

Year-End Report for 2008 Yellow Toadflax Challenge Cost-Share Agreement

By

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PREFACE:

The end of 2008 concludes the third year of a cooperative Challenge Cost-Share Agreement between the US Fish and Wildlife Service, The Nature Conservancy, and Ducks Unlimited. The purpose of this agreement was to continue monitoring, control, research, and public awareness of yellow toadflax in south-central McPherson and north-central Edmunds Counties - primarily on lands owned and managed by FWS, TNC, and DU. The FWS provided funds for the purchase of herbicides and biological control agents totaling \$25,000, and TNC and DU were responsible for providing at least a 1:1 match toward this amount by means of expenditures incurred while completing objectives related to the Scope of Work listed in the CCSA.

MAPPING

A key piece of information concerning the monitoring and control of yellow toadflax in the project area is a detailed GPS/GIS map that indicates current locations of toadflax infestations. The mapping of FWS, TNC, and DU lands within the project area was cooperatively completed during the 2007 field season (Fig 1). However, an area of approximately 320 acres located on FWS property was not inventoried due to an application of herbicides in 2007 or 2008 to control toadflax made prior to mapping efforts. The effect of this herbicide on the yellow toadflax plants made visual detection of the infested acres very difficult and thus, nearly impossible to conduct an accurate inventory.

The Nature Conservancy

The Nature Conservancy updated GPS/GIS map data with new patches as they were found in 2008.

HERBICIDE TEST PLOTS

Ducks Unlimited

Monitoring and testing the effectiveness of various herbicides on yellow toadflax test plots continued on DU property in 2008. Varying combinations of different herbicides, timing of herbicide applications, and grassland disturbance factors prior to herbicide application were tested during 2007-2008. Four herbicide combinations were applied during 3 different time periods and under 3 different grassland disturbance scenarios during the fall of 2007 (Fig 2). Herbicide combinations were: Plateau (10oz/ac) + Telar (1.3 oz/ac), Plateau (10 oz/ac) + Tordon (1.5 pt/ac), Tordon (1.5 pt/ac) + Telar (1.3 oz/ac), and Plateau (10 oz/ac) + Escort (1.3 oz/ac). One control plot that did not receive any herbicide application was established for each of the disturbance scenarios. Either 2 or 3 test plots for each herbicide combination were treated during each of the 3 different time periods during 2007. Monitoring the vegetative response from the 2007 herbicide applications began during the 2008 growing season.

Results from these test plots were varied, with no consistent pattern of herbicide effectiveness being detected among the various treatment scenarios after the first season of monitoring (Fig 3). Most treatment plots appeared to have a limited number of toadflax stems occurring the year after herbicide application, however disturbance by livestock to some plots may have negatively impacted the density of toadflax stems visible for counting. Monitoring the effectiveness of these initial herbicide applications will continue on the test plots in 2009. Additionally, the mixture of Plateau and Escort at the applied rate may have been a little too concentrated for native grasses and forbs to tolerate. Thus, any future broad scale application of this herbicide mixture should be considered very carefully.

The Nature Conservancy

Monitoring the effectiveness of herbicides on toadflax in square meter test plots continued on TNC property this year. Stems counts were collect on 80 test plots comparing effectiveness of 21 different herbicide treatments applied in August of 2006 and/or 2007. Treatments containing some combination of Plateau, Tordon, Telar, and/or 2,4-D seem to be the most promising (Fig 4). Experiments with 2,4-D in combination with Plateau, Tordon, and/or Telar were conducted to determine if this would increase the effectiveness of the treatment. In 2008 some test plots showed 100% reduction in stems, however 2,4-D also seemed to increase injury to cool season grasses especially when in combination with Plateau. In 2008, new test plots were initiated with lower rates of Plateau and 2,4-D to see if good toadflax control was retained without injury to grasses (Fig 5). The results of these test plots will be obtained in 2009. Also in 2008, some previously treated test plots were retreated and will be monitored in 2009 to give more information on the effectiveness of various herbicides after 2 years of consecutive annual treatments. Other test plots were not treated in 2008 but will be monitored in 2009 to give further information on the effectiveness of herbicides 2 years after a single treatment.

