

**Flint Hills Resources
Mississippi River Bluff Property**

2013 Ecological Activities Report



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PROJECT SUMMARY

This report describes the ecological activities completed by Friends of the Mississippi River and Great River Greening at the Flint Hills Resources Bluffland property in 2013. Overall it was a very successful year, with management activities completed on a total of 63 acres, and 116 volunteers engaged in six events. There were some shifts in project activities in response to weather conditions, new information, and new opportunities. Fewer acres of buckthorn were sprayed, for instance, than planned, but goat grazing was used instead.

Monitoring of birds and vegetation has shown positive trends. Bird surveys over the past 5 years have recorded a total of 107 species at the bluffland, of which 67 are likely breeding at the site. Eleven of those are species listed by the MN Department of Natural Resources as having the greatest conservation need due to population declines. Vegetation monitoring also showed positive trends in the native species diversity at the savanna restoration.

A summary of the restoration work is provided in the table below, and a detailed log of is provided in the body of this document.

Summary of 2013 Completed Ecological tasks

Acres	Activity
14	Exotic brush removal (cut, treat, haul)
10	Exotic brush control – goat browsing
25	Savanna management (spot spray invasive forbs, cut/treat woody, spot mow, goat graze)
10	Sand-gravel prairie management (Rx burn, hand pull weeds, spot mow, invasive grass control)
3.5	Prairie reconstruction (burn, spray, seed)
63	Total acres
Other activities:	
Volunteer events: 116 volunteers were engaged in 6 events	
Monitoring: Breeding bird survey, vegetation surveys	
Wildlife feature: One snake hibernaculum constructed	

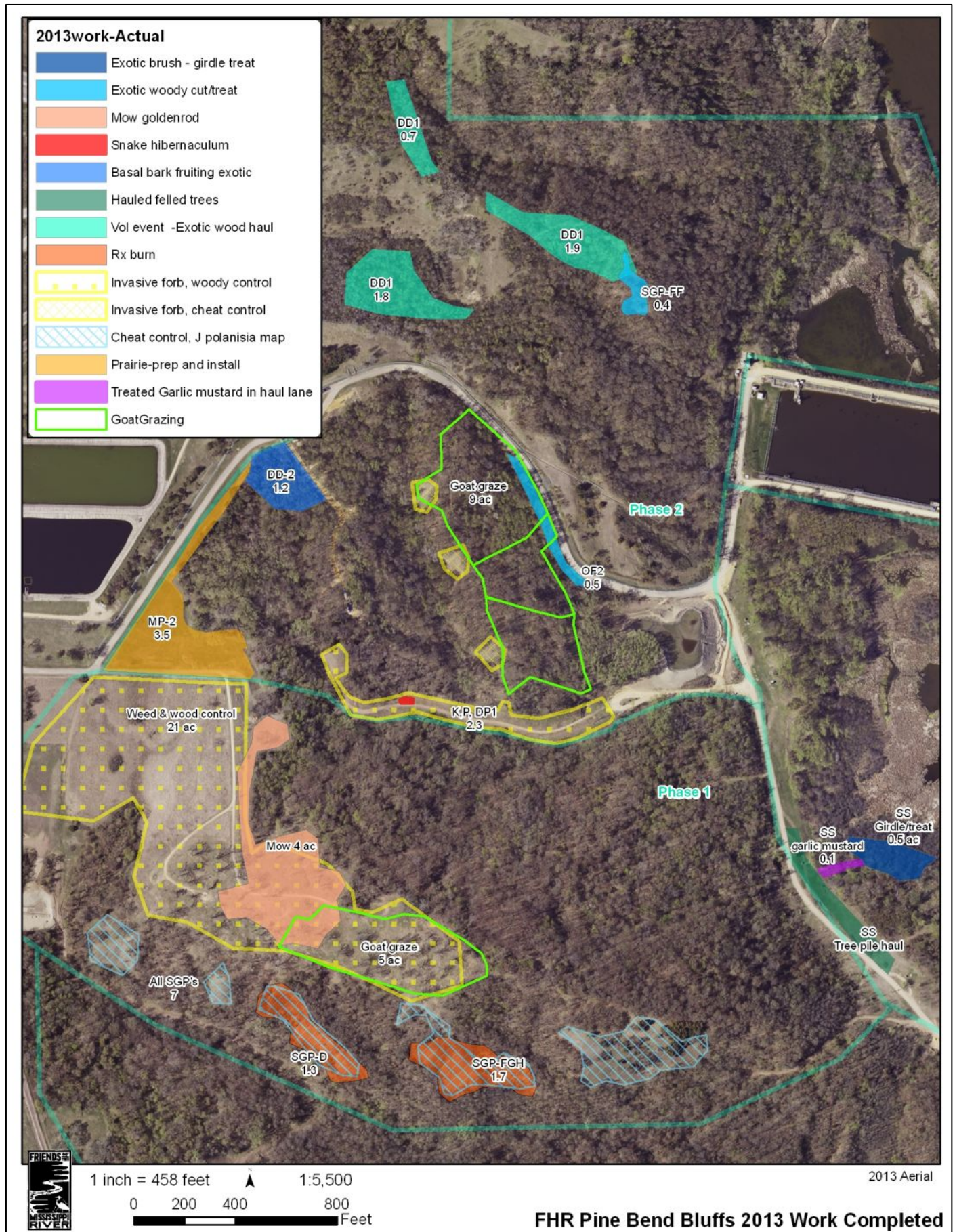
Project highlights

Several new projects were initiated in 2013. A 3.5-acre prairie reconstruction was prepared and installed. Adjacent to the earlier reconstructed prairie, it provides additional prairie bird habitat. A large snake hibernaculum was built, with volunteers assisting, in an effort to provide more overwintering habitat for snakes, which can be a limiting factor. Exotic brush removal was initiated in a new location, at a bluff ridge next to a grassland. That work was the initial stage for a larger prairie restoration planned in the grassland in 2014. Sixty-five volunteers helped to haul and stack that brush for removal. A new method for buckthorn control was also initiated – use of goats for browsing. Ten acres of oak forest were browsed. The goats were also used to graze a 5-acre portion of the savanna, where burning has not been feasible for several years. Results of all these projects will be seen in 2014 and coming years.

On-going projects were primarily maintenance activities in the oak savanna and sand-gravel

prairies. Invasive grasses, especially cheatgrass, continues to be a problem in the prairies, but management methods have kept it in check so that native species diversity is still very good, and the population of the rare plant, Jame's polanisia, appears to be stable. A prescribed burn was done on a portion of the prairie, following a typical historic burn cycle of roughly 4-6 years. In addition to goats, the savanna was managed by site-wide spot-spraying, spot-mowing, and invasive woody removal.

In addition to a "Volunteer kick-off" event with 30 participants, there were 4 events with employee volunteers, with a total of 20 participants, and one community event with 65 participants. Altogether that represents 235 volunteer hours, 6 events, and 116 participants.

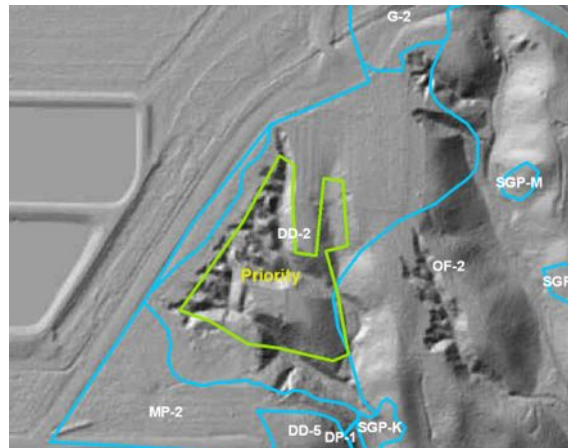


PRAIRIE AND FOREST MANAGEMENT – PHASE 2 UNITS

Task 1: Unit DD2 Exotic Brush Control 2.3 ac

10-8-13, 2-19-14 Basal-bark treated buckthorn and honeysuckle on west side of new gravel access road, and worked north towards south. About 1 acre completed. Determined to spend balance of budget on exotic trees in DP1 corridor.

The remaining area of DD2 is medium-sized buckthorn, and not as steep as sections completed. The eastern border is marked with double pink flagging. Would be good to finish the unit, starting in southeast corner and working up the slope.



Task 2: Unit DD1 and OF4 Exotic Brush Control 4.3 ac

9-27-13. As part of preparation for fall volunteer event, Great River Greening cut and treated isolated pocket of buckthorn and black locust near SGP-FF (**Map 1**). Cut and treated buckthorn along north side of trail to ridge and then 30' in. Cut along south side of trail near trailhead. Hazardous trees were removed as encountered. 10-7-13. Additional 15 hours of cutting

10-25 and 10-26-3 additional cutting due to rise in volunteer numbers.

There is some stacking that remains and can be done with employee groups, crew, or other labor source. There are also 6 large buckthorn remaining at the north end of the north ridge unit. These had to be left because felling them would have made stacking very difficult due to large amount of material.

Task 3: MP2 Restoration

Mowed week of 8/9/13

Sprayed by Applied Ecological Services 10/9/13

Seeding occurred 11/8/13.

Because the foxtail grass grew considerably prior to being sprayed, the seeding strategy was revised. The small seed was broadcast and large seed was drilled. The site was then mowed so the foxtail will serve as a protective mulch. The species seeded are listed in **Appendix A**.



MP2 unit prior to seeding. 10-2-13

Task 4: OF2 Resprout Treatment

After researching the use of goats as a means for buckthorn control, we determined that the OF2 unit at FHR would be the right kind of conditions for goats to be most effective. The buckthorn was young (3-4 ft tall and small diameter stems), there were not a lot of desirable native plants to be concerned about negatively impacting, and there was a lot of garlic mustard, another very invasive plant that goats like to eat. As the goats do not actually kill the

buckthorn in short-term grazing (must be repeatedly grazed for a couple years or more), we planned a follow-up application of herbicide to resprouted plants later in the fall.

After clearing fence lines and installing electric fence and watering station, Goat Peak Ranch delivered 130 goats to a 5-acre unit (see map) on 8/30/13. An entourage of media (newspaper, TV, radio) was on-site for the event, generating a lot of publicity and public interest. After about 11 days the goats were moved to an adjacent 5-acre unit for 7 days. After that the goats were moved to the savanna unit (see Task 14).

The goats were monitored by FMR and GRG several times during their stay, and results were quite good. Virtually every buckthorn leaf was eaten, as well as virtually all other plants, including white snakeroot, which is a native plant but was quite abundant. Based on these positive results, we planned to use the goats again in 2014. Unfortunately, the goat



Typical buckthorn density prior to goats – mostly around 4 ft tall, less than ½" diameter, and dense stems.



