

BASELINE VEGETATION SAMPLING IN A REMNANT BLACKLAND PRAIRIE IN MONTGOMERY COUNTY, TEXAS

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ABSTRACT

Baseline vegetation data for woody and herbaceous species on a remnant blackland prairie in Montgomery Co., Texas, are provided using five permanent vegetation plots. This remnant and restored prairie of about 63 acres is part of privately owned Redbud Nature Preserve, dedicated to the restoration and conservation of native prairies and forested grasslands. Historically the property was a working cattle ranch, but for the last 14 years it has been managed using prescribed burns, mechanical mulching treatments, herbicide treatments, and hand clearing. The flora is composed primarily of native herbaceous species typical for blackland prairies in this region — *Paspalum plicatulum*, *Muhlenbergia capillaris*, *Schizachyrium scoparium*, *Sporobolus compositus*, *Bothriochloa longipaniculata*, *Sorghastrum nutans*, and *Paspalum floridanum*. Most of the prairie habitats have been encroached by the non-native *Rosa bracteata* and *Bothriochloa ischaemum*.

Redbud Nature Preserve, dedicated to the restoration and conservation of native prairies and forested grasslands, includes one of the largest and most well-recovered blackland prairies known in the Pineywoods of East Texas (Keith, pers. observ.). Historically the property was a working cattle ranch and ground disturbance such as farming and intensive grazing occurred throughout the property, but for the last 14 years it has been managed using prescribed burns, mechanical mulching treatments, herbicide treatments, and hand clearing. The Redbud prairie is composed of approximately 63 acres of remnant and restored blackland prairie (Figure 1) and the flora is now composed primarily of native herbaceous species typical for blackland prairies in this region — *Paspalum plicatulum*, *Muhlenbergia capillaris*, *Schizachyrium scoparium*, *Sporobolus compositus*, *Bothriochloa longipaniculata*, *Sorghastrum nutans*, and *Paspalum floridanum*. Most of the Redbud prairie habitats have been encroached by the non-native invasive species (NNIS) *Rosa bracteata* and *Bothriochloa ischaemum*. The surrounding forests are a matrix of pine-hardwood and bottomland hardwood forests.

For this initial study, five Fire Monitoring Handbook (FMH) vegetation plots were established and sampled within the prairie and will be used to conduct long-term monitoring to assess changes to the vegetation as a result of management activities and natural succession (USDI 2003) (Figures 1-6). The prairie habitat is defined as the Little Bluestem [*Schizachyrium scoparium*] – Indiangrass [*Sorghastrum nutans*] Community Series (Texas Natural Heritage Program 1993). The plant association habitat can be more narrowly defined as the Little Bluestem - Indiangrass - Brownseed Crowngrass [*Paspalum plicatulum*] - Little-tooth Sedge [*Carex microdonta*] - Yellow-puff [*Neptunia lutea*] Grassland or Vertisol Coastal Prairie (NatureServe 2021). This community type is ranked as a G1 community, meaning that it is considered “critically imperiled globally because of extreme rarity or because of some factor(s) making it especially vulnerable to extinction with typically 5 or fewer occurrences or very few remaining acres (<2,000) or linear miles (<10)” (NatureServe 2021).

