

**IRVINE PRAIRIE
WORK ASSESSMENT
2019**

IRVINE PRAIRIE SCIENCE UPDATE

Year 2 (2019)

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Introduction

We continued the restoration and maintenance of an ecologically diverse tallgrass prairie at Irvine Prairie in 2019, seeding ~ 19 ac on the back slopes, foot slopes, and toe slopes of the westernmost third of the site. In order to ensure that our efforts at restoring a diverse prairie are effective, we must reliably monitor our progress through detailed vegetation sampling.

Monitoring also allows us to anticipate potential problems in the future, and helps us tweak our management practices in order to get the best results we can get out of the seeds and plants we've planted. This document serves as a "check-up" to see how the restoration is doing, and how well we are meeting our goals. In this update we 1) review how we conducted our monitoring (Methods), 2) show what the monitoring tells us (Results), and 3) discuss steps we should take based on our results (Management Implications).

Methods

Our approach to monitoring is to use randomized, permanent plots to answer our questions about the performance and ecology of Irvine Prairie. We added 20 new monitoring points in 2019. Each permanent plot consists of two steel pipes recessed into the ground at the corners of a ~ 10 ft² square area, with approximately 2 in of exposed pipe. A custom constructed sampling frame with downward facing pipefittings can be placed on the permanently established pipes to form a repeatable sampling area. These permanent steel "corner posts" are designed to withstand both fire and mowing (> 4 in), and similar permanent marker designs have been used successfully under comparable circumstances (Meissen et al. 2017).



Figure 1. Typical view in July 2019 of the west back slopes and northwest toe slope plantings (seeded May 2019). Oat and winter wheat nurse crop well established.



Figure 2. Vegetation detail of the area planted in 2019. Native seedlings can be seen among the oat nurse crop.

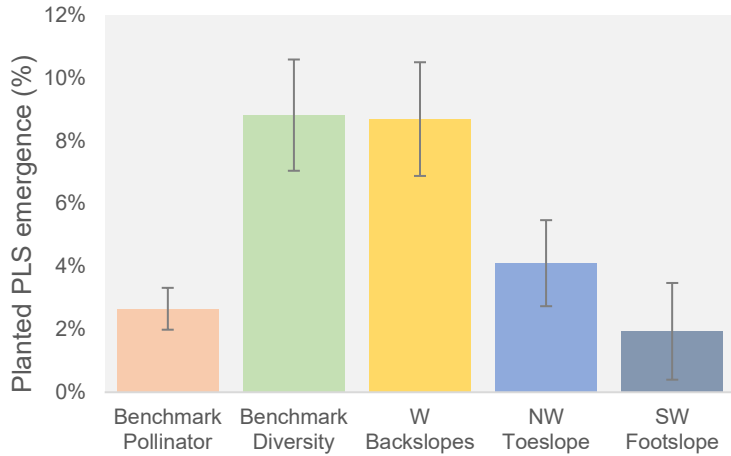


Figure 3. Seedling emergence after one growing season (% planted seeds emerged) of new 2019 plantings, compared to benchmark seed mixes.

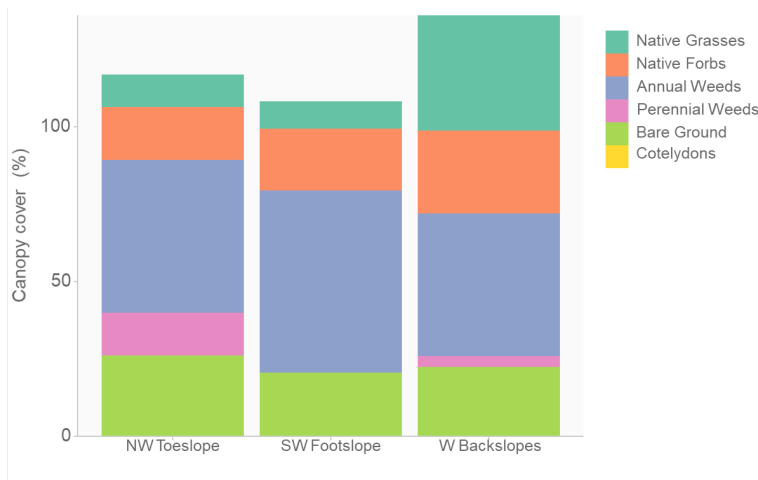


Figure 4. Canopy cover of functional groups sampled in ten ~10 ft² quadrats in 2019 planting areas. Cover may exceed 100% due to use of cover classes.