After 5 days of goat grazing



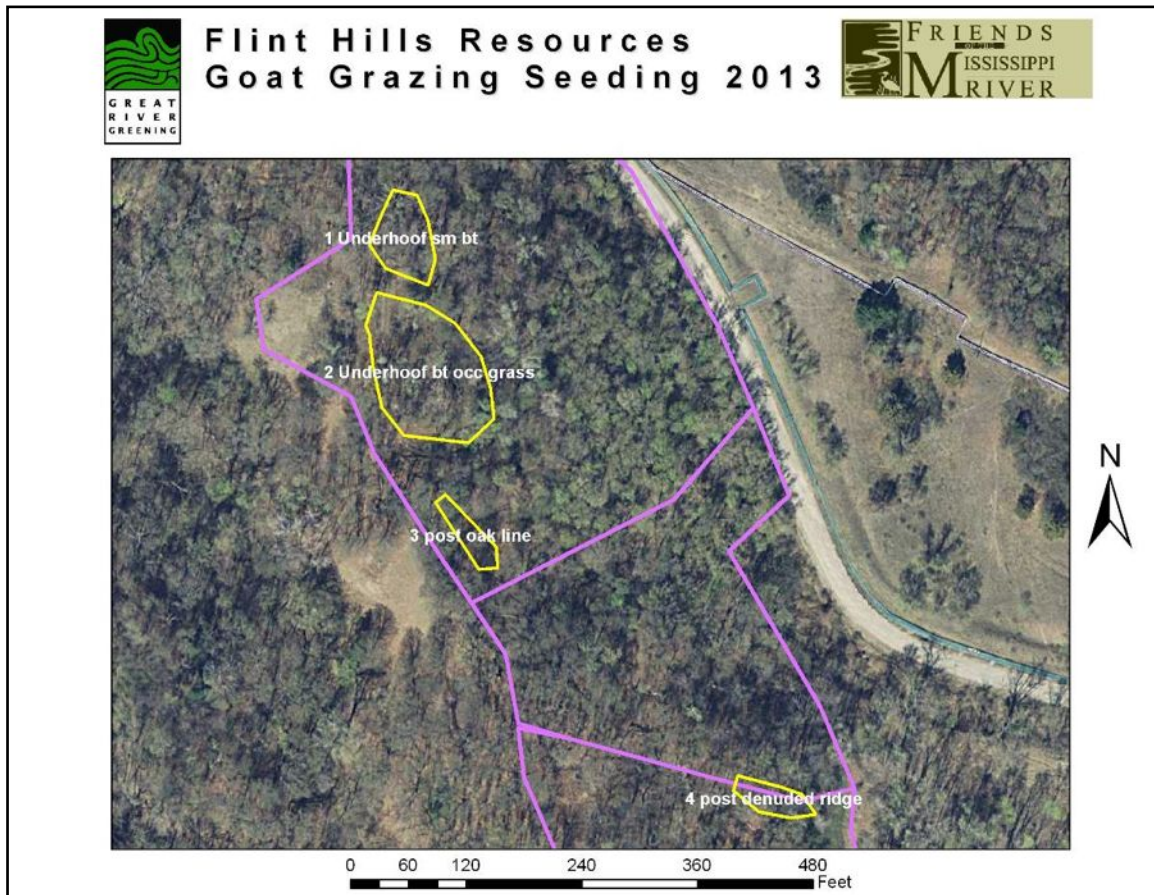
After 10 days of grazing – almost complete defoliation of all plants, excluding grasses and sedges.



South end of south unit, south aspect. It appears that Pennsylvania sedge is being released. Penn sedge tends to proliferate with grazing. It can be over abundant, but will also help to deter some weedy species.

company went out of business, so this task may not be feasible. In that case we will use a

combination of herbicide, cutting, and burning. Native woodland seed was broadcast in several areas prior to the goat release (map below). The activity of the goats hooves was intended to work the seed into the soil.



Elymus Canadensis seeding (4 lbs hand broadcast) 11 September 13



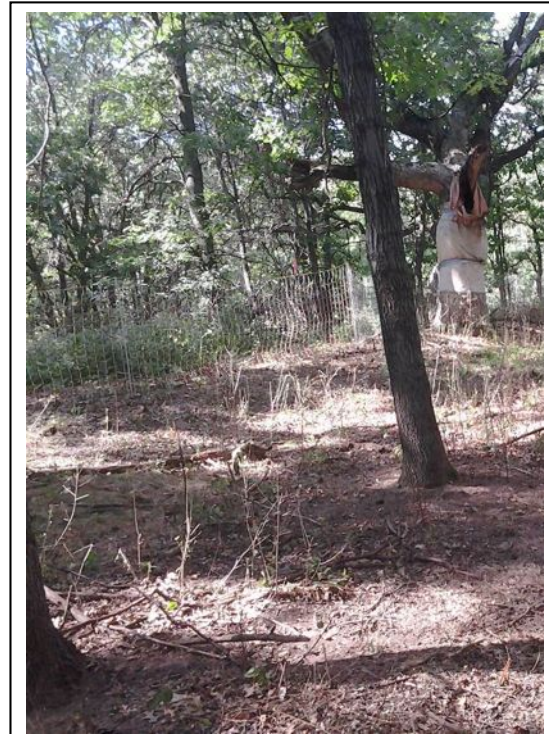
Seeding area 1, typical pre-grazing conditions – dense small buckthorn.



Typical inner woods



Seeding area 2, south end, pre-grazing. Dense white snakeroot.



Seeding area 3, post grazing



Seeding area 4, post grazing – denuded. Goats spent a lot of time here.

Task 5: Exotic Shrub Removal, OF2 at Side of Road.

Removed shrubs and treated stumps. Hauled material off since Ostvig Tree was already there for SS removal.

Task 6: Sand-gravel prairie woody removal, Unit SGP-FF

Week of 8/19/13. Cut and treated exotic shrubs in advance of volunteer event. We determined that black locust should be treated in 2014, with the priority being several that are amongst the oaks. RECOMMENDED mix of growing season control techniques:

- chainsaw girdling with Transline,
- if felling and stump treatment, must plan to foliar spray following year.

If we decide to take down the thick grove of locust on the east aspect, we will need a replanting plan as the canopy will be very open. Concentrate primarily on east aspect - basal bark perimeter shrubs and interior small black locust (leaving medium and large black locust on perimeter and the few in the interior of the unit), remove one 3" red oak, and a thicket of shrubs separating two open areas.

Unit FF looks more robust than before, with more prairie grasses and herbaceous understory. Oak spacing is very handsome.

Recommend black locust felling and removal next growing season, and perhaps a winter volunteer pile-burning event.

Task 7: Sand-gravel prairie invasive forb control Units SGP-P,K; DP-1.

Spot sprayed knapweed week of 24 June. See also Task 25: employee volunteer event. Week of 8/19/13, Hand pulled and bagged knapweed and others, including SGP-I unit.

Task 8: Seepage Swamp - Haul Felled Trees away

District Energy would not come to take this material (black locust trees that were cut in 2012) for biofuels because there was not enough volume. So a contractor (Ostvig Tree) was hired to haul it away in June, to a tipping site in Rosemount.

Task 9: Seepage Swamp Follow-up Buckthorn and Garlic mustard Control

Vegetation survey plots were set up in the seepage swamp and surveyed 5-29-13 (**Appendix B**), with one plot in the 2011 buckthorn removal area, one in the 2012 removal area, and one within an area of old-growth (very large diameter, tall buckthorn) with no buckthorn removal. The vegetation is generally following a pattern of more sun-loving species and dense vegetation in the two buckthorn removal plots, and more woodland species and bare ground in the buckthorn plot. Buckthorn seedlings were minimal in all plots,



2011 buckthorn removal area – garlic mustard common to abundant. 5-29-13



2012 buckthorn removal area – garlic mustard absent. 5-29-13

but it was apparent that garlic mustard is increasing in the areas where buckthorn has been removed (absent from the buckthorn stand). The jewelweed, skunk cabbage and other native plants are dense and abundant, but there is just enough open ground in early spring that

garlic mustard is spreading. The density of native species, however, will likely keep it from ever becoming dominant.



Turtlehead was a wonderful find on 8-20-13. Jewelweed is dense.



Uncut area – old-growth buckthorn, very few native trees. Native ground cover somewhat to very sparse, garlic mustard absent. 5-29-13.

A general survey of the area on August 20, 2013 revealed mostly positive results, with an abundance of native seepage swamp species (see photos).

Fall/winter hauling lanes did have some soil disturbance and 1st year garlic mustard was present there. Soil did not feel compacted. Not sure why annual jewelweed did not colonize; perhaps seeds in bed were lost.

Based on these results a fall foliar spraying of garlic mustard rosettes was planned, and NOT treating buckthorn re-sprout treatment at this time, as it is not really necessary. The garlic mustard spray proceeded the week of 9/30/13 on the hauling lanes in wetland. Adjacent terrace forests, including the northern volunteer work unit from 2012, are also loaded with garlic mustard but were not treated.

Removing buckthorn in the seepage swamp has been challenging for several factors. 1) the large amount of material makes removal quite costly. 2) Access for larger equipment to haul material is difficult due to the very fragile soft soils – even in winter. 3) Chemicals needed for treatment must be wetland-safe, and these chemicals cannot be used below freezing. 4) Lastly, the large amount of



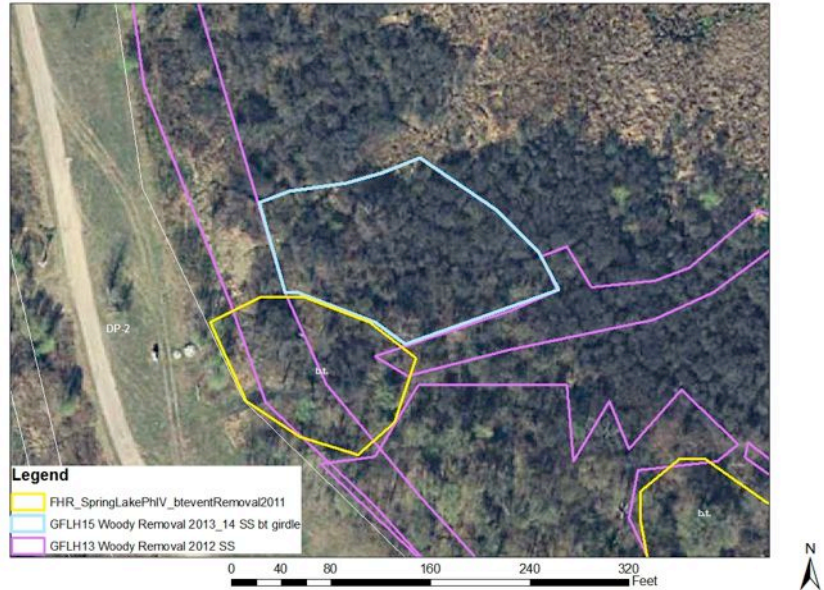
Dead test buckthorn from winter work. 8.20.13 (green foliage is grape vine).

material is cost-prohibitive for removing by hand.