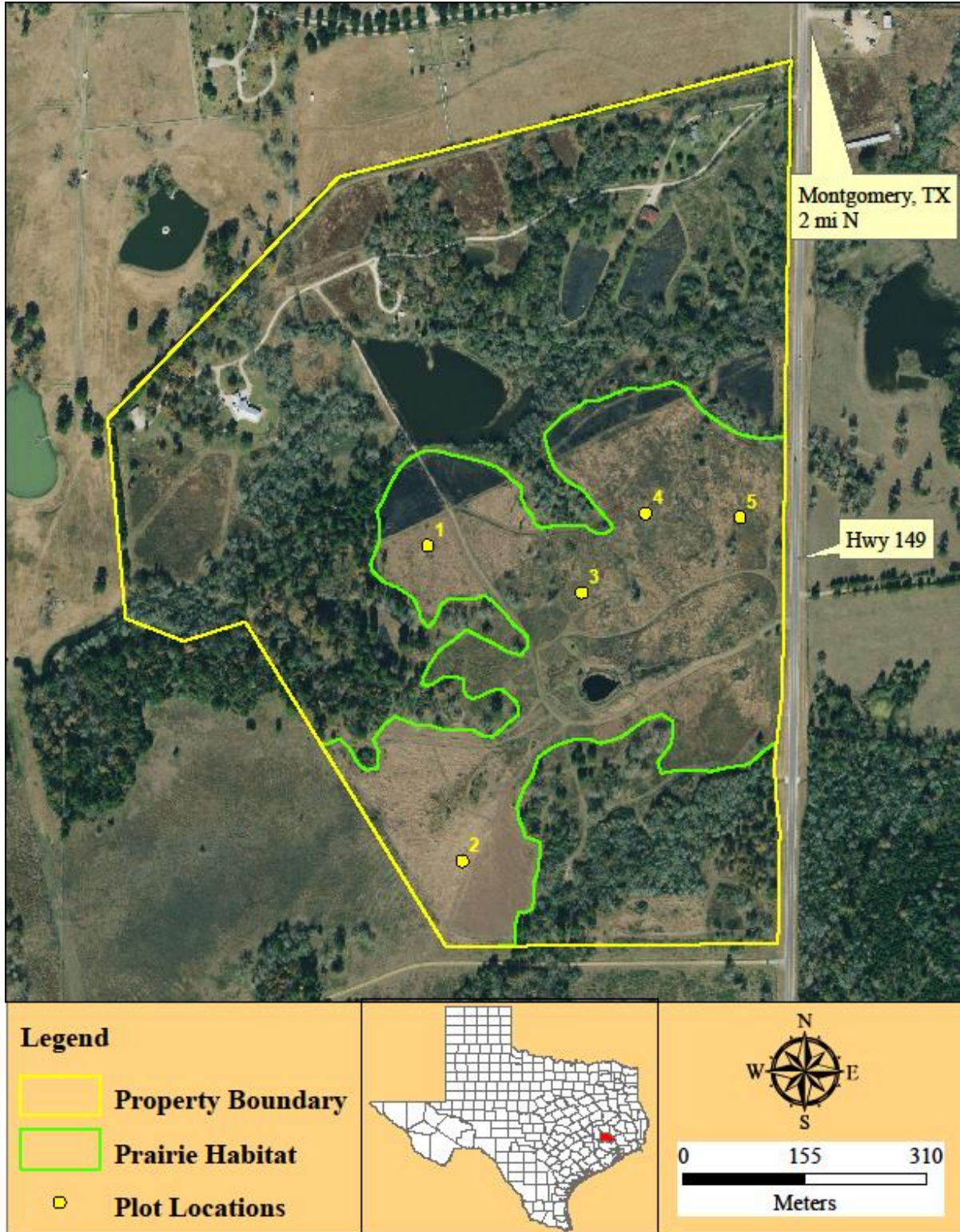


Figure 1. Locations of the five vegetation monitoring plots (Fire Monitoring Handbook, FMH) on Redbud Nature Preserve in Montgomery, Texas.

MATERIALS AND METHODS

The objective of this project was to establish and sample 5 brush FMH vegetation monitoring plots to determine baseline vegetation data in a remnant blackland prairie (USDI 2003). Data collected (here and ongoing) will be used to monitor long-term vegetation changes that occur from management activities such as prescribed burning, mowing and herbicide treatments, woody species encroachment, and climate change. Prior to initial sampling, the prairie had been burned annually for the last 13 years in the non-growing season. The prairie where the plots are located was last burned on March 15, 2019.

