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Leafy spurge control in a tallgrass prairie natural area

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Introduction

The Nature Conservancy owns and manages Bluestem Prairie, a 2,500 acre tallgrass prairie nature preserve located in Clay County, Minnesota. The Minnesota Department of Natural Resources Scientific and Natural Areas Program provides assistance in management of the gene. The prairie is located about 15 miles east of Moorhead, MN.

Bluestem Prairie is one of the finest tallgrass prairie remnants in Minnesota and contains a diversity of habitats and most species common to prairie including Greater Prairie Chicken. The prairie contains 13 plant and animal species listed by the state as either special concern, threatened or endangered and contains a plant species that is on the federal threatened species list.

Leafy spurge occurs on the prairie and is of major concern to The Nature Conservancy because of the potential threat this aggressive and persistent plant poses to the biological diversity of Bluestem Prairie. The other concern of The Nature Conservancy was developing a strategy that would effectively control leafy spurge and not threaten the natural qualities of the prairie that needed to be protected and maintained.

In 1987, experts in biological and chemical control and local agricultural inspectors and other land managers working on leafy spurge were invited to Bluestem Prairie to view the leafy spurge infestation. These individuals were asked to recommend a control strategy that would not compromise the natural values of the prairie, but would address The Nature Conservancy's primary objective of eliminating leafy spurge from Bluestem Prairie. The question posed to the visitors was, "What strategy would lead to elimination without harm to the biological diversity of the site?"

A lot was learned that day, but in the end the recommendations could be condensed to three practices that used in combination might lead to leafy spurge eradication. These practices were early detection, annual applications of picloram (Tordon 22K), and continuous monitoring. Armed with these recommendations, a strategy was developed to maximize leafy spurge control and minimize adverse effects of the herbicide on native flora and fauna.

Methods

Volunteers and contract employees searched the property for leafy spurge patches. A preliminary search was conducted in 1985 and 1986 and a more thorough search of the entire property was conducted in 1987 and 1988. Since 1988, about half of the prairie was surveyed each year. In addition, new patches were identified and documented during treatment of known patches or when other management activities were being conducted.

All patches were permanently marked with steel posts and each patch was assigned a number and tagged with an aluminum marker. Permanently marking patches made re-treatment more efficient. The marked patches were surveyed each year and treated with herbicide if viable plants, seedlings, and new shoots were found.

The first treatment of newly found patches were generally a broadcast treatment with a backpack sprayer. Herbicide treatments were applied to large patches with a John Deere AMT 8 foot boom sprayer using coarse flat fan nozzles and herbicide delivered at a pressure of 30 psi. Follow-up spot treatments of individual or scattered plants were usually made with a backpack sprayer.

Picloram was applied at the maximum labeled rate of 2 lbs picloram/acre. A spray solution contained 2.5 ounces of herbicide and 0.2 ounces of blue dye in 1 gallon of water. The dye made treated plants easier to see, improved treatment efficiency, and enabled safer chemical application because the applicator could easily detect exposure to the spray solution.

Prescribed fire was used to enhance chemical control efforts. Fire effectively removed plant litter in the most heavily infested leafy spurge areas. Benefits to burning include the following.

- 1) Increased visibility of leafy spurge plants, especially small shoots.
- 2) Enabled more chemical to reach the leafy spurge foliage and roots, instead of being intercepted in the litter layer.
- 3) Improved detection and treatment of leafy spurge growing in association with woody species by stimulating regrowth of the weed. This stimulation resulted from suppression of the woody species and release of leafy spurge from competition.
- 4) Possible enhancement of seed germination followed by “flushes” of seedling growth. These flushes of seedlings could serve to deplete viable leafy spurge seed from the soil seedbank.

Results and discussion

A total of 344 leafy spurge patches have been found since searching activities began in 1985. The patches cover about 18 acres or 0.7% of Bluestem Prairie. Patches were found throughout the prairie and assuming even patch distribution, there is one known leafy spurge patch for every 7 acres of grassland. Clearly, without aggressive control, the prairie ecosystem and the biological diversity and uniqueness of the site would be lost. The current distribution of leafy spurge patches on Bluestem Prairie (color coded by year

the patch was located) is illustrated in Figure 1. A total of 204 leafy spurge patches were found after two thorough surveys were completed by 1988 (Figure 2). An average of 32 new patches per year have been found since the survey in 1988 and the total patch count on Bluestem Prairie continues to rise at a disturbing rate (Figure 3).