In an effort to find a partial solution to these issues, one very large buckthorn was girdled and treated with the aquatic-safe glyphosate formula (Rodeo) on a mild (above freezing) day in December 2012 (winter dormancy), to see if it would be effective. When checked on 8.20.13, the tree was quite dead (photo).

Based on this result, it seems that an effective and safe treatment can be accomplished in winter. With subsequent rapid re-colonization by jewelweed, buckthorn seedlings are out-competed, so girdled shrubs could be left standing to rot and eventually fall. Additional girdling and herbicide was therefore completed on a warm day in February 2014 (see map).

For the next year, we recommend continued monitoring to evaluate how the native plant community responds. If additional buckthorn removal is determined to be beneficial and feasible, we recommend pursuing chainsaw girdling and Rodeo application in mild winter weather.



Task 10: Seepage Swamp, Additional Exotic Brush Control

This was an optional task, to be completed if funding was available. It was not.

Task 11: Plan and build a snake hibernaculum

As the natural landscape has been dramatically altered with human development, some snake species have been declining. One possible cause of this is limited overwintering locations, or hibernaculae. In 2013, FMR planned and coordinated construction of a hibernaculum, a large underground rocky cavity, designed to maintain fairly constant humidity and above freezing temperatures. FHR volunteers were recruited to help install rock (see Task 24).



Backhoe excavates the pit, designed to maintain fairly constant temperature and humidity conditions.



The completed hibernaculum looks like a small pile of rocks, but has clear entrances for snakes.

Three motion-activated cameras were installed nearby to try to capture images of any snakes entering in the fall. Photo monitoring is very difficult, as snakes are so low to the ground and slow-moving that they can easily evade detection by most cameras. A camera with time-lapse photography might help.

Black locust trees are now getting large again in this corridor, and will be cut and treated in 2014 (black locust has to be cut in growing season as the chemical used, Transline, is water based).

SAND GRAVEL PRAIRIE MANAGEMENT

Task 12: Prescribed burn of Sand gravel prairie units - SGP-D,E,F,G,H

These were accomplished on two separate days. Both burns were very complete, meeting the resource objectives.

On 4.29.13 The combined SGP-F, G, H unit, about 2 ac, was burned. The burn went well, surprisingly thorough, given the high soil moisture levels in other areas. SGP-E was not included because there was no longer snow surrounding it to provide burn breaks.



The Weather summary data from NOAA

April 29, 2013: Temperature: Max=72, min= 56. Wind: Avg mph=13.1, max=25. Wind direction:280. Peak wind: 32 mph, 230 direction.

May 7, 2013: Temperature: Max=78, min= 53. Wind: Avg mph=3.8, max=13. Wind direction:140. Peak wind: 20 mph, 170 direction

On 5.7.13 Unit SGP-D was burned.



PRESCRIBED BURN REPORT
Use reverse side if more space needed

Site Name	SOP -D		Burn Date:	5-7-13
Contractor Company	Burn Boss	Burn Crew	Number/type of vehicles on-site	
GRO	WS	Mike Robinson Sean Wickham Tyler Trethar Wayne Ashe (for Joe)	300 galbn slip on, truck 50 galbn slip on, ATV	

Weather							
	Time	Wind Dir.	Wind Spd	Temp	Rel Hum	Hvy Fuel Moist	Comment
Forecasted Fire Weather	1600	S	7	75	37%		
Observed weather	1700	S	5	75	37%		will rain, sunset

Observed Fire Behavior				Acres Burned		
Time	Spread Rate (mph)	Flame Lengths	Scorch Ht	Fuel type	Planned ac	Actual ac
p.m.	1-2 mph / hour	1-3'	1-2'	Grass	1	1-
				Woodland	edge	edge +
				Wetland		
					1.3	1.5

Burn Summary: include difficulties, unexpected events, deviations from plan - e.g. weather changes, extensive heavy fuel mop-up, neighbor issues, etc (If significant incident occurred submit separate Incident Report to FMR)

Heavies caught well, some consumption. cork leaf litter burned well.
Thorough burn. A little late, penn sedge etc was green, but otherwise good timing. Did NOT ignite signature cork in NW corner.

Post Burn Observations : were objectives met, what burned or did not

invert refugia came up heavily in cheatgrass; burned areas setback
spl3 cheatgrass v effectively. Natives did well.

Recommendations (for next burn)

continue to try & make units larger. If budget/priorities allow burning
in SOP-R, we can make larger units.

Post Burn - Next Day Site Visit

Name:	Date:	Results:
Willey	5/8	out, cold, no smoke.

Burn Boss Signature

Name:	Title:	Date:
Willey Buck	Burn Boss	8.27.13



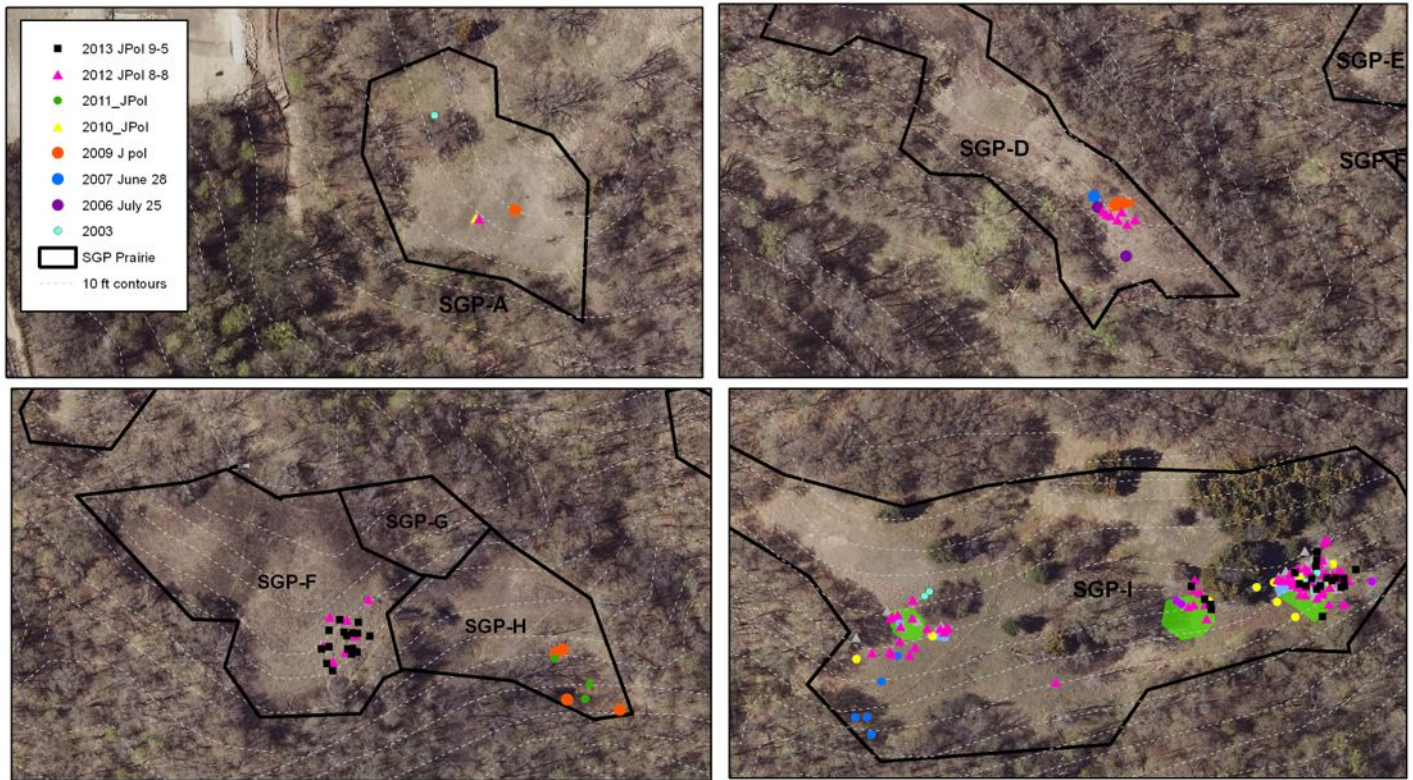
Please email/mail this completed form to FMR within one week of the burn date: kschik@fmr.org
Karen Schik/ Friends of the Mississippi River/ 360 N Robert St, Ste 400/ St Paul, MN 55101

Task 13: Monitor and map James' polanisia

The James' polanisia was surveyed in early September. The number of plants at most of the patches was down considerably from the previous year and down somewhat from two years ago. It is unclear, however, if that result may be due to differences in surveyor methods or if there were significantly fewer plants in 2013. The 2014 survey will provide clarification.

	2003	2009	2010	2011	2012	2013
Survey Dates		Jul 29, Aug 5	Jul 29, Aug 12, Sept 16	8/4, 8/16, 9/1	8-Aug	4-Sep
SGP-A	Present	2	2	0	1	NA
SGP-D_east	Present	23	26	282	99	0
SGP-F	-	-	-	-	49	207
SGP-H_east	-	50	0	15	0	0
SGP-I_east	Present	55	47	134	509	96
SGP-I_mid	-	-	1	0	67	38
SGP-I_west	Present	3	9	12	71	0
		133	85	443	796	341

Flint Hills Resources Sand Gravel Bluff Prairies James' Polanisia Population Survey 2003-2013

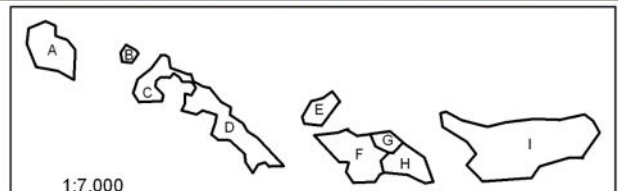


Dots denote individual plants or small groups. Polygons indicate the plant population areas. All counts are tallied on separate table.



1:1,500

0 62.5 Feet 125 250



SAVANNA RESTORATION

Task 14: Prescribed burn of Savanna and seeding

(See also Task 4)

The ultimate goal for the Savanna Units (SV) is to increase the abundance and diversity of native prairie and savanna plant species, especially grasses. There has been an overabundance of many non-native species (Canada thistle, Kentucky bluegrass, smooth brome), with minor amounts of many other non-native species (burdock, creeping Charlie, motherwort, butter & eggs, plantain, dandelion). Some native species have also been overabundant, especially Canada goldenrod and raspberry. The primary tool for managing this type of habitat is fire, which would help to promote the native warm-season grasses.