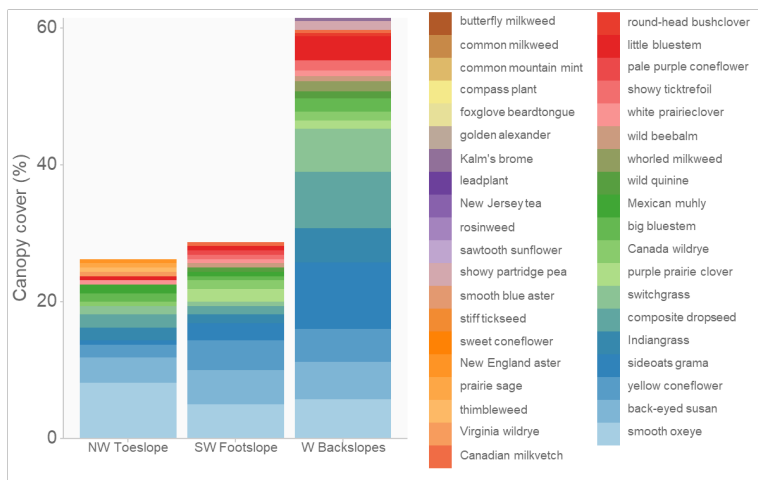


Figure 5. Canopy cover of top 20 species sampled in ten 1m² quadrats in 2019 planting areas. Cover may exceed 100% due to use of cover classes.

We measured species identity, vegetation density and canopy cover metrics at each sampling location in . To measure canopy cover, we identified all species present and estimated the area covering the ~10 ft² quadrat by each species (including bare ground) using Daubenmire cover classes. We then used the class midpoints to estimate canopy cover by species and combined species data to estimate canopy cover by functional group. We used this data (species presence in ~10ft²) to estimate species richness. We measured density data using a smaller ~1ft² quadrat nested in the southwest corner of the larger ~10 ft² quadrat. Here we measured each plant and number for all species present in the quadrat. We also counted stems in quadrats for the new plantings (planted 2019).

We catalogued all species present among plantings using meandering walks. During the walk, we recorded all planted species encountered, and estimated their overall abundance using a qualitative scale: Abundant, Common, Occasional, Rare.

Results

2019 Planting Area (1st Growing Season)

Overall, restoration outcomes were successful, but variable. Seeding was executed without issue, though large rain events shortly after planting caused several washouts in former waterways. Despite washouts, nurse crops and native species mostly established well across the site (Fig. 1, Fig. 2). Weed issues were mostly restricted to high coverage of annual foxtail in foot slope and toe slope areas. Some erosion occurred during times with minimal vegetation coverage in the spring and

early summer, though rills observed in summer had not grown significantly by fall.

Establishment of the planted seed mixes ranged from very good to fair (Fig. 3). Compared to other benchmark seed mixes, the seed mix planted on the back slope areas performed about as well as the Nashua Diversity Mix, which is above average for typical prairie reconstructions. The seed mix planted on the northwest toe slope area established at less than average rates, but still generally better than a typical Pollinator Mix. The seed mix planted on the southwestern foot slope area showed only fair establishment, though native plant density still reached about one seedling per square foot, which is a rule-of-thumb minimum for successful prairie reconstruction.

As in most prairie reconstructions, vegetation structure was mostly dominated by annual weeds in the 2019 planting areas (Fig.4). The back slope areas had a relatively even mix of native forbs, annual weeds, bare ground, and a fairly high abundance of native grass. The toe slope and foot slope areas were characterized by a particular lack of native grass cover. As long as solid overall native establishment continues in the coming years, the relatively lower grass cover may be a benefit to wildlife in the longer term. While dandelions (a perennial weed) were common in the northwest toe slope area, we were encouraged to find little to no other perennial weed cover in the new plantings.

We found over 40 species throughout the planting site (Table 1). This is encouraging given the generally late timing of planting- many forbs are likely to emerge next year as dormancy is broken over the cold months. We expect the list of species present on site to grow substantially in 2020.

Table 1. Species and abundance found in the planting areas seeded in 2019 (first growing season).