Plot sampling was conducted on July 7, 2020. Vegetation was analyzed and quantitatively described as outlined in USDI (2003) and FEAT/Firemon Integrated (FFI) software (FFI 2009) using the following specific protocols. Data for shrub transects were collected on a 30 m long x 5 m wide transect. All woody species, including trees, shrubs, and woody vines (retaining above-ground stems from year to year) were recorded. Point-line intercepts were counted at 0.3 m intervals along a 30 m transect for all species, including tree species that normally exceed 2 m tall. Data on herbaceous species were collected using a 1 m square at three locations (9 m, 19 m, and 29 m) along the 30 meter transect. Digital photographs were taken in each plot following protocols outlined in USDI (2003) (Figures 2-6). Nomenclature for species recorded in plots generally follows Diggs et al. (1999, 2006), FNA Editorial Committee (1993+), and Turner et al. (2003).

RESULTS

The most common woody species recorded (Table 1) include *Rosa bracteata* (McCartney rose) with 39,693 stems/ha. This aggressive species, once established, is difficult to eradicate. It is hoped that growing season fires planned for summer 2021 may have some impact on these plants. Other common woody species include *Rubus trivialis* (7,040 stems/ha), *Ulmus crassifolia* (2,200 stems/ha), *Smilax bona-nox* (1,467 stems/ha), and *Sideroxylon lanuginosum* (907 stems/ha).

Table 2 shows absolute cover for all species recorded along the 30 m transects. Percentage values are absolute cover as recorded in point-line intercept transects. Absolute cover plots record all woody and herbaceous species within plots (Table 2). Average absolute cover is 247% across all plots (Table 2). This value reflects relatively dense vegetative cover with greater than one species being recorded at each 0.3 m point. An absolute cover value of 100% would indicate that an average of one species was recorded at each point. The highest cover value is recorded in Plot 5 (269%), and the lowest cover value is recorded in Plot 2 (221%) (Table 2). Average species richness (total number of species) for all plots is 28.4 species (Table 2). The most common species recorded along the 30 m transect include *Rosa bracteata* (32.6%), *Muhlenbergia capillaris* (32%), *Bothriochloa ischaemum* (31.4%), *Carex microdonta* (18.4%), *Andropogon glomeratus* (11.2%), *Sporobolus compositus* (10.6%), *Paspalum plicatulum* (9.6%), and *Rhynchospora harveyi* (9%).

Table 3 shows herbaceous species recorded in three 1 m² plots. These species include all annual, biennial, and perennial species that die above ground each year and either reemerge from seed (annuals) or resprout from root bases (biennials and perennials). Herbaceous species richness and densities are often used to measure the health of ecosystems because of their susceptibility to competition from woody species encroachment in fire-suppressed habitats (Gotelli & Colwell 2001). The highest number of herbaceous stems is recorded in Plot 4 (524.7 stems/m²) and lowest number of stems in Plot 2 (156 stems/m²) (Table 3). Herbaceous species richness is an average of 25.4 species (Table 3). The most common herbaceous species recorded in plots include *Muhlenbergia capillaris* (62 stems/m²), *Bothriochloa ischaemum* (48.7 stems/m²), *Carex microdonta* (27.9 stems/m²), *Iva angustifolia* (26.4 stems/m²), *Hedyotis nigricans* (23.1 stems/m²), *Sporobolus compositus* (15.9 stems/m²), *Iva annua*, (15.8 stems/m²), *Setaria parviflora* (13.9 stems/m²), *Paspalum plicatulum* (11.5 stems/m²), *Rhynchospora harveyi* (11.5 stems/m²), and *Solidago altissima* (11 stems/m²).