Attempts to burn, however, have been repeatedly thwarted for the past three years, due to unfavorable weather conditions (wet, cold, wrong wind direction). As an alternative, the unit was strategically mowed in early July 2011 and May 2012. In 2013, a different strategy was implemented, with using goats to graze. Goats prefer any kind of plant except grasses, so they were a good choice to reduce the many undesired forbs.

Goat Peak Ranch cleared fence lines and installed electric (solar powered) fences and water tanks. On 9/19/13 they brought 130 goats (mix of nannies and their kids). The goats were there for about 2 weeks in a 5-acre area. They defoliated all broad leaves, nibbled twigs up to 1/8" diameter, and did not touch graminoids.



Native seed was broadcast on 9/17/13, with the intent that the goats hooves would help to work it into the soil, prior to the winter freeze-thaw cycle.

Species seeded: (weights are estimates)

Indian Grass (<i>Sorghastrum nutans</i>) 6 lb	Big Bluestem (<i>Andropogon gerardii</i>) 6 lb
Switchgrass (<i>Panicum virgatum</i>) 1 lb	Prairie coreopsis (<i>Coreopsis palmata</i>) (.5 oz)
Sunflower (<i>Helianthus laetiflorus</i>) .5 oz	Flowering spurge (<i>Euphorbia corollata</i>) .25 oz
Sky blue aster (<i>Aster azureus</i>) .5 oz	American harebell (<i>Campanula Americana</i>) .125 oz
Wild anise (<i>Agastache foeniculum</i>) .5 oz	Black-eyed Susan (<i>Rudbeckia hirta</i>) 1 lb



Day 1 in savanna. Goats barely visible in dense vegetation.



After nearly 2 weeks, goats in the SV unit have removed most of the vegetation except grasses.

Task 15: Savanna goldenrod mow in SV1 unit.

As part of the on-going strategy to reduce Canada goldenrod by mowing, it was mowed in SV-1 on 8-13-13. Though later than previous years, the timing was good as the goldenrod (and everything else) was delayed this year due to the extremely cold spring. The optimal time is approximately when the plants are beginning to form flower heads.

Task 16: Spot treat invasives in Savanna units.

Canada thistle was worse than expected this year. Spot-spraying was done on 6/17/13 and on 6/24 any missed plants were cut. On 8/20 more thistles were mowed.

Black locust still needs to be managed. Plan on cut/treat and foliar follow up in 2014.

Task 17: Monitor vegetation study plots in Savanna Restoration

FMR surveyed the study plots in July and September to evaluate the progress and effects of management (**Appendix C**).

There have been decreases in some weedy species, increases in other weedy species, and increases in native species. Overall, the unit has moderately improved,



Vegetation survey at Mid-plot showed a significant increase in native grasses.

with more positive changes than negative. The survey was completed prior to the goat grazing, so the 2014 survey should provide some quantitative results of the grazing.

East Plot: Positive - decrease in some weeds (Canada thistle, burdock, creeping Charlie). Two new native species found – northern bedstraw and Kalm's brome. Both good species that were seeded on the site, but have not been seen much.

Negative: moderate increase in Kentucky bluegrass

Mid Plot: Positive: creeping Charlie and garlic mustard had been low amounts, now appear to be gone. Significant increase in Canada and Virginia wild rye (not recorded before, now 5-25%) and decrease in Kentucky bluegrass.

Negative: Canada thistle increased a little.

West Plot: Not a lot of changes. Positive: Garlic mustard appears to be gone, after seedling carpet 2 yrs ago.

Negative: Butter&eggs and Canada goldenrod appear increased a little.

Task 18: Maintain oak trees in Savanna

The savanna oaks were surveyed on September 11, 2013. Overall, the bur oaks on the savanna looked good (Figures 1). They seemed to be recovering, slowly, from the stress they have been under for the last several years. Many of them had signs of former stress, with much dieback in the crown (ends of branches dead or dying), but most of the dieback was from previous years, and not from the current year (Figure 2). In the groves by the road, on the west end of the



Figure 1. Grove of bur oaks on the savanna at FHR. These oaks look good—they have dark green leaves and fully leafed-out branches with a nice canopy.



Figure 2. Bur oaks with old dieback in top branches. These trees are in fair condition and slowly recovering from stress.

savanna, the trees looked nice and full, with much new growth occurring.

Annual growth was assessed on several trees, by measuring the distance between branch scars on lower branches—those that could be easily reached from the ground. Annual growth was not fast (2 to 6 inches), which is to be expected from large, mature, old bur oaks, but it was pretty steady from year to year, which is a good sign. Some years had a little more growth, and other years had less, which is generally an indicator of how dry the year was.

One tree, right next to the field road, had a large, lower branch that had been broken and was hanging down. Later in the year it had broken off completely. This tree did not show signs of wilt, but had a few dead branches that had been killed when the large branch broke (Figure 3). This tree should be closely monitored in the future.

The trees on the south end of the savanna were exhibiting signs of stress, with some of the branches containing brown leaves, and also some “point death” of small branches scattered throughout the crown. One tree looked particularly stressed, with whole branches that were dead or dying, which could potentially be caused from oak wilt, so that tree was sampled (Figures 4). Three “sides” of the tree were sampled (following typical oak wilt sampling protocol) with a pole pruner, and tested at the Plant Pathology Lab at the University of Minnesota. The results came back negative for oak wilt, which does not completely rule out the disease in this tree, but builds evidence that it does not have oak wilt. The tree may be suffering stress from other causes, including insects and root loss. For now, we do not recommend any oak wilt treatment for this tree, but it should be closely monitored in the future. If it shows more signs of wilt, early in the hot season of 2014, then it should be sampled again. Root cutting could be an option for treatment, but not until it has a positive sample. (This tree is located next to a slope, to the south, which would complicate root cutting treatment, but there are many more bur oaks on this south slope that should be protected.)



Figure 3. Bur oak by field road with broken branch (middle top of this photo). Note the brown branches were killed by the large one that broke.



Figure 4. Bur oak tree that was sampled for oak wilt in 2013. Note the extensive portions of brown leaves on several branches. Results of tests were negative for the disease.

CHEATGRASS MANAGEMENT

Task 19: Cheatgrass Control

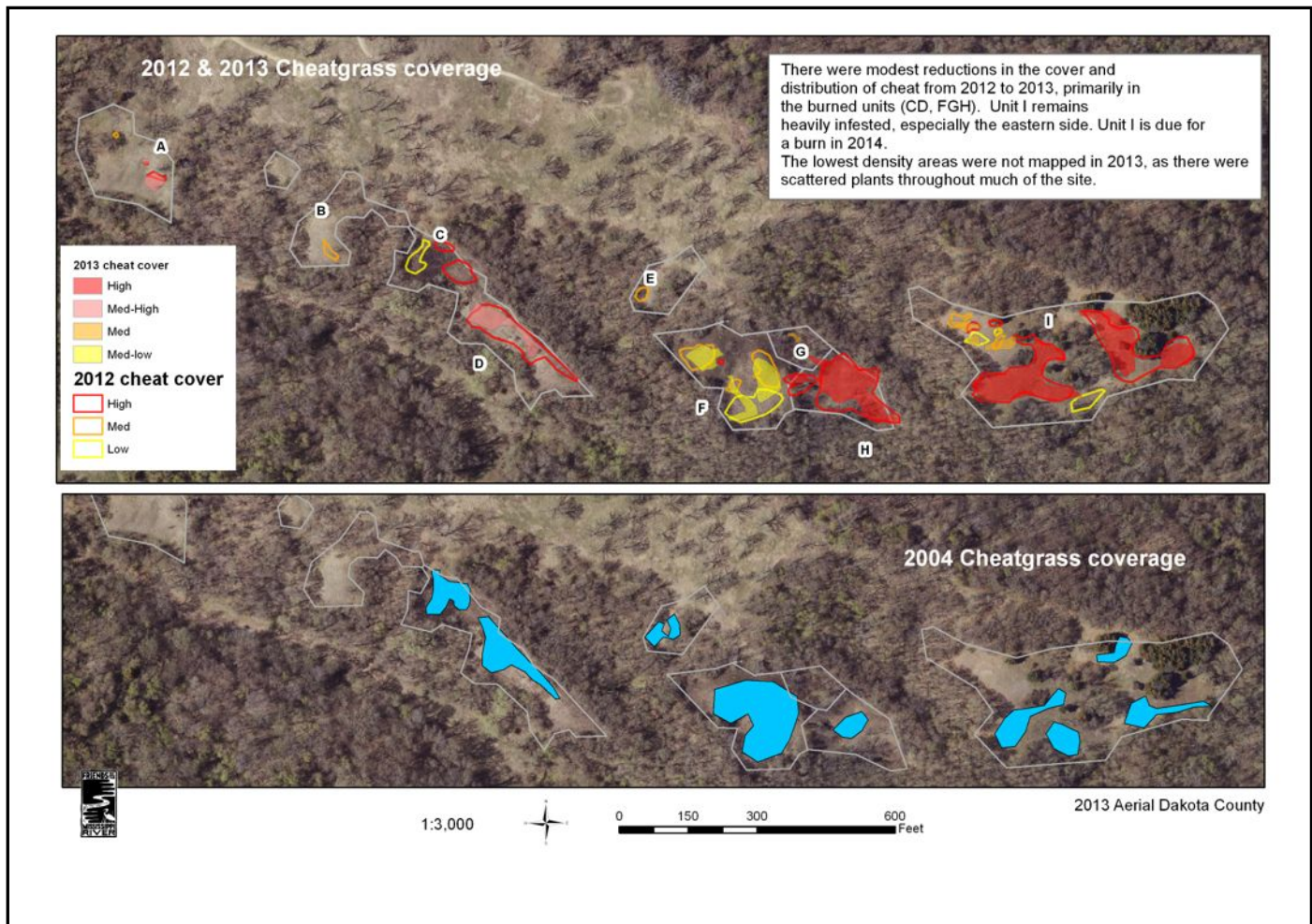
We determined the spring application of sethoxydim (the grass herbicide) is no longer needed. The results have not been significant, and the application requirements are so restrictive that it was often not feasible. The herbicide must be applied when temperatures are above freezing and skies are cloudy. At this site, it also needed to be in very early spring, before natives emerge. That combination of conditions has been very rare in most years. In 2013 the conditions did not occur at all because the cheat was late and greened up the same time as the native species, due to the very cold/late spring. So instead of sethoxydim, we opted for cutting in mid-May, which in 2013 was prior to most of the native species being up (there was 8 inches of snow on 5/6).