<i>Common Name</i>	<i>Scientific Name</i>	<i>Abundance</i>	<i>Common Name</i>	<i>Scientific Name</i>	<i>Abundance</i>
big bluestem	<i>Andropogon gerardii</i>	Occasional	grass-leaved goldenrod	<i>Euthamia graminifolia</i>	Rare
sideoats grama	<i>Bouteloua curtipendula</i>	Common	American licorice	<i>Glycyrrhiza lepidota</i>	Rare
Canada wildrye	<i>Elymus canadensis</i>	Common	sneezeweed	<i>Helenium autumnale</i>	Occasional
Virginia wildrye	<i>Elymus virginicus</i>	Occasional	sawtooth sunflower	<i>Helianthus grosseserratus</i>	Occasional
Mexican muhly	<i>Muhlenbergia mexicana</i>	Rare	stiff sunflower	<i>Helianthus pauciflorus</i>	Rare
switchgrass	<i>Panicum virgatum</i>	Common	smooth oxeye	<i>Heliopsis helianthoides</i>	Common
little bluestem	<i>Schizachyrium scoparium</i>	Occasional	wild beebalm	<i>Monarda fistulosa</i>	Occasional/Rare
Indiangrass	<i>Sorghastrum nutans</i>	Common	biennial guara	<i>Oenothera guara</i>	Rare
composite dropseed	<i>Sporobolus compositus</i>	Common	wild quinine	<i>Parthenium integrifolium</i>	Occasional
Canadian milkvetch	<i>Astragalus canadensis</i>	Occasional	yellow coneflower	<i>Ratibida pinnata</i>	Common
showy partridge pea	<i>Chamaecrista fasciculata</i>	Occasional	back-eyed susan	<i>Rudbeckia hirta</i>	Common
white prairie clover	<i>Dalea candida</i>	Rare	sweet coneflower	<i>Rudbeckia subtomentosa</i>	Rare
purple prairie clover	<i>Dalea purpurea</i>	Common	rosinweed	<i>Silphium integrifolium</i>	Rare
showy ticktrefoil	<i>Desmodium canadense</i>	Occasional	stiff goldenrod	<i>Solidago rigida</i>	Rare
prairie sage	<i>Artemisia ludoviciana</i>	Rare/Occasional	heath aster	<i>Symphyotrichum ericoides</i>	Rare
swamp milkweed	<i>Asclepias incarnata</i>	Occasional	smooth blue aster	<i>Symphyotrichum laeve</i>	Rare
common milkweed	<i>Asclepias syriaca</i>	Occasional	New England aster	<i>Symphyotrichum novae-</i>	Occasional
butterfly milkweed	<i>Asclepias tuberosa</i>	Rare	prairie ironweed	<i>Vernonia fasciculata</i>	Rare
whorled milkweed	<i>Asclepias verticillata</i>	Occasional	American vetch	<i>Vicia americana</i>	Rare
pale purple coneflower	<i>Echinacea pallida</i>	Rare			
tall boneset	<i>Eupatorium altissimum</i>	Rare			
boneset	<i>Eupatorium perfoliatum</i>	Rare			

Species abundance was highly variable, but we found most at low abundance (1-5% cover) (Fig. 5). Some species like composite dropseed, sideoats grama, oxeye, and black eyed susan were particularly common, with cover ranging from 5-10%.

2018 Planting Area (2nd Growing Season)

Progress toward a diverse tallgrass prairie continued on the hilltop planted in 2018. Native cover and biomass production was very high in its second year, and we observed the expected trends in species composition (early successional species dominance) (Fig. 1, Fig. 2). Weed abundance remained low, and was generally restricted to scattered annual weeds.

Native grass heavily dominated the site this year (Fig.4). Forb cover was lower than expected, though this was likely due to the late timing of the surveys

We found 50 species throughout the planting site (Table 1). We expect the list of species present on site to grow in 2020 as more conservative species such as blazingstar and rattlesnake master germinate or become more easily observable.

Species abundance was highly variable, but we found most at low abundance (1-5% cover) (Fig. 5). Some species like composite dropseed, sideoats grama, oxeye, and black eyed susan were particularly common, with cover ranging from 5-10%.

Management Implications

The outcomes from our formal vegetation assessment showed that the majority of the Irvine Prairie is establishing and progressing well. We also identified several areas in need of close monitoring that may need targeted management if native plant establishment does not improve. Current site-preparation, seeding, and establishment management activities have resulted in success, and no changes in management techniques are needed.

