammunition storage area at the former Savanna Army Depot. We measured the widest diameter of each patch and the width perpendicular to the widest dimension. Near the center of the patch we measured the height of the vegetation. Within each patch we estimated the percent cover of crown vetch and noted the presence of any other species. In most patches the only other species with cover of 5% or more was Kentucky bluegrass (*Poa pratensis*). We treated five patches with each herbicide using backpack sprayers on 5 October 2007. Treatments were assigned randomly and post-hoc tests confirmed that patch characteristics (area, height, initial crown vetch cover) did not differ among treatments (Table 1). We monitored these plots in late October 2007, late May 2008, and late October 2008, recording the status or percent cover of crown vetch each time. Because crown vetch often forms a persistent seed bank we anticipated new seedlings would grow in the treated patches. We intended to treat new seedlings in the patches in spring 2008 with a hand-held infrared weeder but the equipment was not purchased. The remaining 15 patches of crown vetch were to be treated as above in spring 2008 after a prescribed burn but the area requested was not burned so these patches were left untreated.

Results

All three herbicides appeared to kill the crown vetch within 3 weeks (Figure 1). By the following spring most patches appeared dead and matted (Figure 2). However, a closer examination of treated patches in spring revealed seedlings or resprouts in nine of the fifteen patches. Percent cover of crown vetch within treated patches in May 2008 was highest in patches treated with Roundup (Figure 3). Crown vetch cover in May 2008 ranged between 5-25% in patches treated with Roundup and, with one exception, between 0-1% for patches treated with 2,4-D and Garlon. One patch treated with 2,4-D had 10% crown vetch cover in May 2008, perhaps because it was not completely sprayed with herbicide.

Larger patches recovered more quickly and percent crown vetch cover in May 2008 was positively correlated with initial patch area (Figure 4). This effect of area was driven by the recovery of patches treated with Roundup because all but one of the other patches had between 0-1% crown vetch cover in May 2008. After one year percent cover was not related to initial patch area (Figure 4). On the other hand, crown vetch cover after one year (October 2008) was strongly related to cover in May 2008 (Figure 5).

One year after treatment the difference between patches treated with Roundup and the other two herbicides was striking. Roundup-treated patches had substantial cover of crown vetch with smaller amounts of other weedy forbs, some bare ground, and very little grass (Figure 6). Patches treated with Garlon or 2,4-D had substantial grass cover with crown vetch seedlings or resprouts scattered through the patch (Figure 7). Not surprisingly, grass cover (mostly the non-native cool-season species *Poa pratensis*) was significantly lower in Roundup-treated plots than in the other two treatments (Figure 8). All the patches had some crown vetch one year after treatment. Most Garlon and 2,4-D plots had crown vetch cover of 15% or less while Roundup plots had 50-80% crown vetch cover one year after treatment.

Conclusions and Recommendations

Crown vetch is a threat to the native flora of the site (Symstad 2004) and little has been done by land managers to limit the spread of existing patches and prevent new patches from developing. Control of crown vetch should be a high priority if preservation of the native prairie plant communities is a goal of the land management plan at Lost Mound. But widespread spraying of herbicides could be just as detrimental as doing nothing because of the many native species, and in particular rare species, that occur at Lost Mound and could be affected by herbicide drift. Therefore, targeted spraying with backpacks should be the primary strategy in high quality areas. A truck-mounted boom sprayer could be used along some roadsides, especially after mowing, but most of the crown vetch occurs not along roads but scattered through out the sand prairies. An ATV-mounted sprayer could be used in particularly large patches (such as in the southern part of E-area), but off-road vehicle use should be minimized because of soil compaction and collateral damage to bird nests, other wildlife, and plants. Tracks from off-road vehicles (including seed harvesters) are visible for several years and vehicles spread seeds of invasive species such as sweet clover (*Melilotus alba* and *M. officinalis*)and knapweed (*Centaurea maculosa*)