The pre-emergent application was completed 10/7/13. We thought it would be too dry (fall drought was on), but there were heavy rains in early October, breaking the drought and providing good conditions for cheatgrass to germinate. Preliminary evaluation of SGP-I indicated the timing and results were good. However, more will be known in spring 2014.

Task 20: Map cheatgrass coverage of Sand-gravel prairie units.

FMR completed the annual mapping of cheatgrass coverage at the sand-gravel prairie units A-I in June 2013. The map below shows the 2012 and 2013 coverages, as well as the 2004 coverage. While we don't have density indications from 2004, the overall area of cheat coverage has been roughly similar over the past 10 years. Each year varies somewhat, with increases in some and decreases in others. Management of this grass continues to be extremely difficult and full control has not been achieved. Eradication would only be feasible if the natives species were also eradicated, which, of course, is absolutely not recommended. However, while the coverage has not decreased, the abundance and diversity of native prairie species remains largely intact. We feel that the management is serving the purpose of keeping the cheatgrass in check and allowing native species to persist.

This site is a unique situation - we know of no other sites where cheatgrass has become so invasive on a native prairie. Typically cheat does not persist or take over where native prairie is well-established. The nature of this dry prairie, however, is sparse vegetation, and the bare soil is what enables the cheatgrass to persist. Efforts to find the "magic bullet" will continue, and in the meantime we will continue with the management methods that are preventing the cheat from completely overtaking these prairies.

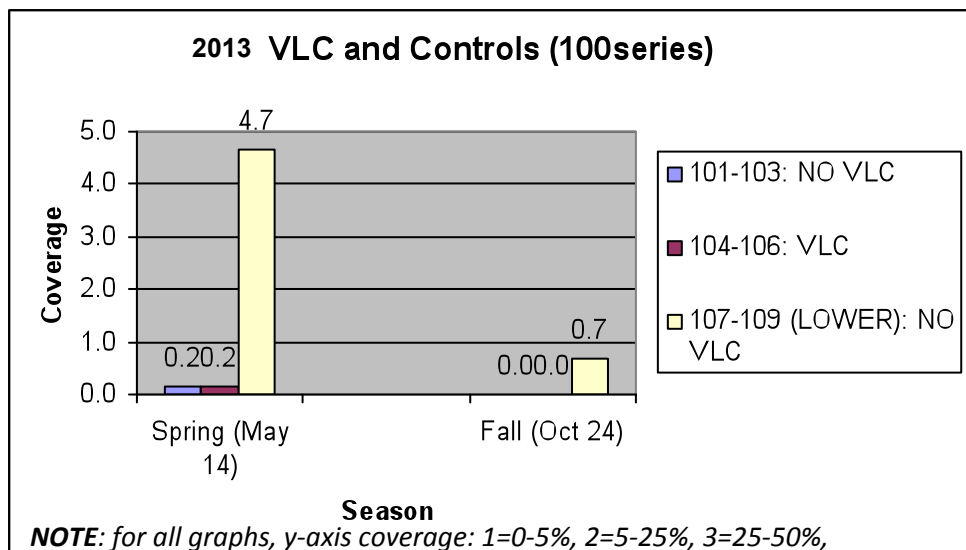


Task 21: Cheatgrass Plot Surveys

Data collection on cheatgrass plots continued in 2013 to determine the most effective controls. This is done over a series of three study areas. Surveys were completed on May 14 and October 24.

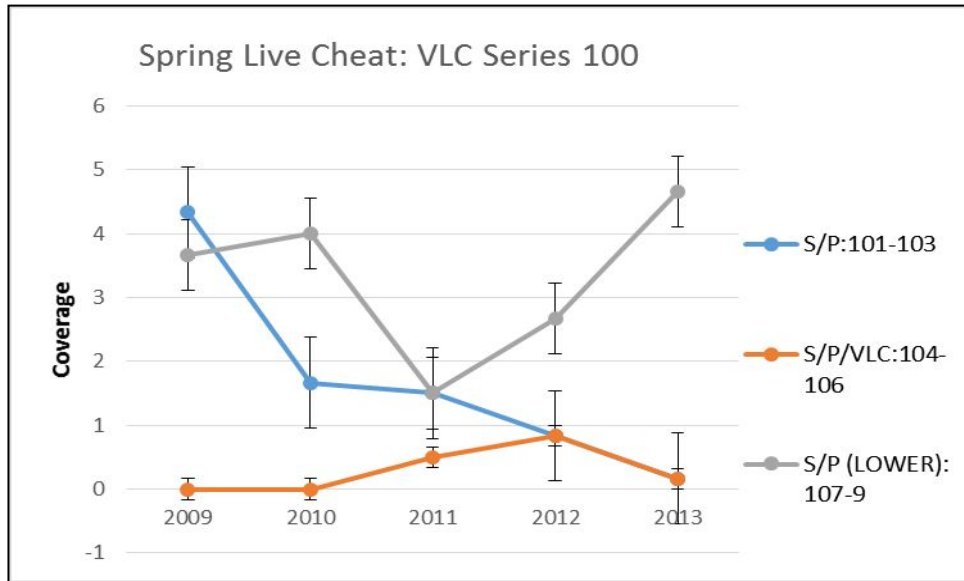
Series 100

The 100 series is the original plots on SGP-I. Plots receive the full treatment except Very Late Cut (VLC) is withheld from two control plots. The first control plot is high on the hill adjacent to the treatment plot; the second control plot is much lower on the



hill. The 2014 data show a significant decrease in cheatgrass between control and treatment plots, indicating that the VLC treatment has been effective.

For long term trends, data from spring surveys were used. Spring is the best data set as neither 2011 nor 2012 fall data was not collected since no measurable cheatgrass germination occurred in treatment, control, or general management areas, due to drought. The long term trend on the Series 100 plots are:



Note: 2011 the 107-109 plots were mistakenly treated with VLC.

Conclusions:

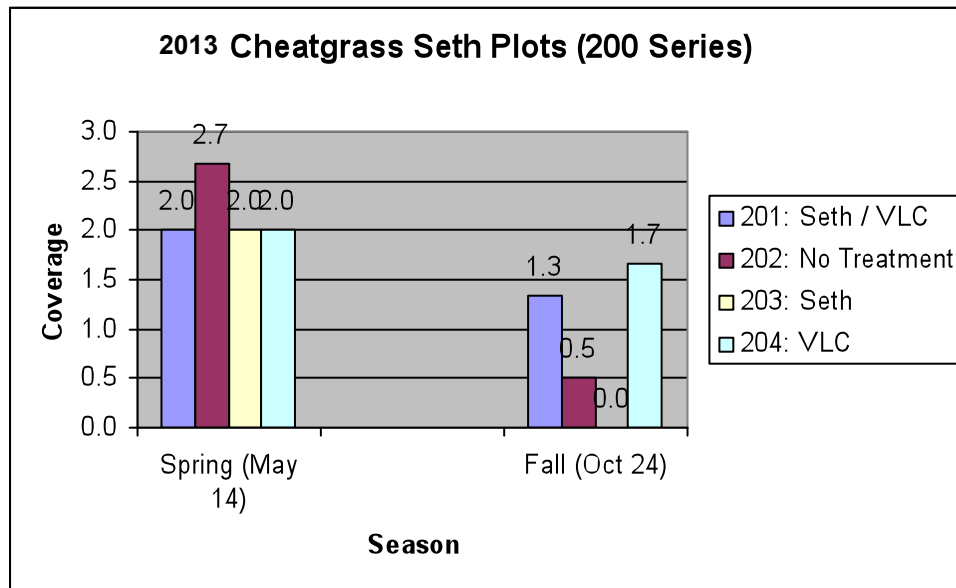
- Cheatgrass is being nearly eradicated on the higher parts of the hill (SGP-I, west slope).
- In earlier years, VLC accelerated this control.
- The higher part of the hill is drier. Perhaps VLC is most effective where it is dry and/or only in the early years of control when cheatgrass is more dominant.

Recommendations for 2014:

- Add VLC to the lower units 107-109 and see if the trend to lower cheatgrass continues.

200 Series

The 200 series is in DP-1 and is designed to tease out the effects of Sethoxydim and VLC. The 200 series 'greened up' earlier in the spring of 2013 than the other plots. The 200 series data is from May 4, while on that same date 100 and 300 series plots did not have sufficient germination and a return trip on June 6 was made to collect data from those plots.



For long term trends, data from spring surveys were used. Spring is the best data set as neither 2011 nor 2012 fall data was not collected since no measurable cheatgrass germination occurred in treatment, control, or general management areas, due to drought. The long term trend on the Series 200 plots are shown in the graph below.

Conclusions:

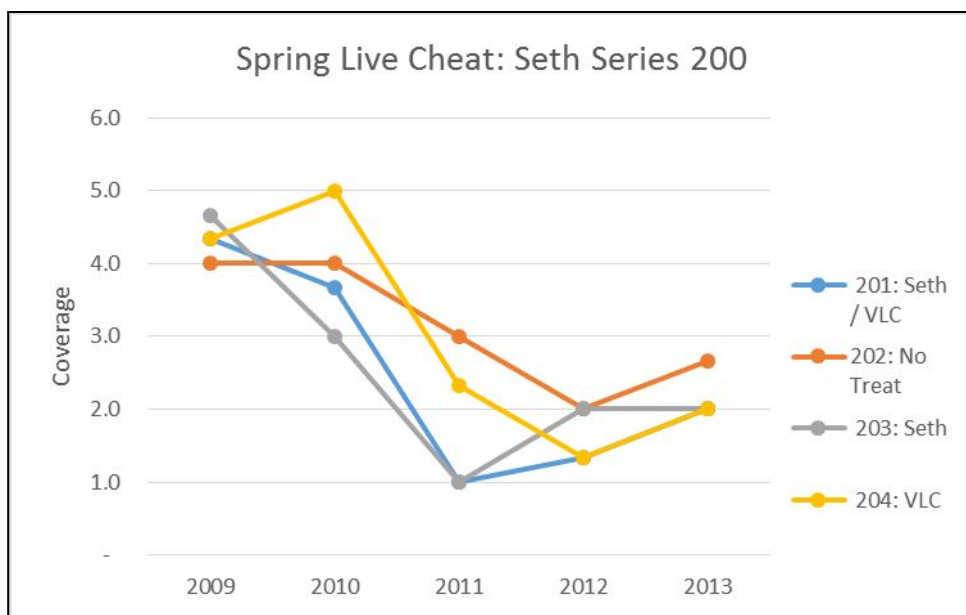
- Cheatgrass control is weak in this series.
- Cheatgrass control has high variability in fall; soil disturbance during management may be a confounding variable, or perhaps spotty soil moisture in fall
- Compared to control plot, Sethoxydim application does not appear to be very effective

Recommendations for 2014:

- Discontinue monitoring this series of plots. We have earlier discontinued the use of sethoxydim in general management areas, due to its limited window of application.