Anecdotal information suggests that an earlier herbicide application (before or at the time toadflax flowering) may be more effective in the control of yellow toadflax than later applications. In 2008, 23 new sample plots were initiated to test 11 herbicides which were applied between late June and early July (Fig 6).

BROAD-SCALE TREATMANT OPERATIONS

Ducks Unlimited

Due to only the modest effectiveness of yellow toadflax control resulting from the application of the herbicide mixture (Tordon @ 1 pt/ac + Telar @ 0.75 oz/ac) applied by a spot spraying method on about 300 acres during 2006 and 2007, it was decided the amount of herbicides applied per acre would be increased (Tordon @ 1 qt/ac + Telar @ 1 oz/ac) on acres spot sprayed in 2008. This higher rate of herbicide was applied to over 300 additional acres on DU properties during the 2008 season from late August through mid-October. Effectiveness of this higher concentration of the herbicide mixture will be monitored in 2009.

The Nature Conservancy

Based upon the great variation in test plot results, numerous herbicide treatments were applied in a spot-spray approach on over 75% of the Conservancy property in 2007 and again in 2008 (Fig

7). The treatments were applied from late August through early October. Treatments were made to some areas before flowering (July) to see if the timing of the treatment would increase effectiveness and/or be a viable option for extending the herbicide application window on toadflax. Different rates were also used in different areas to see if toadflax control can be maintained without harming grasses.

The Fish and Wildlife Service

Approximately 525 acres of yellow toadflax infestations on the Perch Lake Waterfowl Production Area (WPA's) received herbicide treatments using a Tordon and Telar tank mix rate of 1pt./1oz. per acre on August 7, 8, 12, and 14. Other Fish and Wildlife Service properties receiving herbicide treatments were; Long Lake WPA, 5 ac.; Burrer-Schnabel WPA, 14.6 ac.; Helfenstein-Opp WPA, 53 ac.; 10/45 WPA, 7 ac.; Schumacher WPA, 3.2 ac.; Anderson-Vilhauer WPA, 74 ac.; Schurr WPA, 35 ac.; and Adam Geiner WPA, 20 acres. Treatment dates for these units occurred during August 7 through September 16. 736 acres of Service lands were treated with herbicides for yellow toadflax control.

BIOCONTROL

Ducks Unlimited

During late May of 2008, *Mecinus janthinus* insects (stem-mining weevils) were released at 3 different locations on DU property. Two of the releases were made at sites where these insects were released in the previous 2 years. It is currently unknown if these insects can survive the winter months and maintain a self-sustaining population at this locality due to the yellow toadflax plant physiology and/or due to the extreme winter weather conditions in the region. A test plot was designed to determine the potential for survival of this insect species over the winter months. Thus, the third release was conducted inside of a 3' X 3' X 3' screened cage that was placed over a dense stand of toadflax growing on DU property. Live stem counts of yellow toadflax were made prior to release of the insects inside of the cage. The cage will remain in place throughout the winter of 2009. During the spring and summer of 2009 this cage will be monitored to determine if any of the insects released in 2008 survived the winter, or experienced reproductive success. Counts of live toadflax stems will also be made in 2009 to determine if such a high density of insects (100 insects in a 3' square patch) will have an impact on toadflax control. During early August of 2008 *Gymnetron antirrhini* (seed-feeding weevils) were also released at 3 different locations on DU property. The same protocol was followed as was for the stem-mining weevils, including a release of these insects within a screened cage.

The Nature Conservancy

In 2008, 800 *Mecinus janthinus* insects were released at 2 new sites and as supplements to 4 previous release sites on the Conservancy property. Pre-release stem counts were conducted at all release sites. One year and two year post-release stem counts were conducted at the sites initiated in 2006 and 2007. One of the releases initiated in 2006 is showing a significant reduction in stems (-91%). Unfortunately, due to a spring wildfire and bison/cattle trampling, the exact location of two plots could not be determined in 2008. These two sites were supplemented with another release in 2008. In 2008 plant counts within a square meter plot at 2 and 5 meters from the release site was conducted to determine the spread and effect of the insects at a wider scale (Fig 8).