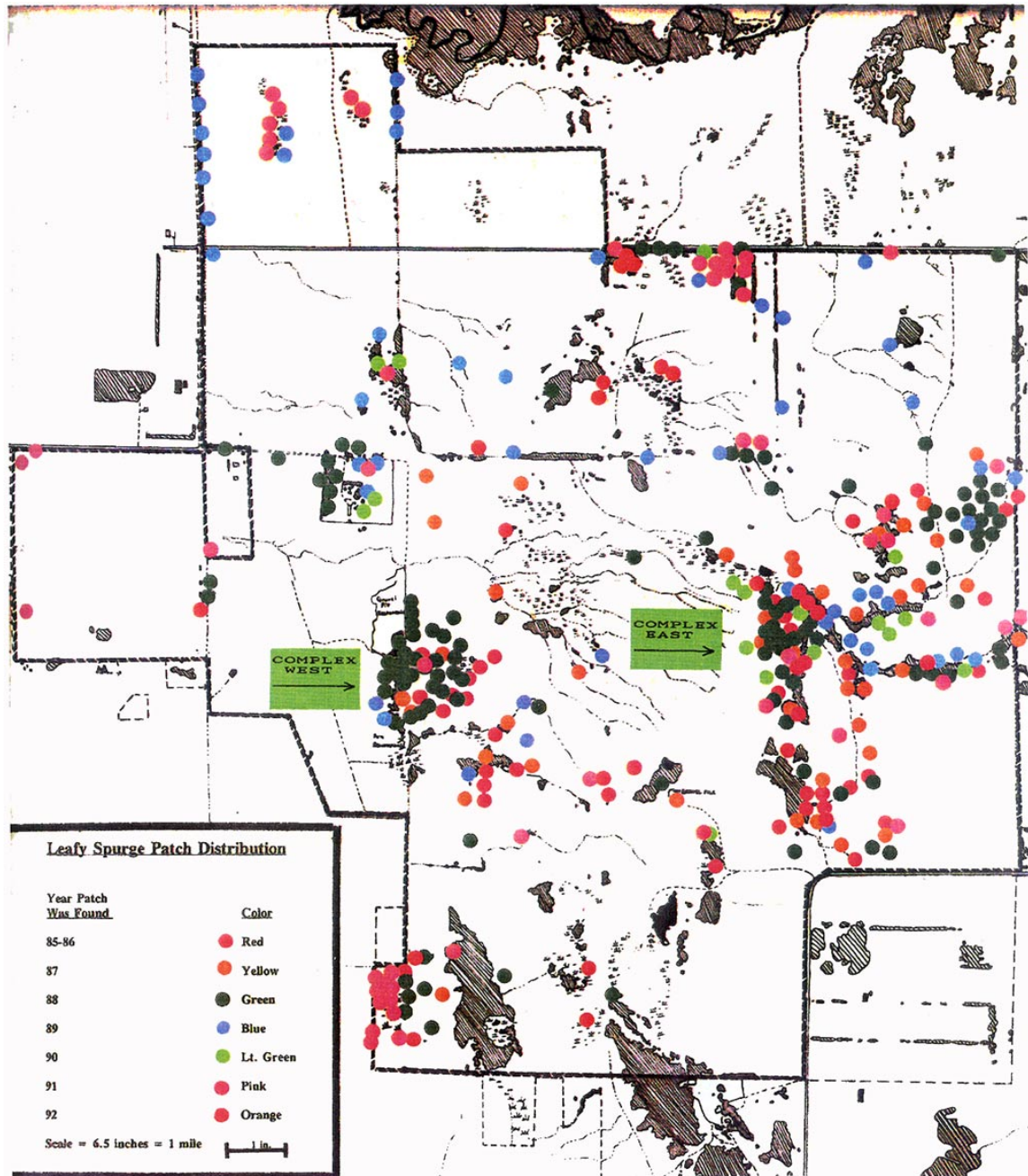


Figure 1. Bluestem Prairie leafy spurge patch distribution color coded by year the patch was found.

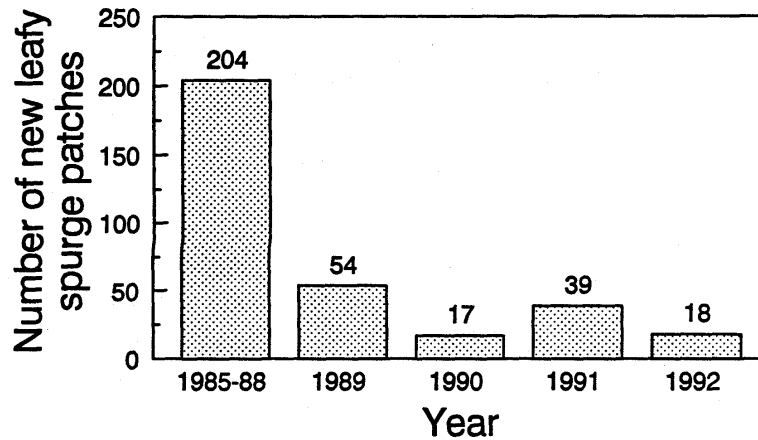


Figure 2. Number of new leafy spurge patches found each year on Bluestem Prairie.