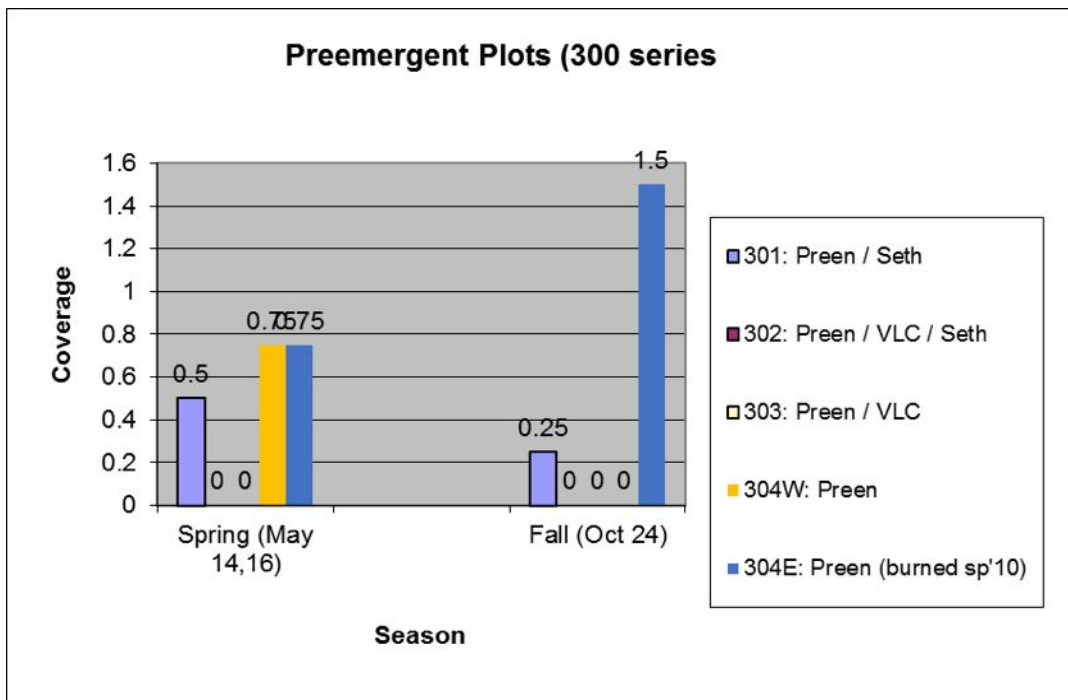


Survey plots at DP1 (200 series) show a clear increase in native forbs, especially milkweed, in the two left plots, both treated with Sethoxydim, the grass herbicide. Cheatgrass is seen as a tan cover in the untreated plot, upper right quadrant. July 2013



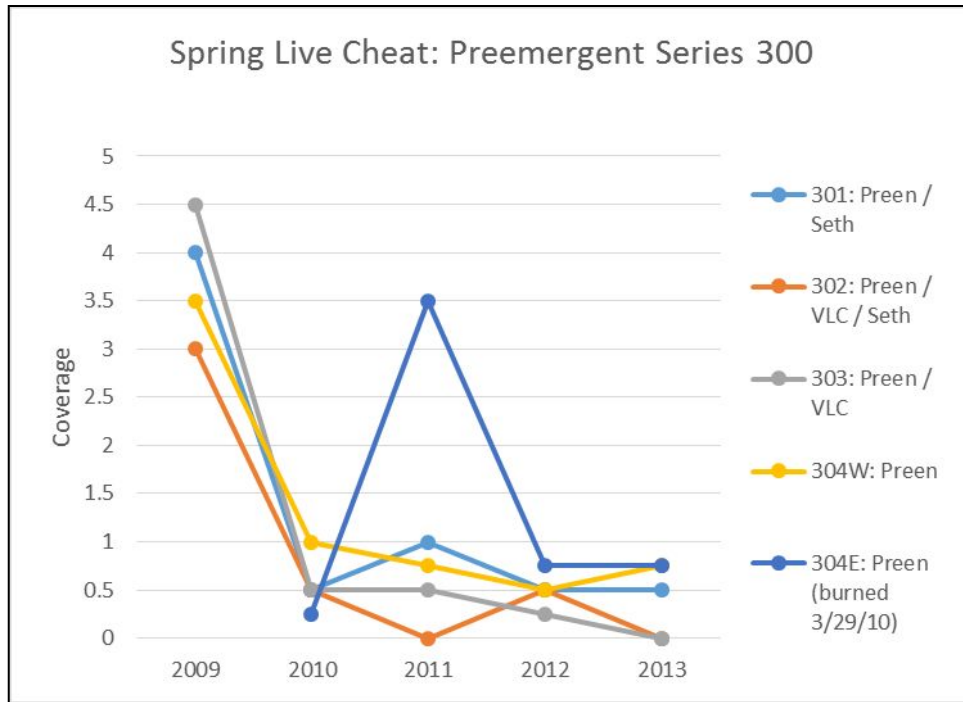
300 Series

The 300 series is designed to test the effects of pre-emergent granules (Preen or equivalent). This series is located in SGP-K high on the hill (similar to 101-106 plots).



For long term trends, data from spring surveys were used. Spring is the best data set as neither 2011 nor 2012 fall data was collected since no measurable cheatgrass germination occurred in treatment,

control, or general management areas, due to drought. The long term trend on the Series 300 plots are:



Conclusions

- Overall, application of pre-emergent appears to be a very effective management strategy.
- Pre-emergent and VLC appear to be a very effective combination, at least under these high hill / drier conditions in a) early years of high infestation, and b) perhaps at the end to eradicate cheatgrass from a plot, as pre-emergent alone does not appear yet to put the nail in the coffin.

Overall Conclusions

- Sethoxydim is not cost effective
- More data on VLC should be collected to determine if we can get by with just using VLC in the early and late stages of control.
- Pre-emergent should be maintained. It is the easiest to apply in addition to being the most effective.
- Plateau (which contains pre-emergent) should be considered for planted prairie DP-1.

VOLUNTEER EVENTS

Task 22: FHR Employee Volunteer Events Kick-Off

The event was held from 11-12:00, with lunch provided as usual. About 30 people attended, similar to other years. We provided a brief summary of 2012 projects and 2013 plans, but we also had a different presentation this year with the “State of the River”, a detailed summary of the condition of the Mississippi River, presented by FMR’s executive director, Whitney Clark. A lot of people signed up for the 4 events planned.

Task 23: Employee Bird Hike

Five employees attended the bird hike. The weather, unfortunately was not good – cool and drizzly. The bird activity, however, was fairly good with 35 species, similar to other years. Three new species were recorded, and three species on conservation need (**Appendix D**).

Task 24: Snake Hibernacula Construction with FHR Volunteers

On July 6, a volunteer event was held to help build the snake hibernaculum. A FHR contractor assisted with tasks needing machinery – digging a large hole, bringing rocks, finishing the covering. The volunteers assisted with laying the fabric and installing the small rocks. Eight enthusiastic FHR volunteers attended for this unusual activity.

Task 25: Prairie Tending with FHR Volunteers

Four FHR volunteers attended this event on July 10. They lopped the heads off of mullein plants and pulled spotted knapweed in Unit DP-1. The timing was good and a lot was accomplished with the small group. A winter event might be worth trying, to see if more volunteers participate. The hot summer weather may be a deterrent.

Task 26: Seed Collection

Three volunteers attended the seed collection event on October 10 and collected a good quantity of grass seed from the savanna units. The seed will be used in portions of the savanna that have low abundance of grasses.

Task 27: Community Volunteer Event

Sixty-six volunteers participated in a most successful event! Enormous amounts of exotic buckthorn were removed from wooded areas along the bluff and adjacent to an existing sand-gravel prairie. This will build on planned restoration of the adjacent grassland to prairie, which is proposed for 2014. The event was very satisfying for volunteers, with vistas of the river opened up, and transformation of the woodland edge. Watching the brush piles grow to giant proportions also spurred enthusiasm.



Volunteers built massive buckthorn piles on the wooded bluffs above the river on a chilly October 26 morning.

BREEDING BIRD SURVEY

Task 28: Breeding Bird Survey

The annual breeding bird survey was completed on June 6 and July 1, at the same points and using the same point count methods that have been used for several years (**Appendix D**). Each year a few new species are recorded and the total number of breeding birds species increases incrementally. Just one new species was detected during the breeding bird survey in 2013, but three new species were noted in the spring bird hike, bringing the total number of species recorded on site to 107, with 67 potential breeding species. Twenty-three species recorded at the FHR property, including 11 potential breeding species, are on the MN Department of Natural Resources list of Species of Greatest Conservation Need (SGCN). In any given year, there are typically 6 to 8 SGCNs recorded in the breeding survey.

The most abundant species, with an average of 10 to 13 recorded in any year are: brown-headed cowbird, house wren, American goldfinch, cedar waxwing, song sparrow, and American redstart. All are habitat generalist species and very common throughout their range. The abundance of cowbirds is an unfortunate byproduct of the habitat fragmentation that has occurred with human development of the landscape. These brood parasites are much more abundant than they were historically, and have very negative impacts on the breeding success of many other bird species.

The next most common species, with an average of 5 to 8 recorded each year, are common yellowthroat, American robin, gray catbird, black-capped chickadee, indigo bunting, Baltimore oriole, northern cardinal, blue jay, great-crested flycatcher, and yellow warbler. Three additional species, field sparrow, eastern wood pewee, and rose-breasted grosbeak, are SGCNs. The numbers of these species have been fairly constant over the years.

The presence of all these bird species is a positive indicator that the Flint Hills Resources property provides very valuable habitat for many species, both during breeding season and during migration. What is not known, however, is what the likely breeding success is for species that attempt to nest on site. Habitat fragmentation plays an enormous role in nest success because it enables access by many predators (e.g. raccoons, skunks, fox) as well as cowbirds, that would not otherwise be there in an intact, large forest. Recent studies by Macalester College of ground-nesting birds at the nearby Ordway field station showed that nest success was essentially zero. That site would be considered a “population sink”, whereby more individuals of the larger population are lost than are produced. It would be worthwhile to evaluate the nest success of both forest and grassland birds at FHR. What could be done to remedy the situation if it is an issue is not known at this time. The general management methods that have been occurring for the past 14 years are the best tools for providing a healthy habitat for wildlife. There may be more specific methods that could help offset some of the negative impacts of habitat fragmentation on breeding bird populations.