The Fish and Wildlife Service

The Service continues to maintain one biological control release site on the Perch Lake WPA. This site has received annual releases of Mecinus janthinus and Gymnetron antirrhini since 2006. Control effects of these insects is unknown at this time.

OUTREACH

Providing useful public information gained from this project is critical in the overall control of yellow toadflax in and around the project area. A public awareness meeting was conducted in 2008 for local landowners and agencies. Field tours and power point presentations were given to inform meeting participants about the findings of this collaborative project over the past 3 years. Suggestions were made on the various ways to control and stop the spread of yellow toadflax that have, in part, resulted from work completed on this project .

MATCH FOR THE 2008 FIELD SEASON

Ducks Unlimited

The \$32,564 of match contributions made by DU toward the 2008 CCSA was above the estimated \$19,708 amount listed in the Agreement. The breakdown of matching contributions for DU in 2008 is as follows:

		<u>Incurred Amount</u>	<u>Grant Amount Requested</u>	<u>Difference</u>
Technician Cost	173 hours @ \$40/hr =	\$6,920	\$6,200	\$(720)
Primary Assistant Cost	96 hours @ \$60/hr =	\$5,760	\$4,920	\$(840)
Land Manager Cost	108 hours @ \$73/hr =	\$7,884	\$4,088	\$(3,796)
Equipment Cost	100 hours @ \$25/hr =	\$2,500	\$2,500	\$0
Herbicide (Telar) Cost	24 pounds @ \$350/lb =	\$8,400	\$1,300	\$(7,100)
Project Materials and Supplies		\$1,100	\$ 700	\$(400)
Total Cost by DU in 2008 =		\$32,564	\$19,708	\$(12,856)

The Nature Conservancy

As of September 30, 2008 The Conservancy had match expenses totaling \$6825.99 for Salaries and \$288 for food at the outreach event. Salary expenses related to work on data analysis and reports after September 30, 2008 are not included in the above number.

CONCLUSION:

Work completed and new information gathered during the past three years by the primary participating Agencies concerning the yellow toadflax CCSA project has been quite beneficial in the overall battle to control and better understand this invasive weed species. Through experimental design, field trials and continued monitoring, we are just now beginning to narrow the spectrum of effective herbicide combinations, herbicide application rates, timing of application, and other practices that may eventually allow more efficient and effective control of this troublesome plant. However, as is the case with many new projects, time is an essential and critical element for success. Even though three plus years of work have been done within the project area, much more work needs to be accomplished before this project may be considered successful. Further work and cooperation among Agencies and surrounding landowners is essential to the continued success of this project.

FIGURES

Figure 1. Yellow toadflax infestation on DU, TNC, and USFWS lands (2006-2008).