DISCUSSION

Despite woody species encroachment, the Redbud prairies are in relatively natural condition and dominated by native herbaceous species typical of intact prairies. Annual prescribed burns have been somewhat effective in slowing woody species encroachment with the exception of *Rosa bracteata*, which is common and typically hidden below and amongst prairie grasses (Figures 2-6). The only other NNIS species recorded in plots is *Bothriochloa ischaemum*, but these don't appear to threaten an overall change in composition of the prairie, given that native prairie species remain dominant and appear to be flourishing. With the exception of these two species, other typically common NNIS species found in prairie habitats, such as *Bromus japonicus*, were not recorded in plots or even observed within prairie habitats. Early successional native prairie species such as *Andropogon glomeratus*, *Andropogon virginicus*, and *Aristida longespica* are still prominent, indicating the prairie continues to recover from historical ground disturbance. While not recorded in plots, the relatively rare Texas endemic species *Chloris texensis* and *Tauschia texana* were observed within the prairies including dozens of plants of both species. Monitoring of these vegetation plots will continue to determine whether implemented management practices are effective in maintaining this imperiled habitat and controlling NNIS species.

Table 1. Density (stems/ha) for all woody species recorded in plots as recorded in 30 m X 5 m plots along the 0P-30P transect.

Species	Stems/ha					
	Avg.	1	2	3	4	5
<i>Campsis radicans</i>	13					67
<i>Carya illinoensis</i>	120	67		533		
<i>Celtis laevigata</i>	13		67			
<i>Diospyros virginiana</i>	147			533		200
<i>Fraxinus americana</i>	40			200		
<i>Hypericum hypericoides</i>	120			600		
<i>Rosa bracteata</i>	39693	60333	54200	45333		38600
<i>Rubus trivialis</i>	7040	1133	20600	267	1933	11267
<i>Sideroxylon lanuginosum</i>	907	1267	133	1667	733	733
<i>Smilax bona-nox</i>	1467	3800	933	1867		733
<i>Symphoricarpos orbiculatus</i>	27			133		
<i>Ulmus crassifolia</i>	2200	800		6533	267	3400
All species	51786	67400	75933	57666	2933	55000
Species Richness	6	6	5	10	3	7

Table 2. Percent absolute cover of all recorded species along a 30 m transect in all plots sampled. Cover measurements were recorded every 0.3 m along the 30 m transects. Substrate includes leaf litter, duff, rocks, and bare soil.

Species	Absolute Cover (%)					
	Avg.	1	2	3	4	5
<i>Acalypha gracilens</i>	0.4			1.0		1.0
<i>Ambrosia psilostachya</i>	1.8		8.0		1.0	
<i>Andropogon glomeratus</i>	11.2	1.0	9.0		28.0	18.0
<i>Andropogon virginicus</i>	0.6			3.0		
<i>Aristida longespica</i>	1.2	2.0		3.0	1.0	

Species	Absolute Cover (%)					
	Avg.	1	2	3	4	5
<i>Aristida purpurascens</i>	0.2				1.0	
<i>Arnoglossum plantagineum</i>	0.2	1.0				
<i>Bothriochloa ischaemum</i>	31.4	49.0	65.0	4.0	6.0	33.0
<i>Bothriochloa longipaniculata</i>	2.0	3.0		3.0	2.0	2.0
<i>Brickellia eupatorioides</i>	1.2				6.0	
<i>Campsis radicans</i>	0.2					1.0
<i>Carex cherokeensis</i>	2.8		11.0	1.0	2.0	
<i>Carex microdonta</i>	18.4	33.0	22.0	4.0	21.0	12.0
<i>Croton monanthogynus</i>	0.2					1.0
<i>Cyclosporum leptophyllum</i>	0.2		1.0			
<i>Dalea compacta</i>	0.8				4.0	
<i>Desmanthus acuminatus</i>	0.8	1.0	2.0		1.0	
<i>Desmanthus illinoensis</i>	2.0	3.0	2.0		3.0	2.0
<i>Dichanthelium oligosanthes</i> spp. <i>scribnerianum</i>	2.4	2.0	4.0	1.0	5.0	
<i>Dichanthelium sphaerocarpon</i>	0.4			2.0		
<i>Dichondra carolinensis</i>	0.4				2.0	
<i>Diospyros virginiana</i>	0.4			2.0		
<i>Erigeron strigosus</i>	0.4				2.0	
<i>Eustoma grandiflorum</i>	0.2				1.0	
<i>Euthamia leptoccephala</i>	3.4			11.0		6.0
<i>Hedyotis nigricans</i>	7.6	4.0		1.0	31.0	2.0
<i>Hypericum drummondii</i>	0.2			1.0		
<i>Indigofera miniata</i>	4.6	20.0			3.0	
<i>Iva angustifolia</i>	8.4				42.0	
<i>Iva annua</i>	4.0				19.0	1.0
<i>Lithospermum bejarensense</i>	0.2		1.0			
<i>Muhlenbergia capillaris</i>	32.0	2.0		91.0	1.0	66.0
<i>Nassella leucotricha</i>	0.2	1.0				
<i>Neptunia lutea</i>	1.0	4.0		1.0		
<i>Oenothera speciosa</i>	0.6		1.0		2.0	
<i>Panicum anceps</i>	0.6	1.0		2.0		
<i>Paspalum floridanum</i>	1.4					7.0
<i>Paspalum langei</i>	0.6		3.0			
<i>Paspalum plicatulum</i>	9.6	12.0	14.0	5.0	5.0	12.0
<i>Paspalum pubiflorum</i>	0.4		1.0		1.0	
<i>Paspalum setaceum</i>	2.2			3.0	2.0	6.0
<i>Phyla nodiflora</i>	1.0		4.0		1.0	
<i>Physalis cinerascens</i>	0.2	1.0				
<i>Rhynchosia minima</i>	0.4	2.0				
<i>Rhynchospora harveyi</i>	9.0			21.0	1.0	23.0
<i>Rosa bracteata</i>	32.6	43.0	48.0	45.0		27.0