APPENDIX A. Prairie species seeded at MP2 (3.5 ac) on 11/8/13

Scientific Name	Common Name	Gross % of seed count	Gross # seeds/ s.f.	Net # seeds/ s.f.	oz/ acre	Lb/ acre
<i>Andropogon gerardii</i>	big bluestem	27	14.85	8.91		2.43
<i>Bouteloua curtipendula</i>	side-oats grama	18	9.9	4.95		2.25
<i>Bromus kalmii</i>	kalm's brome	1	0.2	0.10		0.54
<i>Elymus trachycaulus</i>	slender wheatgrass	5	1	0.50		3.16
<i>Elymus virginicus</i>	virginia wild rye	17	9.35	3.74		1.96
<i>Panicum virgatum</i>	switchgrass	6	1.2	0.72		2.24
<i>Schizachyrium scoparium</i>	little bluestem	24	13.2	9.24		1.68
<i>Stipa spartea</i>	porcupine grass	2	0.4	0.04		0.16
<i>Sorghastrum nutans</i>	Indian grass	23	12.65	8.86		2.01
			62.75	37.06		16.42
FORBS, Small shrubs						
<i>Agastache foeniculum</i>	blue giant hyssop	0.5	0.1	0.12	0.06	
<i>Amorpha canescens</i>	lead plant	0.9	0.18	0.13	0.45	
<i>Anemone cylindrica</i>	long-headed thimbleweed	0.2	0.04	0.04	0.07	
<i>Artemisia ludoviciana</i>	prairie sage	0.09	0.018	0.04	0.01	
<i>Asclepias syriaca</i>	common milkweed	0.04	0.008	0.00	0.03	
<i>Aster ericoides</i>	heath aster	0.8	0.16	0.32	0.07	
<i>Aster laevis</i>	smooth aster	1.2	0.24	0.24	0.19	
<i>Astragalus canadensis</i>	Canada milk vetch	0.3	0.06	0.05	0.12	
<i>Ceanothus americanus</i>	American New Jersey tea	0.2	0.04	0.02	0.11	
<i>Chamaecrista fasciculata</i>	partridge pea	2.2	0.44	0.13	2.13	
<i>Coreopsis palmata</i>	bird's foot coreopsis	1.2	0.24	0.14	0.63	
<i>Dalea candida</i>	white prairie clover	1	0.2	0.16	0.37	
<i>Dalea purpurea</i>	purple prairie clover	6	3.3	2.31	0.42	
<i>Desmodium canadense</i>	Canada tick trefoil	1	0.2	0.08	0.63	
<i>Epilobium angustifolium</i>	fireweed	2	0.4	1.20	0.10	
<i>Galium boreale</i>	northern bedstraw	0.5	0.1	0.13	0.08	
<i>Gentiana flavida</i>	yellowish gentian	0.05	0.01	0.02	0.01	
<i>Heliopsis helianthoides</i>	ox-eye	1	0.2	0.10	0.69	
<i>Lespedeza capitata</i>	round-headed bush clover	0.3	0.06	0.03	0.16	
<i>Liatris aspera</i>	rough blazing star	2	0.4	0.32	0.87	
<i>Liatris ligulistylis</i>	northern plains blazing star	3	0.6	0.36	1.57	
<i>Monarda fistulosa</i>	wild bergamot	1.3	0.26	0.31	0.19	
<i>Ratibida pinnata</i>	gray-headed coneflower	1.1	0.22	0.22	0.32	
<i>Rosa arkansana</i>	prairie rose	0.02	0.004	0.00	0.02	
<i>Rudbeckia hirta</i>	black-eyed susan	3	0.6	0.60	0.28	
<i>Silphium laciniatum</i>	compass plant	1.2	0.24	0.01	0.79	
<i>Solidago speciosa</i>	showy goldenrod	0.05	0.01	0.01	0.01	
<i>Tradescantia ohiensis</i>	Ohio spiderwort	1.4	0.28	0.14	0.76	
<i>Verbena stricta</i>	hoary vervain	0.8	0.16	0.24	0.11	
<i>Veronicastrum virginicum</i>	Culver's root	0.8	0.16	0.69	0.04	
<i>Vicia americana</i>	American vetch	0.08	0.016	0.00	0.10	
<i>Zizia aptera</i>	heart-leaved alexanders	0.8	0.16	0.11	0.41	
Total		35.03	9.106	8.2796	11.8	0
Total		35	72	45	12	16

APPENDIX B. Seepage Swamp Vegetation Survey

Survey plots were 2x2 m. Corners marked with wooden posts and flagged.

A transect survey was also done between the 2 north corners of each plot.

Photographs were taken from west to east.

				Surveyed 5/29/2013					
Plot 1 was cleared of buckthorn in fall 2011. No canopy				1		2		3	
Plot 2 cleared in fall 2012. No canopy.				South		Middle		North	
Plot 3 was not cleared. 4-8" diameter buckthorn, no native canopy or subcanopy - 100% buckthorn.				% Cover*	No. stems	% Cover	No. stems	% Cover	No. stems
NON-Nativ	Family	Scientific name	Common Name	GPS 14 +10'	1 Transect	GPS 15 +13'	2 Transect	GPS 16 +23'	3 Transect
Groundlayer (0 to 0.5 m height)				5		4		3 (50%)	
	Forbs, ferns								
x	Brassicaceae	<i>Alliaria officinalis</i>	garlic mustard	2 (5%)	7				
	Ranunculaceae	<i>Anemone quinquefolia</i>	wood anemone					+	1
	Araceae	<i>Arisaema triphyllum</i>	Jack-in-the-pulpit			+	1	1	
	Ranunculaceae	<i>Caltha palustris</i>	marsh marigold			2	1		
	Asteraceae	<i>Eupatorium perfoliatum</i>	Boneset	1	1				
	Balsaminaceae	<i>Impatiens capensis</i>	Spotted jewelweed	4	21	3	5		
	Urticaceae	<i>Laportea canadensis</i>	wood nettle			2	4		
	Liliaceae	<i>Lilium michiganense</i>	Michigan lily					+	
	Primulaceae	<i>Lysimachia sp</i>	Loosestrife (native)		1			+	2
	Liliaceae	<i>Maianthemum canadense</i>	false lily of the valley					+	1
	Apiaceae	<i>Osmorhiza claytonii</i>	sweet cicely					+	
	Roseaceae	<i>Rubus hispidus</i>	swamp dewberry			1	2	+	2
	Arumaceae	<i>Symplocarpus foetidus</i>	skunk cabbage	4	7	3	3	2	2
	Thelypteridaceae	<i>Thelypteris palustris</i>	marsh fern			+		1	
		<i>Unknown sp</i>	fuzzy stem	1	1	+			
		<i>Unknown sp</i>	Like lysimachia		1				
	Bryophytes	Mosses				3		2	6"
	Graminoids								
	Equisetaceae	<i>Equisetum sp</i>	bottlebrush			+	2		
	Woody								
	Vitaceae	<i>Parthenocissus inserta</i>	Virginia creeper					+	
	Roseaceae	<i>Prunus serotina</i>	black cherry					+	
X	Rhamnaceae	<i>Rhamnus cathartica</i>	common buckthorn			+	1	1	2
	Ulmaceae	<i>Ulmus americana</i>	American elm			+	1		
Bare Soil					13 cm		30.5 cm	4	51 cm
Understory (0.5 - 3 m height)				0		0		0	
Canopy (3 - 5 m)				0		0		5	
X	Rhamnaceae	<i>Rhamnus cathartica</i>	common buckthorn					5	
* D=dominant, A=abundant, C=Common, P=present, R=rare									
* Cover Classes for individual species and vegetation layers: + (0-1%), 1 (1-5%), 2 (5-25%), 3 (25-50%), 4 (50-75%), 5 (75-100%).									
NOTES									
Plot 1: Garlic mustard is much more prevalent than it was in 2012. Distinct line between 2011 removal and 2012 removal areas.									
Plot 2: Michigan lily is common in the area (none in plot). Buckthorn seedlings and wild geranium also common. Early meadowrue found.									
Plot 3: Ground layer veg is only 50% vs 100% in 1 & 2. More woodland species than 1 & 2. No jewelweed.									

APPENDIX C. SAVANNA VEGETATION SURVEY

Three vegetation survey plots were established in 2011 in SV2, 3x3 m each.

Seeded species are blue highlight. Species that were likely seeded, but no records are green highlight.

Notable changes in coverage are highlighted in orange.

Flagged stakes mark the SE corner. Photos were taken from south to north.

2013: all but flagged stakes were gone, so plots not exact. Mid and west plots were mowed in July 2013, so Sept survey was not possible.