Cooperative Toadflax Mapping Project

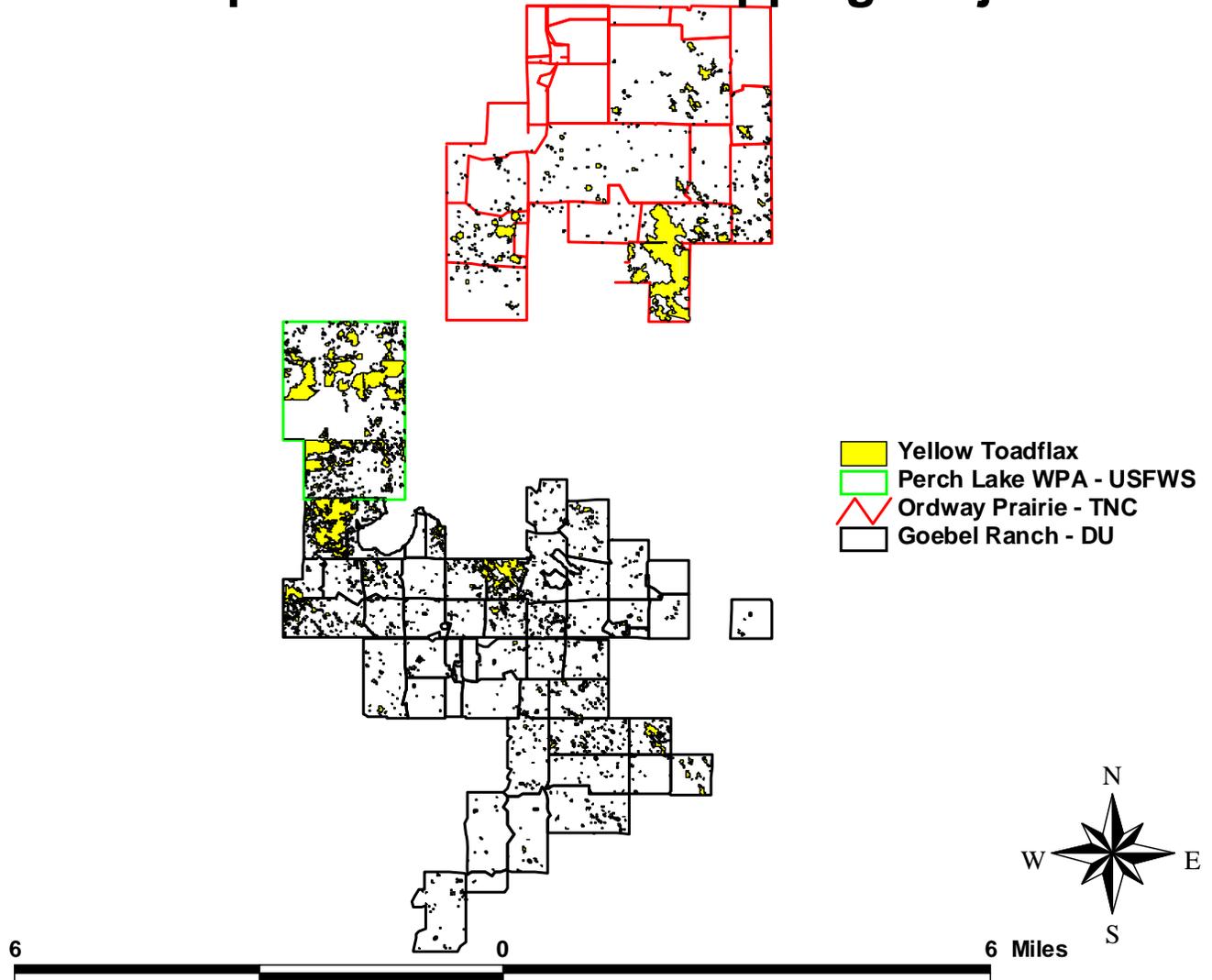


Figure 2.