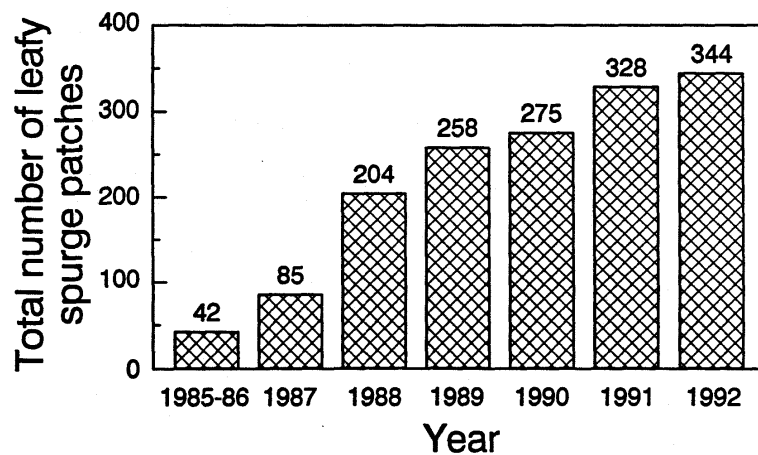


Figure 3. Total number of known leafy spurge patches on Bluestem Prairie. The total in 1991 includes 14 patches found on 180 acres of additional land.

Comprehensive survey of the property enables detection of small patches. These surveys have been and continue to be absolutely essential to The Nature Conservancy's management program to eliminate leafy spurge. Early detection of leafy spurge patches stops additional seed production, thereby, decreasing new patch establishment rate, reduces the amount of herbicide needed because most patches are small, and increases level of control because plants in small patches usually have less extensive root systems and can be eliminated more easily than older, well established patches.

Applying picloram in the manner described has been effective. There has been a substantial decrease in the number of leafy spurge stems per patch as number of treatments has increased (Figure 4). There was an estimated average of 530 stems per patch before the first herbicide treatment, but after 8 treatments, average stem count per patch dropped to 30 stems.

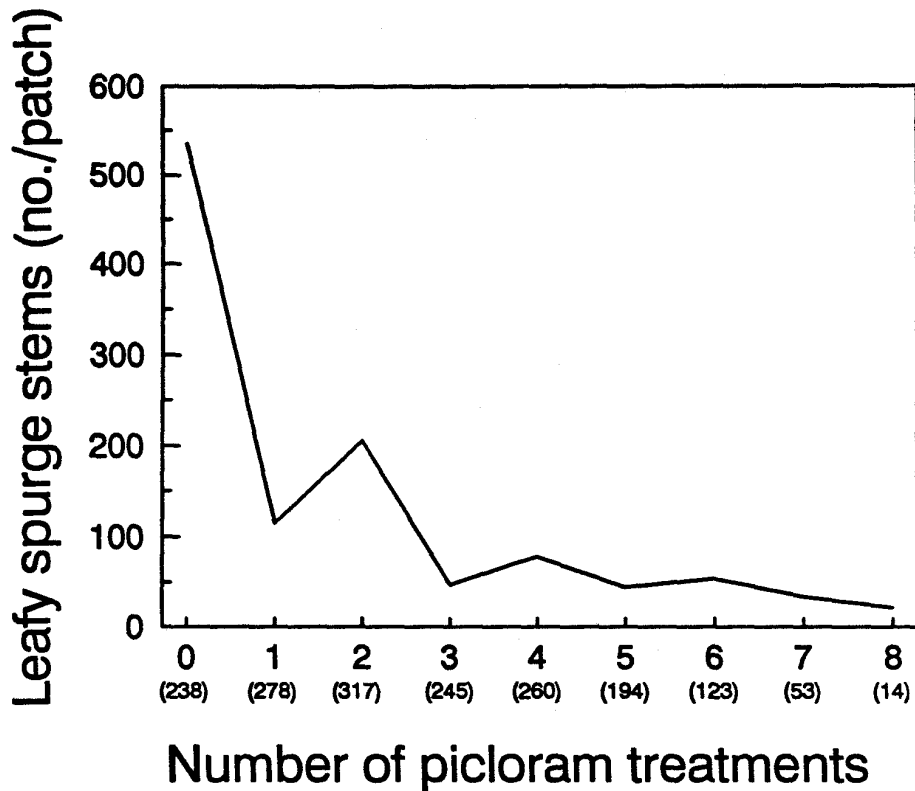


Figure 4. Mean number of leafy spurge stems per patch receiving from 0 to 8 consecutive annual applications of picloram (TORDON 22K) on Bluestem Prairie. Values in the parenthesis are number of patches used to calculate number of leafy spurge stems per patch.