NON-Native	Scientific name	Common Name	EAST				MID			WEST		
			5/25/11	5/10/12	7/1/13	9/4/13	5/25/11	5/10/12	7/1/13	5/25/11	5/10/12	7/1/13
		GPS: 496					497			498		
	Groundcover, 0 to 1 m											
	Forbs, vines		5	4	4	4	5	3	4	5	3	3
X	<i>Achillea millefolium</i>	yarrow										
	<i>Alliaria petiolata</i>	garlic mustard	1	+			2	1		5-sdl carpet	+	
	<i>Ambrosia artemisiifolia</i>	common ragweed			1	1	+					
	<i>Anemone cf cylindrica</i>	thimbleweed	+							+		
	<i>Anemone canadensis</i>	Canada anemone										
X	<i>Arctium minus</i>	common burdock	2	2	1				+	+		
	<i>Asclepias syriaca</i>	common milkweed									+	+
X	<i>Berteroa incana</i>	hoary allysum			1							+
X	<i>Cirsium arvense</i>	canada thistle	2 (20%)	2	1	1	1	1	2	2		2
	<i>Cirsium discolor</i>	field thistle									1	
X	<i>Cirsium vulgare</i>	bull thistle		1						1 (20%)	+	
	<i>Convolvulus sp</i>	bindweed								+		
	<i>Galium aparine</i>	cleavers	+				1			+		
	<i>Galium boreale</i>	Northern Bedstraw			1							
X	<i>Glechoma hederacea</i>	creeping charlie	4	4	2	2	1	1				
X	<i>Hackelia virginiana</i>	Virginia stickseed	1				+			+		
X	<i>Leonurus cardiaca</i>	motherwort	+	+			+	1	1	+		
X	<i>Linaria vulgaris</i>	butter and eggs								1 (1%)	1	2
	<i>Monarda fistulosa</i>	bergamot			+	+				+		1
	<i>Oxalis stricta</i>	wood sorrel	+		+							1
	<i>Parthenocissus inserta</i>	Virginia creeper	1	+	1							+
X	<i>Plantago major</i>	plantain		1			+	+		+		
	<i>Potentilla sp</i>	cinquefoil								+		
	<i>Rubus ideaus & alleghensis</i>	raspberry (red, black)	+	1 (5%)	1	1	3(40%)	3 (25%)	3	+	2 (dom)	2
x	<i>Rumex crispus</i>	curly dock			+							
	<i>Solidago canadensis</i>	Canada goldenrod	2 (6%)	2(6%)	2	2	1	+		2	2 subdom	3 dom
	<i>Solidago gigantea</i>	late goldenrod							+			
x	<i>Taraxacum officinale</i>	dandelion	+	+			+	+			+	
	<i>Urtica dioica</i>	stinging nettle	+	1			1	+	1	3	1	1
	<i>Verbena stricta</i>	Hoary Vervain			+	+						
	<i>Viola sp.</i>	violet		1	1		+	1		+		
	Graminoids		2	3	3		3 (<50%)	5(76%)	4	2	3	
X	<i>Agropyron (Elytrigia)repens</i>	quackgrass	+	1			1	1		+		
	<i>Andropogon gerardii</i>	big bluestem			1							
X	<i>Bromus inermis</i>	smooth brome		1								
	<i>Bromus kalmii</i>	Kalm's brome				1						
X	<i>Bromus tectorum</i>	Cheatgrass								2		
	<i>Carex blanda</i>		1	1				+		1	2-3 (dom)	2
	<i>Carex sp - thin blade (cf pennsylvanica)</i>		1									
	<i>Elymus canadensis</i>	Canada Wild Rye		1	1				2		1	
	<i>Elymus virginicus</i>	Virginia Wild Rye							1			
X	<i>Phalaris arundinaceae</i>	reed canary grass	1(5%)									
X	<i>Poa pratensis</i>	Kentucky bluegrass		1	2		3	3	2	2	2(subdom)	2
	<i>Schizachrium scoparium</i>	little bluestem		2							+	
x	<i>Setaria glauca</i>	yellow foxtail				2						
	Woody plants					1						
	<i>Acer negundo</i>	boxelder		+								+
X	<i>Lonicera tartarica</i>	Tartarian honeysuckle									+	1
	<i>Prunus serotina</i>	black cherry (native)			+	+						
	<i>Quercus rubra</i>	red oak		+	sdl							
x	<i>Rhamnus cathartica</i>	common buckthorn	+		+	+						
	<i>Ulmus pumila</i>	Siberian elm (sdl)									+	+
	<i>Ulmus americana</i>	American elm			+							
	<i>Celtis occidentalis</i>	Hackberry			+	+			+			
	<i>Vitis riparia</i>	Wild grapevine			+	+						
	<i>Ribes sp</i>	Currant/gooseberry			+							
	sdl=seedling											
	Percent Coverages: + = <1%, 1=1-5%, 2=5-25%, 3=25-50%, 4=50-75%, 5=75-100%											

APPENDIX D. BIRD SURVEY DATA

Bird Species Recorded at Flint Hills Resources Bluff Property - 2008, 2009, 2010, 2011, 2012, 2013
Species of Greatest Conservation Need (Minnesota Department of Natural Resources) are RED font.
Starting with 2010, new species found each year are highlighted orange.

			2009	5/20/10	2010	5/12/11	2011	5/15/12	2012	5/15/13	2013	2009-2013
	Common name	2008	Breeding Survey	Bird Hike	Breeding survey**	Bird Hike	Breeding survey**	Bird hike	Breeding Survey**	Bird hike	Breeding Survey**	Breeding Spp
1	Alder flycatcher										1	1
2	American Crow	X	2		6	1	4	1	2		2	1
3	American Goldfinch	X	19	1	9	1	8	1	13	1	5	1
4	American Kestrel		2				1					1
5	American Redstart	X	12	1	5	1	8		11	1	13	1
6	American Robin	X	7	1	6	1	10	1	7	1	6	1
7	American white pelican									1		
8	Baltimore Oriole	X	5	1	7	1	8	1	4	1	3	1
9	Barn swallow			1								1
10	Barred owl						1					1
11	Black-and-white warbler					1		1				
12	Black-billed cuckoo											
13	Blackburnian Warbler	X										
14	Black-capped Chickadee	X	2	1	8		4		7	1	12	1
15	Blackpoll warbler					1						
16	Black-throated Green Warbler	X										
17	Blue grosbeak			1								
18	Blue Jay	X	4	1	4	1	7		5	1	6	1
19	Blue-gray Gnatcatcher	X	5	1	5		1		5	1	6	1
20	Bobolink	X										
21	Brown-headed Cowbird	X	29	1	10	1	11	1	6	1	11	1
22	Brown thrasher						1	1				1
23	Canada goose											
24	Carolina wren	X										
25	Cedar Waxwing	X	4	1	13		19		10		5	1
26	Chestnut-sided Warbler	X				1						
27	Chimney swift	X							5	1	3	1
28	Chipping Sparrow	X	7	1	2		2		4	1	5	1
29	Clay-colored Sparrow	X	4	1	5	1	2	1	3	1	7	1
30	Cliff swallow								3			1
31	Common Yellowthroat	X	1		9	1	13	1	10	1	9	1
32	Cooper's hawk								1			1
33	Dark-eyed junco											
34	Double-crested cormorant (FO)			1								
35	Downy Woodpecker	X	1		1		3		1			1
36	Eastern bluebird	X	4	1	1	1	4	1	4	1	2	1
37	Eastern Kingbird	X	1	1	2	1	2		2		1	1
38	Eastern meadowlark		2	1							2	1
39	Eastern Phoebe	X	6		1		2		1			1
40	Eastern Towhee	X	3	1	3	1	3	1	7	1	5	1
41	Eastern wood pewee	X	6	1	4		3		9		5	1
42	European Starling	X	1			1	1					1
43	Field Sparrow	X	7	1	4	1	7	1	10	1	4	1
44	Golden-winged warbler					1						
45	Grasshopper sparrow							1		1		
46	Gray Catbird	X	7	1	8	1	4	1	10	1	7	1
47	Great Blue Heron	X			4				1			1
48	Great Egret	X	1		20							1
49	Great-crested Flycatcher	X	6	1	3	1	6	1	5	1	6	1
50	Hairy woodpecker		1		1				1			1
51	Harris sparrow									1		
52	House Finch	X	2							1		1
53	House Wren	X	14	1	12	1	8		14	1	15	1
54	Indigo Bunting	X	7	1	6	1	8	1	7		5	1
55	Killdeer	X									1	1
56	Lark Sparrow									1		
57	Least Flycatcher	X		1								
58	Marsh wren				4		5				2	1
59	Mourning Dove	X	1			1	3		1		1	1
60	Mourning Warbler	X						1				
61	Nashville Warbler	X				1				1		
62	Northern cardinal	X	7	1	7	1	4	1	6	1	3	1
63	Northern Flicker	X	1	1	1		2	1	2			1
64	Northern harrier											

FHR BIRD SURVEY DATA (continued)

			2009	5/20/10	2010	5/12/11	2011	2012	2012	2013	2013	2009-2012
	Common name	2008	Breeding Survey	Bird Hike	Breeding survey**	Bird Hike	Breeding survey**	Bird hike	Breeding Survey**			Breeding Spp
65	Northern Rough-winged Swallow	X	1	1	1		1				2	1
66	Northern parula					1						
67	Olive-sided flycatcher							1				
68	Orange-crowned warbler									1		
69	Orchard oriole	X		1	1		2		1		3	1
70	Osprey-carrying a crappie							1				
71	Ovenbird	X	5	1	1		4		2		3	1
72	Palm Warbler	X										
73	Pileated Woodpecker	X	1					1	1			1
74	Red-bellied woodpecker			1		1	3	1	1		1	1
75	Red-eyed Vireo	X	3	1	3	1	3	1	6	1	4	1
76	Red-headed woodpecker					1						
77	Red-tailed Hawk	X		1			1	1	2	1		1
78	Red-winged Blackbird	X	3		3		7		4		3	1
79	Ring-billed Gull	X										
80	Ring-necked pheasant											
81	Rose-breasted Grosbeak	X	8	1	6	1	3	1	1	1	5	1
82	Ruby-crowned kinglet											
83	Ruby-throated Hummingbird	X	2							1	2	1
84	Sand-hill crane											
85	Scarlet tanager	X			1				1		1	1
86	Sedge wren			1	1							1
87	Sharp-shinned Hawk	X	1				1					1
88	Song Sparrow	X	14	1	12	1	6	1	8		10	1
89	Swainson's Thrush	X				1				1		
90	Swamp Sparrow	X			1		2		1		1	1
91	Tennessee Warbler	X		1		1		1				
92	Tree Swallow	X	5	1	3	1	2	1	27	1	1	1
93	Turkey vulture					1		1				
94	Warbling vireo		1		2		2		1		2	1
95	Western Meadowlark	X										
96	White-breasted Nuthatch	X		1	4	1	2	1	2		2	1
97	White-throated sparrow											
98	Wild Turkey	X	3	1		1		1		1		1
99	Wilson's Warbler	X										
100	Wood duck				6				27		1	1
101	Wood thrush	X	1						1			1
102	Yellow Warbler	X	5		6	1	4		6	1	5	1
103	Yellow-bellied Sapsucker	X										
104	Yellow-billed cuckoo						1					1
105	Yellow-headed blackbird											
106	Yellow-rumped Warbler	X				1				1		
107	Yellow-throated vireo	X			1				1		4	1
	No. Birds		234	40	223		209		287		203	
	No. Species	68	47	40	46	39	48	32	50	35	46	67
	No. new species				3		6	3	2	3	1	
	No. SGCN		7		8		8	3	6	3	8	11
	2008 walking surveys on May 16, May 22, Jun 24, Jul 31, Aug 14.											
	2009 point count survey at 12 points, 50 m radius, 5 to 8 minutes.											
	*2009 data represent all individuals recorded on Jan 28, April 15, May 11, and the maximum of two visits on June 11, June 17											
	** Breeding survey data are the maximum of two visits 2010: 6/10 & 6/30; 2011: 6/6 & 6/28; 2012: 6/11 & 6/27; 2013: 6/4 & 7/1											

Map B-1. Bird survey

FHR 2010 Bird Survey
50 m point count, 8 minutes with 5 min split.
For breeding birds, conduct in June betw 6-9:30 am.

1. At RR ties - DELETED
2. At SW corner of field
3. At bend in pipeline
4. At tree gap on N side of rd
5. At first drive - DELETED
8. At south bend in Pipe- go to edge of wds
9. At large dead snag
10. At bend in rd
11. At oak tree grove
12. By second evergreen clump at Unit I
13. At end of small drive on west of rd.
14. About 50 ft east of monit. well. Tree marked 7.
15. Near pump no. 1, at opening along shore.

- FHR bird pts**
- Deleted pts in 2010
 - Shifted pt in 2010
 - New pt in 2011
 - Same pts as 2009
 - Phase I Units
 - Phase 2 Area



0 50 100 200 Meters



1:8,200

1 inch = 683 feet