Roundup was much less effective in controlling crown vetch in general, and was particularly ineffective with larger patches. However, all patches had some recovery so a single treatment of

any herbicide will not be an adequate control strategy. In addition, patches treated with 2,4-D and Garlon were dominated after one year by the non-native cool season grass *Poa pratensis*. In other words control of crown vetch led to a secondary invasion (Symstad 2004). Thus, a multi-step treatment is necessary. One possibility is to treat patches in the fall and then burn the individual patches in late spring. At this time (late May) all the patches, regardless of herbicide were dead and matted (Figure 2) and the seedlings of new or resprouted crown vetch and the surrounding vegetation were green. A burn at this time may kill the new seedlings and could be done on a patch by patch basis with a two- or three-person burn team. An alternative is to spray two or three years consecutively and deplete the seed bank. Either approach will require seeding with native species in the spring. Given the nitrogen-fixation of crown vetch and subsequent changes to soil nutrients the more crown vetch spreads the more difficult it will be to restore native prairie species because the native species tend to be poor competitors with fast-growing nitrogen-demanding species which are often non-native species. Therefore, control of crown vetch will be a long-term process but needs to start in earnest immediately.

Citation

Symstad, A.J. 2004. Secondary invasion following the reduction of *Coronilla varia* (crownvetch) in sand prairie. American Midland Naturalist 152: 183–189.

Table 1. Patch characteristics, herbicide treatments, and post-treatment crown vetch and grass cover. Herbicide treatments were assigned to patches randomly. Patch characteristics including area (ANOVA F= 1.2; df = 2, 12; P = 0.3), height (F= 0.3; df = 2, 12; P = 0.7), and initial crown vetch cover (F= 0.9; df = 2, 12; P = 0.4) did not differ among treatments.

plot #	Patch Area (sq M)	Patch height (cm)	Initial cover (%) 10/4/07	Herbicide treatment 10/5/07	Vetch cover (%) 05/28/08	Vetch cover (%) 10/28/08	grass cover (%) 10/28/08
1	56	40	70	Garlon	1	5	90
2	27	30	90	Roundup	15	75	20
3	24	30	85	Roundup	5	50	50
4	26	40	50	2,4-D	0	5	95
5	19	30	85	2,4-D	1	5	85
6	34	20	75	Garlon	1	2	95
7	16	40	80	Garlon	0	60	40
8	46	40	70	Roundup	25	75	5
9	13	40	75	Garlon	0	15	75
10	10	40	65	2,4-D	0	10	90
11	50	50	50	Roundup	20	50	5
12	47	40	80	2,4-D	10	45	50
13	33	50	50	2,4-D	0	1	95
14	78	40	85	Roundup	25	80	15
15	49	40	80	Garlon	0	10	95

Figure 1. Crown vetch plot (#13) 19 days after fall treatment with 2,4-D.

Figure 2. Crown vetch plot (#8) in May 2008, seven months after treatment with Garlon.

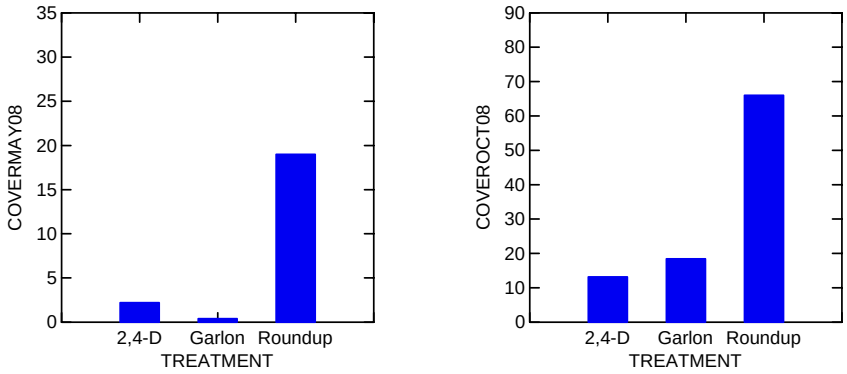

Figure 3. Average percent cover of crown vetch within treated patches seven months (left) and one year (right) after treatment with three herbicides. Crown vetch cover in Roundup patches was significantly greater compared to the other two herbicides in May 2008 (ANOVA F= 14.09; df = 2, 12; P = 0.001) and October 2008 (ANOVA F= 11.45; df = 2, 12; P = 0.002).