Species	Absolute Cover (%)					
	Avg.	1	2	3	4	5
Rubus trivialis	4.0	1.0	11.0		5.0	3.0
Rudbeckia hirta	0.8			2.0		2.0
Ruellia humilis	0.4			2.0		
Ruellia nudiflora	0.8		3.0	1.0		
Sabatia campestris	0.2			1.0		
Salvia lyrata	1.0			1.0	1.0	3.0
Schizachyrium scoparium	2.2			1.0		10.0
Scleria ciliata	4.4			19.0		3.0
Setaria parviflora	8.2	15.0	10.0	2.0	8.0	6.0
Sideroxylon lanuginosum	0.4			2.0		
Smilax bona-nox	0.6	1.0		2.0		
Solidago altissima	8.0	14.0		18.0		8.0
Sporobolus compositus	10.6	6.0			44.0	3.0
Strophostyles leiosperma	0.2	1.0				
Symphyotrichum ericoides	0.6	1.0			2.0	
Symphyotrichum lanceolatum	1.4					7.0
Tragia betonicifolia	0.4	1.0		1.0		
Tragia urticifolia	0.2			1.0		
Ulmus crassifolia	2.2	1.0		6.0		4.0
Verbena xutha	0.4	1.0	1.0			
Total	247.0	227.0	221.0	264.0	254.0	269.0
Species Richness	28.4	29	20	34	32	27
Substrate	0.4	0.0	2.0	0.0	0.0	0.0

Table 3. Density (stems/m²) for all herbaceous species in plots sampled as recorded in three 1 m² plots along the 0P-30P transects.

Species	Stems/m ²					
	Avg.	1	2	3	4	5
Acalypha gracilens	0.3			1.3		
Ambrosia psilostachya	4.3	2.0	11.0		7.3	1.3
Andropogon glomeratus	5.5		1.3		6.7	19.7
Andropogon virginicus	2.8			1.3		12.7
Argythamnia humilis	0.2		1.0			
Aristida longespica	0.8			4.0		
Aristida purpurascens	1.6			8.0		
Bothriochloa ischaemum	48.7	78.7	52.3	11.3	15.0	86.3
Bothriochloa longipaniculata	1.3			1.7	2.0	3.0
Brickellia eupatorioides	0.5				2.3	
Carex cherokeensis	1.5		7.7			
Carex microdonta	27.9	42.0	22.3		56.3	19.0
Chamaesyce maculata	0.1			0.3		