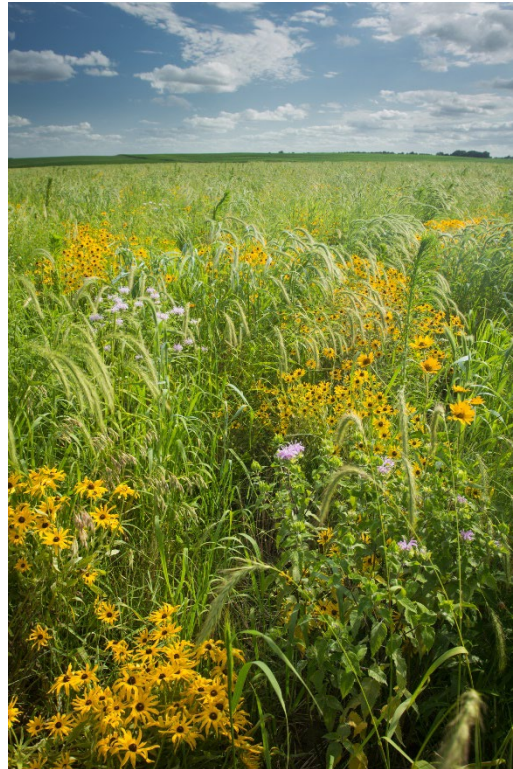


Figure 6. Typical view in July 2019 of the hilltop planted in 2018. Canada wildrye dominates the area, with black-eyed susan, wild bergamot, and oxeye flowering.



Figure 7. Vegetation understory detail of the hilltop planted in 2018. Grass cover of Canada wildrye and switchgrass was unusually high in 2019.

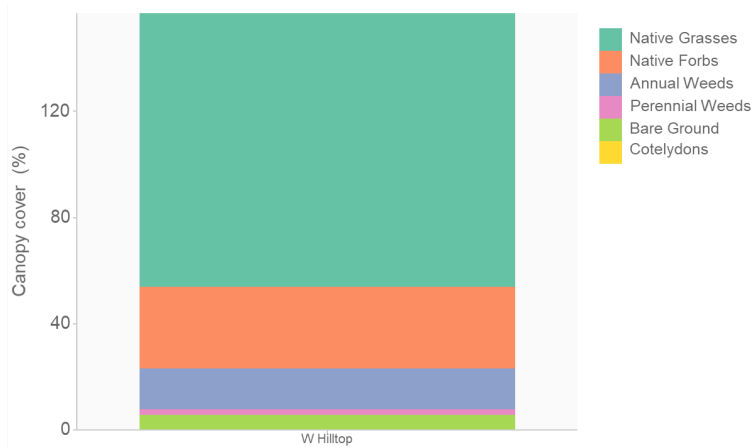


Figure 8. Canopy cover of functional groups sampled in ten ~10 ft² quadrats in 2018 planting areas. Cover may exceed 100% due to use of cover classes.

Due to less than expected establishment rates, the majority of low lying areas in the 2019 planting area should be closely monitored and mowed again in 2020 to promote growth of native seedlings. It is unclear why establishment rates were so low, though in part it is probably related to lower seeding rates and less ideal conditions (too wet) for important grasses like rough dropseed and side-oats grama, which established very well in drier areas. Assuming sown seeds that did not germinate remain viable and unburied, mowing should encourage more seedling establishment when seedlings emerge this year.

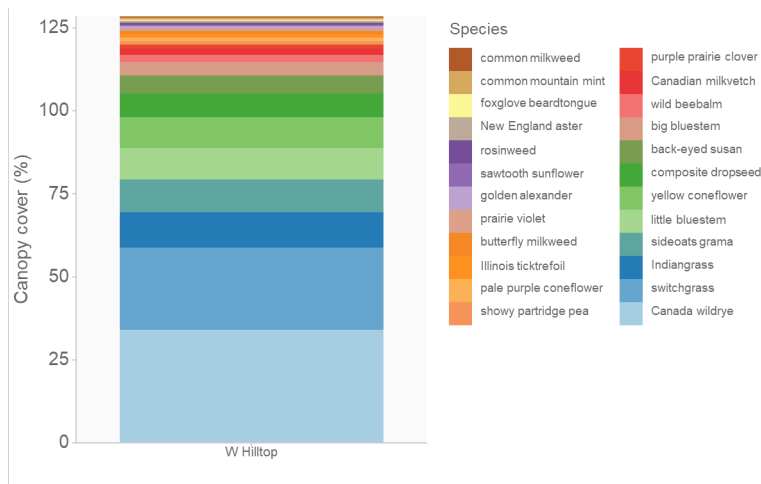


Figure 5. Canopy cover of top 20 species sampled in ten 1m² quadrats in 2018 planting areas. Cover may exceed 100% due to use of cover classes.