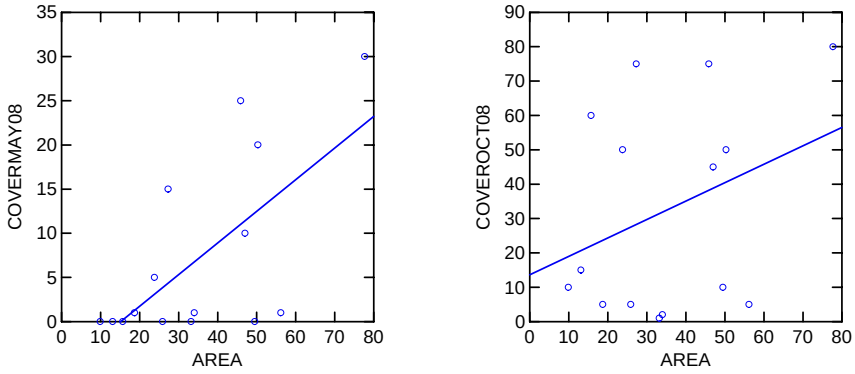

Figure 4. Percent cover of crown vetch within treated patches seven months (left) and one year (right) after treatment as a function of initial patch area. Cover in May 2008 (left) was greater in larger initial patches (F= 9.67; df = 1, 13; P = 0.008) but note that this relationship was only true for patches treated with Roundup. One year after treatment (right) cover was not related to initial patch area (F= 1.6; df = 1, 13; P = 0.2).

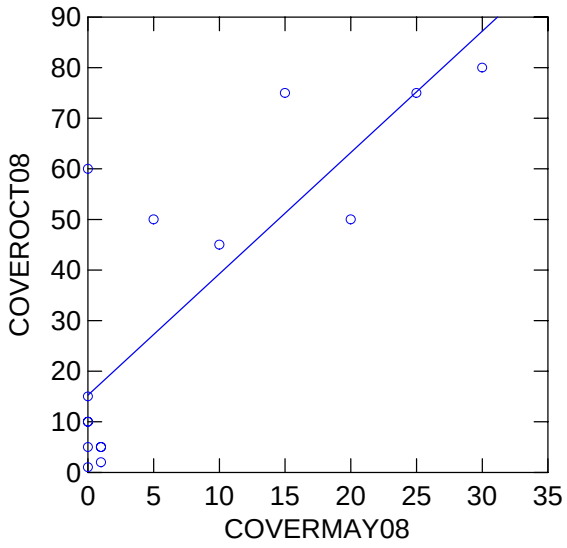

Figure 5. Crown vetch cover in treated patches after one year (October 2008) is strongly related to cover after seven months (May 2008). ($F = 26.2$; $df = 1, 13$; $P < 0.001$)

Figure 6. Crown vetch plot (#8) one year after treatment with Roundup. In close view (below) note *Solanum carolinense* with orange fruits.

Figure 7. Crown vetch plot (#12) one year after treatment with 2,4-D showing substantial grass cover (above) mixed with new seedlings or resprouts of crown vetch (below).

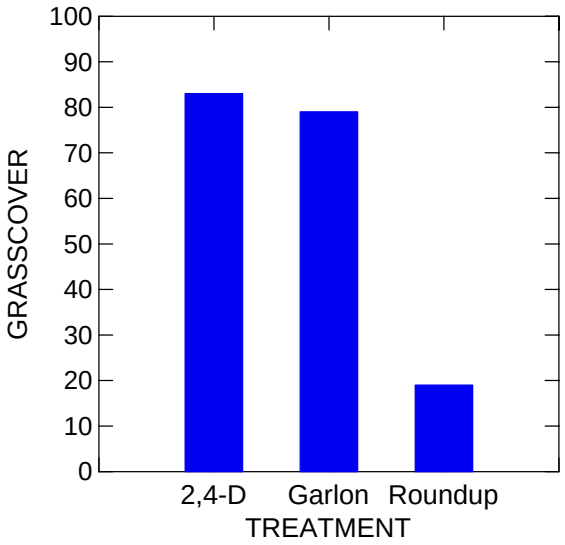

Figure 8. Percent grass cover in treated crown vetch plots one year after treatment. Grass cover is significantly lower in Roundup plots compared to the other two treatments (ANOVA F= 15.5; df = 2, 12; P < 0.001).