Yellow Toadflax Test Plots Goebel Ranch 2007

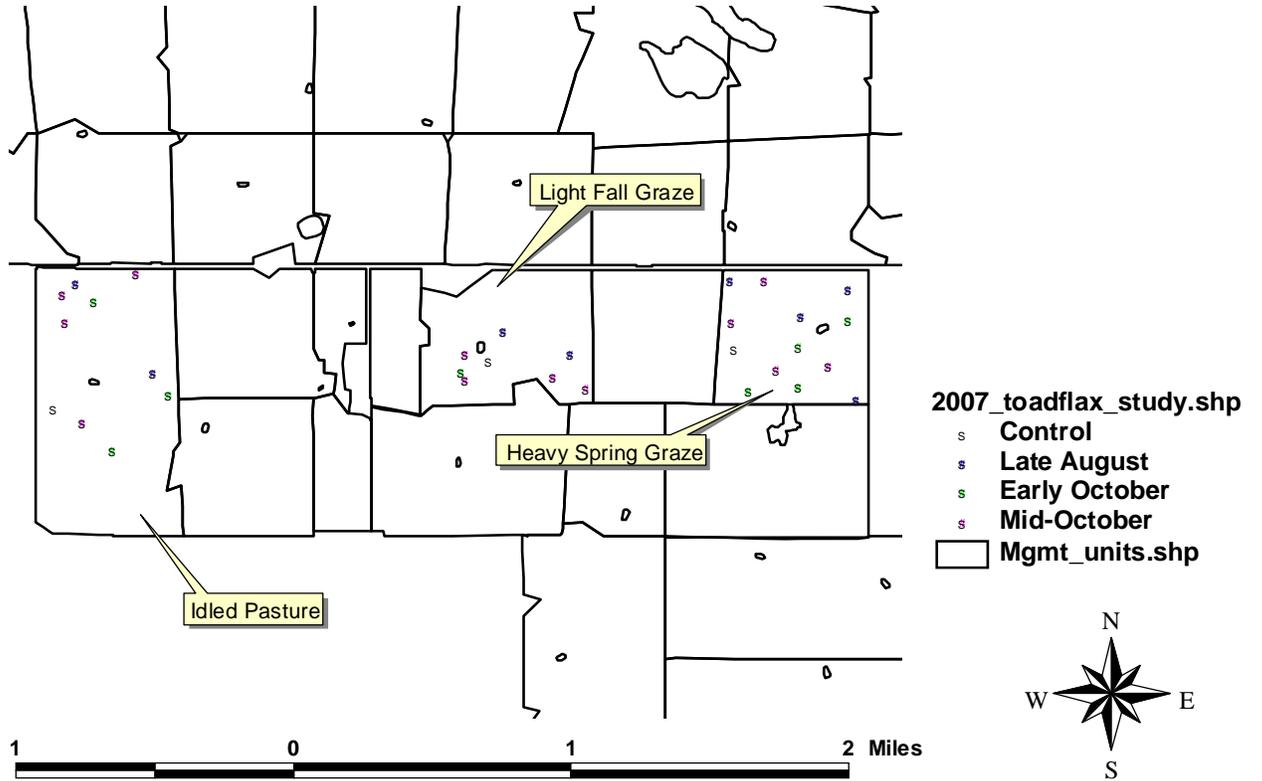


Figure 3. Results of different herbicide applications made at different dates under varying habitat disturbance factors which were made prior to herbicide application on DU property.