Excellent control with picloram can be achieved, but as posed earlier, “Is elimination of leafy spurge patches possible?” In 1992, 69 of the 344 patches (20%) had no plants present when checked for treatment from mid-June to mid-July (Table 1). It is unlikely that these 69 patches have been eliminated. About 2 to 5% of the patches have been eliminated, based on number of consecutive years that a patch has had no leafy spurge present (Table 1). This is an underestimate of the success of the weed control strategy, because the percentages were calculated using all 344 patches. This total patch number reflects an average of 32 new patches per year that have been identified; therefore, many patches have received just 1 or 2 treatments and elimination should not be expected after such a few number of treatments.

Amount of herbicide applied per patch and time spent treating each patch were measured. The average amount of herbicide applied per patch dropped from about 3 oz in 1988 to 0.4 oz in 1992 (Table 2). Time spent treating decreased each year since the leafy spurge eradication program was implemented. Time treating included time spent traveling between patches, spraying time, and time spent searching for plants. The decrease in treatment time was partly due to decreased travel time between patches caused by an increase in the number of patches identified. As the control program has matured, the time spent searching for plants within a patch increased, while time spent spraying decreased.

Table 1. Percent of total number of leafy spurge patches that had 0 plants present for 1, 2, 3, and 4 consecutive years.

Consecutive years	Years	Patches with no plants
		-----%-----
1	1992	20
2	1991 through 1992	7
3	1990 through 1992	5
4	1989 through 1992	2

Table 2. Mean ounces of picloram (Tordon 22K) applied per patch and time spent treating each patch from 1988 to 1992.

Year	Picloram applied	Patches with no plants
	----- oz/patch -----	----- % -----
1988	3	63
1989	1.2	33
1990	1	34
1991	1.2	26
1992	0.4	18

Conclusions

Several conclusions can be drawn from these results with leafy spurge control on Bluestem Prairie.

1) The decision to use picloram to control leafy spurge in manner described minimized the adverse effects of both picloram and leafy spurge on the native prairie community.

2) Extensive surveys for new patches is essential to the eradication program. Patches must be found when they are small and the survey should be repeated annually because many small, non-flowering patches can be easily missed. In addition, leafy spurge seed remains viable for up to 8 years and can contribute to reestablishment of patches.

3) Diligent leafy spurge control by neighbors is critical to control program success because leafy spurge seeds are readily dispersed and easily establish new catches. Many new patches were and are being found each year despite virtually 100% elimination of seed production on Bluestem Prairie.

4) Leafy spurge patches must be permanently marked to enable thorough and efficient treatment each year. Without markers, the ability to locate, and retreat many patches would not be possible until a few surviving plants reestablish the patch and increase its visibility.

5) Patches can be eliminated using picloram, but it takes time and persistence. Excellent control, but not eradication, is achieved after the first treatment.

6) Time spent treating and picloram applied per patch decreased as did the overall cost of the control program with follow-up treatments. Continued cost benefit and ultimate success of the control will hinge on eventually halting establishment of new patches.

The Nature Conservancy's leafy spurge control program has been successful at controlling the patches that have been sprayed annually for a number of years. Preliminary evidence suggests that elimination of small patches may be occurring within Bluestem Prairie. Picloram is very persistent and does damage some native plant species even when used properly. Picloram is classified as a restricted use herbicide and must be applied by an EPA certified applicator. There are restrictions in where this herbicide can be used particularly on sites where the depth to ground water is shallow. The herbicide must be applied in accordance with the label. Herbicides are a tool of last resort in The Nature Conservancy's natural areas management program and are appropriate technology to reach the management objective of leafy spurge eradication. In the next few years, it is hoped that there will be a decrease in the number of new patches found and that herbicide treatments will eradicate leafy spurge from the Bluestem Prairie.

Another aspect that warrants additional attention is a need to increase monitoring and application of control measures on lands adjacent to Bluestem Prairie. This coupled with increased efforts to educate other landowners and the general public about the threat leafy spurge poses to native plant communities is essential to the success of The Nature Conservancy's control program.