Switchgrass continued to overperform in both 2018 and 2019 plantings. In the 2018 planting, the relative abundance of switchgrass increased slightly from 17% to 18% of native plant cover in the second year. If switchgrass continues to increase in abundance and exceeds 25% of native plant cover, we may initiate late spring burning in this area which may help reduce switchgrass cover (Blocksome 2011). Because we halved the amount of switchgrass in our seed mix based on last year's vegetation data, switchgrass was found in acceptable abundance in the 2019 planting areas. No seedmix resulted in switchgrass canopy cover exceeding 7%, which

should almost certainly prevent its potential for competitive exclusion of other species. Seed mixes on new planting areas will continue to use switchgrass seeding rates similar to those sown in 2019.

Former waterways and adjacent areas throughout Irvine Prairie are proving to be difficult for native species establishment. Some degree of poor establishment is due to the physical presence of scattered to patchy pasture grass that previously made up the waterway vegetation (mostly tall fescue and orchardgrass). However, even in former waterway areas without significant cool season pasture grass, native species establishment has been minimal. To improve longer term native establishment in these areas, we will conduct spot herbicide treatments there throughout the first growing season, and follow up in the fall to re-seed.

Table 2. Species and abundance found in the planting areas seeded in 2018 (second growing season).

<i>Common Name</i>	<i>Scientific Name</i>	<i>Abundance</i>	<i>Common Name</i>	<i>Scientific Name</i>	<i>Abundance</i>
big bluestem	<i>Andropogon gerardii</i>	Common	pale purple coneflower	<i>Echinacea pallida</i>	Common
sideoats grama	<i>Bouteloua curtipendula</i>	Abundant	tall boneset	<i>Eupatorium altissimum</i>	Rare
Kalm's brome	<i>Bromus kalmii</i>	Rare	flowering spurge	<i>Euphorbia corollata</i>	Rare
Canada wildrye	<i>Elymus canadensis</i>	Abundant	sawtooth sunflower	<i>Helianthus grosseserratus</i>	Occasional
switchgrass	<i>Panicum virgatum</i>	Abundant	smooth oxeye	<i>Heliopsis helianthoides</i>	Common
little bluestem	<i>Schizachyrium scoparium</i>	Common	wild beebalm	<i>Monarda fistulosa</i>	Common
Indiangrass	<i>Sorghastrum nutans</i>	Common	wild quinine	<i>Parthenium integrifolium</i>	Occasional
composite dropseed	<i>Sporobolus compositus</i>	Common	prairie cinquefoil	<i>Potentilla arguta</i>	Rare
sedge	<i>Carex sp.</i>	Common	hairy mountain mint	<i>Pycnanthemum pilosum</i>	Occasional
Canadian milkvetch	<i>Astragalus canadensis</i>	Common	yellow coneflower	<i>Ratibida pinnata</i>	Abundant
white wild indigo	<i>Baptisia alba</i>	Rare	back-eyed susan	<i>Rudbeckia hirta</i>	Abundant
showy partridge pea	<i>Chamaecrista fasciculata</i>	Occasional	sweet coneflower	<i>Rudbeckia subtomentosa</i>	Occasional
purple prairie clover	<i>Dalea purpurea</i>	Common	Rosinweed	<i>Silphium integrifolium</i>	Occasional
Illinois bundleflower	<i>Desmanthus illinoensis</i>	Rare	prairie ironweed	<i>Vernonia fasciculata</i>	Uncommon
showy ticktrefoil	<i>Desmodium canadense</i>	Common	compass plant	<i>Silphium laciniatum</i>	Occasional
Illinois ticktrefoil	<i>Desmodium illinoense</i>	Occasional	stiff goldenrod	<i>Solidago rigida</i>	Rare
round-head bushclover	<i>Lespedeza capitata</i>	Occasional	heath aster	<i>Symphotrichum ericoides</i>	Rare
thimbleweed	<i>Anemone cylindrica</i>	Occasional	smooth blue aster	<i>Symphotrichum laeve</i>	Rare
prairie sage	<i>Artemisia ludoviciana</i>	Rare	New England aster	<i>Symphotrichum novae-</i>	Rare
common milkweed	<i>Asclepias syriaca</i>	Common	prairie spiderwort	<i>Tradescantia bracteata</i>	Occasional
butterfly milkweed	<i>Asclepias tuberosa</i>	Common	Ohio spiderwort	<i>Tradescantia obiensis</i>	Occasional
whorled milkweed	<i>Asclepias verticillata</i>	Occasional	hoary vervain	<i>Verbena stricta</i>	Rare
false boneset	<i>Brickeellia eupatoriodes</i>	Rare	prairie ironweed	<i>Vernonia fasciculata</i>	Occasional
New Jersey tea	<i>Ceanothus americanus</i>	Rare	golden alexander	<i>Zizia aurea</i>	Common
stiff tickseed	<i>Coreopsis palmata</i>	Rare			