Plot	Treatment	Herbicide	Date Sprayed	Pre-Treat Stem #	Post-Treat Stem #	Comments
33A-8	Idle	Control	.	85	83	Many stems grazed off, thistle present in plot.
34B-4	Light Fall Graze	Control	.	134	?	Only one stake left. Dense infestation.
35B-5	Heavy Spring Graze	Control	.	105	96	Fairly dense all around.
34B-5	Light Fall Graze	Plateau/Telar	8/24/2007	76	0	Limited growth. Hit pretty hard.
35B-9	Heavy Spring Graze	Plateau/Telar	8/24/2007	112	0	All stake gone. No TF anywhere, mostly big blue and scurv-pea.
33A-3	Idle	Plateau/Telar	10/3/2007	143	0	Very little live vegetation. No toadflax within 20m.
34B-7	Light Fall Graze	Plateau/Telar	10/3/2007	92	41	Limited growth.
35B-4	Heavy Spring Graze	Plateau/Telar	10/3/2007	91	0	Limited growth. Few stems within 10m.
33A-10	Idle	Plateau/Telar	10/22/2007	313	0	Large swath of dead grass, all stakes removed no TF in area.
35B-6	Heavy Spring Graze	Plateau/Telar	10/22/2007	175	20	Limited growth. TF plants very small.
33A-2	Idle	Plateau/Tordon	8/24/2007	137	0	Heavily trampled/grazed. No toadflax within 20m.
35B-1	Heavy Spring Graze	Plateau/Tordon	8/24/2007	75	0	Large dead spot. All posts busted and removed. Some TF within 20m.
33A-9	Idle	Plateau/Tordon	10/3/2007	115	0	Heavily trampled, plenty of TF outside plot.
34B-6	Light Fall Graze	Plateau/Tordon	10/3/2007	76	0	Isolated stems within 10m.
35B-7	Heavy Spring Graze	Plateau/Tordon	10/3/2007	111	-25	3 Stakes removed. Limited growth, but TF rebounding well.
34B-2	Light Fall Graze	Plateau/Tordon	10/22/2007	81	141	Dense patch ~15m diameter.
35B-10	Heavy Spring Graze	Plateau/Tordon	10/22/2007	70	?	All stakes gone. Sprayed area visible, with lots of TF growing in sprayed area.
33A-5	Idle	Tordon/Telar	8/24/2007	101	0	Heavily grazed. No toadflax within 20m.
35B-12	Heavy Spring Graze	Tordon/Telar	8/24/2007	74	0	All stakes gone. No TF within sprayed area.
33A-6	Idle	Tordon/Telar	10/3/2007	174	11	Grazed hard, fair amount of TF within 10m.
34B-1	Light Fall Graze	Tordon/Telar	10/3/2007	85	0-3	Only 1 stake remaining; some TF within 10m.
35B-2	Heavy Spring Graze	Tordon/Telar	10/3/2007	56	19	Isolated stems nearby.
33A-1	Idle	Tordon/Telar	10/22/2007	65	0	Heavily trampled/grazed. Moderate infestation <10m of plot.
35B-8	Heavy Spring Graze	Tordon/Telar	10/22/2007	111	0	3 stakes removed. Very few stems within 10m.
34B-8	Light Fall Graze	Plateau/Escort	8/24/2007	117	0	No live plants within plot. <5 TF stems within 20m.
35B-3	Heavy Spring Graze	Plateau/Escort	8/24/2007	88	0	All dead vegetation in plot. Some TF within 10m. 3 Stakes gone.
33A-7	Idle	Plateau/Escort	10/3/2007	118	0	Very little grass remaining. Very little TF within 20m.
34B-3	Light Fall Graze	Plateau/Escort	10/3/2007	106	0	Large dead spot, only 1 stake left. No TF within 20m.
35B-11	Heavy Spring Graze	Plateau/Escort	10/3/2007	164	?	All stakes gone. Sprayed area visible, with lots of TF growing in sprayed area.
33A-4	Idle	Plateau/Escort	10/22/2007	116	0	Bare dirt. Toadflax outside of plot.
35B-13	Heavy Spring Graze	Plateau/Escort	10/22/2007	58	?	All stakes gone. Moderate infestation within sprayed area.

Figure 4. Average percent control of yellow toadflax stems per square meter plot observed in August 2008 on Ordway Prairie, TNC. (Numbers in red represent a percent increase in stems)

Less than 50% control

Treatment	Rate	n	% change 1 yr post treatment	n	% change 2 yr post treatment	n	% change 1 yr post 2 consecutive treatments
Milestone + Plateau	3 oz + 0.5 pt/A	3	52%			2	-80%
Transline	1 pt/A	1	50%	1	53%		
Milestone +Tordon	3 oz + 0.5 qt/A	1	49%			1	-63%
Control		4	46%				
Milestone	5 oz/A	3	-3%				
Plateau + Escort	0.5 qt + 0.75oz/A	3	-10%			1	-68%
Plateau	1 pt/A	5	-19%			1	-100%
Tordon	1.5 qt/A	5	-26%			2	-89%
Dicamba	5 oz/A	2	-36%				
Garlon + Transline (Redeem)	1 qt + 1 pt/A	2	-43%				
2, 4-D	2 qt/A	2	-47%			1	-68%

Greater than 50% control

Treatment	Rate	n	% change 1 yr post treatment	n	% change 2 yr post treatment	n	% change 1 yr post 2 consecutive treatments
Telar	1.25 oz/A	4	-66%	2	-69%	1	-100%
Milestone + Telar	3 oz + 0.75 oz/A	3	-80%	1	-89%	1	-79%
Plateau + Telar	0.5 pt + 0.75oz/A	5	-81%	2	-93%		
Milestone + Escort	3 oz + 0.75 oz/A	4	-81%				
Dicamba + Telar	5 oz + 0.75 oz/A	1	-87%				
Escort	1.5 oz/A	3	-91%	1	-100%		
Plateau + Tordon + Escort	0.5 pt + 0.5 qt + 0.75oz/A	4	-93%				
Plateau + Telar + 2,4-D	0.5 pt + 0.5 oz + 0.75qt/A	2	-100%				
Tordon + 2,4-D + Plateau	0.5 qt + 0.75qt + 0.5pt/A	2	-100%				
Tordon + Telar	1 qt + 0.75 oz/A	2	-100%				
Tordon + Telar + Plateau	0.5qt+0.75oz+0.5pt/A	2	-100%				

Figure 5. Herbicides and application rates used in 2008 on late August test plots on Ordway Prairie, TNC.

Herbicide	Rate/A	n
Plateau + Telar	0.5 pt + .05 oz	2
Plateau + Telar	0.5 pt + 1 oz	2
Telar + Tordon	0.75oz+ 1.5qt	2
Plateau + telar + 2,4-D	0.5 pt + 0.75oz + 0.5 pt	3
Plateau + telar + 2,4-D	0.25pt + 0.75oz + 1pt	3
Tordon + Telar + Plateau	0.75 qt + 1.25oz + 0.25 pt	3
Tordon + Telar + Plateau	1 qt+ 1 oz+ 0.25pt	3
Tordon + 2,4-D + Plateau	1 qt + 1.5 qt + 0.25pt	3
Tordon + 2,4-D + Plateau	1.5qt+ 1 qt+ 0.25pt	3
Control		2

Figure 6. Herbicides and application rates used in 2008 on late June –early July test plots on Ordway Prairie, TNC.

Herbicide	Rate/acre
Control	
Tordon	1.5 qt/A
Telar	1.25 oz/A
Plateau	1 pt/A or 0.5 qt/A
2,4-D	2 qt/A
Plateau + Telar	0.5 pt + 0.75oz/A
Plateau + Escort + 2,4-D	0.25 pt + 0.25 oz + 0.35qt/A
Plateau + Escort + 2,4-D	0.5pt + 0.5oz + 0.75qt/A
Plateau + Tordon + Escort	0.5 pt + 0.5 qt + 0.5oz/A
Plateau +Tordon + Escort	0.25pt + 0.25qt + 0.25oz/A
Plateau + Telar + 2,4-D	0.3 pt + 0.3oz + 0.5 qt/A
Plateau + Telar + 2,4-D	0.3pt + 0.5 oz + 0.5qt/A
Tordon + 2,4-D + Plateau	0.5qt + 0.75qt + 0.5pt/A
Telar + Tordon	0.75oz + 1qt/A
Telar + Tordon	0.5oz + 1qt/A
Tordon + Telar + Plateau	0.5qt + 0.75oz + 0.5pt/A
Tordon + Telar + Plateau	0.5qt + 0.5oz + 0.5pt/A

Figure 8. Number of *Mecinus janthinus* insects released, stem counts per square meter plot each year, percent change in number of stems between year of first release and 2008 on Ordway Prairie, TNC.

Release Site ID#	2006 # stems/m ² plot (June)	2006 # bugs released	2007 # stems/m ² plot (June)	2007 # bugs released	2008 # stems/m ² plot (June)	2008 # bugs released	# stems/m ² plot (Aug 2008)	average stems/m ² plots (8 m ² plots) Aug 2008	patch radius(m)	2008 spring fire	% change from date of release to Aug. 2008
3B-1	106	280	112		53	100	35	44.25	15		-67%
5	47	100	16	200	0	100	4	13.125	30		-91%
1-2	52	200								yes	
1-2 new plot					21	100	27	14.375	20	yes	
9-2	27	100	21		0?						
9-2 new plot					41	100	38	23.5	50		
9-1	73	100					64	67.375	32		-12%
1-1			57	300			49	45.375	13	yes	-14%
3B-6			142	200	96		73	65	15		-49%
N6				800							
7B-1					50	200	54	0	0.75		8%