References

- Meissen, J. C., S. M. Galatowitsch, and M. W. Cornett. 2017. Meeting seed demand for landscape-scale restoration sustainably: the influence of seed harvest intensity and site management. *Ecoscience* 24:145–155.
- Blocksome, C. 2011. Prescribed burning notebook. Kansas State University, Manhattan, KS.

**IRVINE PRAIRIE
PLANNED WORK
2020**

2020 Irvine Prairie Restoration and Management Work Plan

Work in 2020 will consist primarily of new planting: frost and spring seeding, summer mowing, and potential fall re-seeding in problem areas. Some plug transplanting will occur. Tasks to support 2020 restoration and management operations follow:

Winter (January 1-March 31)

Frost Seeding

Approximately 8 acres of Irvine Prairie will be drop seeded by TPC staff using a 6ft Truax native seed drill. Two seed mixes will be planted across the north central section of Irvine Prairie (see Map 4). Seeding will be conducted as early as feasible to promote dormancy breaking in seeded forbs.

Operator: JM/LW
Equipment: Truax Drill (6ft)
Location: North half of 2020 Work Area (see Map 4)
Timing: Anytime with frozen soil and no snow cover Feb-Mar

Spring (April 1-June 30)

Prescribed Burning

Approximately 8 acres of Irvine Prairie planted in 2018 will be burned as part of the long-term management of the site. Work is dependent on favorable weather and availability of qualified contractors. Site will be hayed in early July if burning is not feasible this spring.

Operator: TBD (Potentially Ben Bonar, Dysart Fire Department)
Equipment: Contractor provided
Location: Throughout 2018 planting area
Timing: March-May

Spring Seeding

Approximately 8 acres of Irvine Prairie will be drilled in early spring by TPC staff using a 6ft Truax native seed drill. Two seed mixes will be planted across the south central section of Irvine Prairie (see Map 4). Seeding will be conducted as early as feasible to promote dormancy breaking in seeded forbs.

Operator: JM/AK
Equipment: Truax Drill (6ft)
Location: Throughout 2019 Work Area (see Map 4)
Timing: mid-late April

Supplemental Plug Planting

Plug planting will primarily focus on greenhouse grown Virginia bunchflower that was initially collected from nearby ditches. Planting locations are currently unknown, but will likely focus on wetter areas in the northwest corner of Irvine Prairie. Some additional sedges, New Jersey tea, and leadplant will also be transplanted into strategic locations.

Operator: LFW
Equipment: Volunteer labor, hand tools
Location: TBD
Timing: April-May

Invasive Grass Mowing #1

Problem perennial grass areas found in old waterways should be mowed to promote uniform growth in preparation for a spring herbicide application.

Operator: JM or CI
Equipment: Any mower set to 4 in. cutting height
Location: Past waterways
Timing: Green up (April)

Invasive Grass Spot Herbicide Application #1

After invasive perennial grass areas have had time to regrow, they should be sprayed with Roundup at label recommended rates. Spot spraying will minimize off-target effects.

Operator: JM
Equipment: Backpack sprayer
Location: Past waterways
Timing: early May

Establishment Mowing #1 (2019 and 2020 Areas)

All early plantings benefit from mowing relatively early in the season to encourage light penetration to the soil surface. This mowing will cover ~28 acres, including low, weedy areas in the 2019 plantings and new 2020 plantings. Depending on the equipment available, rotary disc mowers or other hay mowers are ideal for avoiding vegetation matting, which can impede light penetration to soil surface.

Operator: TBA
Equipment: Hay mower ideal, brush hog OK, mower at ~6 in
Location: Foothslopes/toeslopes of 2019 plantings and all 2020 Work Area (see Map 1 & 2)
Timing: late June

Summer (July 1-September 1)

Crab Grass Herbicide Application

The area seeded that is adjacent to the staging/parking area was overwhelmed with crabgrass in the first year, which prevented most establishment. Application of a contact herbicide such as glufosinate (e.g. Liberty 280 SL) when crab grass seeds germinate in the summer may allow the perennial natives that did establish to regrow in a low competition environment. Dormant seeding of the area should follow.

Operator: TBD
Equipment: TBD
Location: Staging area
Timing: July

Invasive Grass Mowing #2

Problem perennial grass areas found in old waterways should be mowed again to promote uniform growth in preparation for a summer herbicide application.

Operator: JM or CI
Equipment: Any mower set to 4 in. cutting height
Location: Past waterways
Timing: Green up (July)

Invasive Grass Spot Herbicide Application #2

After invasive perennial grass areas have had time to regrow, they should be sprayed with Roundup at label recommended rates. Spot spraying will minimize off-target effects.

Operator: JM
Equipment: Backpack sprayer
Location: Past waterways
Timing: July

Establishment Mowing #2 (2019 Planting Areas)

A second mowing should occur when weed or cover crop reaches approximately 2ft in height. Plan to mow at the end of July. This mowing will cover the 15 acres, planted in 2020. Depending on the equipment available, disc or sickle mowers are ideal for encouraging light penetration to soil surface.

Operator: TBA
Equipment: Hay mower ideal, bush hog OK, mower at 4-6in
Location: Throughout 2020 Work Area (see Map 1 & 2)
Timing: late July

Establishment Mowing #3 (2019 Planting Areas)

A third mowing may not be necessary, but should occur when weed or cover crop once again reaches approximately 2ft in height. Plan for a final mow mid-late August. This mowing will cover the 18 acres, planted spring 2020. Depending on the equipment available, disc or sickle mowers are ideal for encouraging light penetration to soil surface.

Operator: TBA
Equipment: Hay mower ideal, bush hog OK, mower at 4-6in
Location: Throughout 2020 Work Area (see Map 1 & 2)
Timing: late August

Fall September 1-December 1

Seeding Establishment and Vegetation Outcomes Monitoring

In order to assess the success of the planting areas, formal monitoring needs to be undertaken. Information derived from monitoring will be used to identify areas for reseeding next year, and plan for future management prescriptions.

Operator: JM
Equipment: GPS, Sampling frame, datasheets
Location: Throughout 2018-2020 Work Area (see Map 3)
Timing: September

Invasive Grass Spot Herbicide Application #3

After invasive perennial grass areas have had time to regrow, they should be sprayed with Roundup at label recommended rates. Spot spraying will minimize off-target effects.

Operator: JM
Equipment: Backpack sprayer
Location: Past waterways
Timing: October

Dormant Broadcast Seeding (Possible)

If cover crop establishes satisfactorily by winter, a portion of the 2021 seeding area may be dormant broadcast, depending on equipment procurement and satisfactory weather. Re-seeding will also occur at sites where vegetation was terminated with herbicide earlier in the year.

Operator: JM

Equipment: TBD Broadcast seeder

Location: TBD, Past waterways,

Timing: November

2020 Irvine Prairie Outreach and Education Activities

Outreach and education in 2020 will consist in large part of continuing and expanding education partnerships, website development and improving the entrance facilities. Currently planned tasks to support 2020 outreach and education operations include:

- Producing new prairie education activities that will be shared through the Irvine Prairie Education webpage for use by field trip organizers and other visitors
- Adding information about commonly observed flora and fauna to the Irvine Prairie webpages
- Developing ideas for public events that could be realized through partnerships with other organizations
- Designing and constructing a weather-proof box (to be modeled after the sign-in box at Cedar Hills Sand Prairie) for display of a visitor log and handouts
- Consulting with an architect for free advice about the design and functions of the parking and welcome areas