Species	Stems/m ²					
	Avg.	1	2	3	4	5
<i>Commelina erecta</i>	0.6			3.0		
<i>Conyza canadensis</i>	0.3		1.0		0.3	
<i>Croton monanthogynus</i>	0.7	2.0	1.0		0.3	0.3
<i>Cyclospermum leptophyllum</i>	0.2		1.0			
<i>Dalea compacta</i>	2.0	0.3			9.7	
<i>Desmanthus acuminatus</i>	0.7	2.0	0.7		0.7	
<i>Desmanthus illinoensis</i>	0.2	0.7			0.3	
<i>Dichanthelium oligosanthes</i> subsp. <i>scribnerianum</i>	1.5		3.0		4.3	
<i>Dichanthelium sphaerocarpon</i>	1.3			6.7		
<i>Dichondra caroliniana</i>	1.1		1.0		3.7	1.0
<i>Euphorbia bicolor</i>	0.5	1.3	0.3		1.0	
<i>Eustoma grandiflorum</i>	0.3				1.3	0.3
<i>Euthamia leptcephala</i>	4.3			15.3		6.3
<i>Galactia regularis</i>	0.3			1.3		
<i>Hedyotis nigricans</i>	23.1	5.3			107.0	3.0
<i>Heliotropium tenellum</i>	0.3				1.7	
<i>Hypericum drummondii</i>	0.1			0.3		
<i>Indigofera miniata</i>	3.3	12.7			4.0	
<i>Iva angustifolia</i>	26.4				132.0	
<i>Iva annua</i>	15.8	0.3			75.7	3.0
<i>Muhlenbergia capillaris</i>	62.0			248.3		61.7
<i>Nassella leucotricha</i>	1.2				6.0	
<i>Neptunia lutea</i>	0.4	2.0				
<i>Oenothera speciosa</i>	2.5	2.0	2.0		7.7	0.7
<i>Oxalis dillenii</i>	0.1				0.3	
<i>Panicum anceps</i>	0.5			1.3		1.3
<i>Paspalum floridanum</i>	0.2					1.0
<i>Paspalum plicatulum</i>	11.5	3.0	23.7	7.0		24.0
<i>Paspalum setaceum</i>	3.5				5.0	12.3
<i>Phyla nodiflora</i>	0.4		0.3		0.7	1.0
<i>Physalis cinerascens</i>	0.1		0.3			
<i>Prunella vulgaris</i>	1.8			2.7		6.3
<i>Rhynchospora harveyi</i>	11.5			46.3		11.0
<i>Rudbeckia hirta</i>	0.7			0.7	1.0	2.0
<i>Ruellia humilis</i>	0.2			1.0		
<i>Ruellia nudiflora</i>	0.5		0.3		2.3	
<i>Sabatia campestris</i>	0.1			0.3		
<i>Salvia lyrata</i>	0.7			1.0	1.7	0.7
<i>Schizachyrium scoparium</i>	2.0			4.3		5.7
<i>Scleria ciliata</i>	8.3			36.7		4.7
<i>Setaria parviflora</i>	13.9	21.3	16.0	2.0	14.7	15.7

Species	Stems/m ²					
	Avg.	1	2	3	4	5
Solidago altissima	11.0	8.7	9.3	33.0		4.0
Sporobolus compositus	15.9				32.3	47.0
Stylosanthes umbellata	0.1			0.3		
Symphyotrichum ericoides	4.6	2.0			21.0	
Symphyotrichum lanceolatum	1.7					8.7
Symphyotrichum lateriflorum	0.3					1.3
Tragia betonicifolia	0.1			0.7		
Verbena xutha	0.1		0.3		0.3	
All stems	334.5	186.3	156.0	440.3	524.7	365.0
Species Richness	25.4	17	21	27	32	30



Figure 2. Plot 1: July 7, 2020. From origin northward (top) and from terminus southward (bottom).



Figure 3. Plot 2: July 7, 2020. From origin northward (top) and from terminus southward (bottom).



Figure 4. Plot 3: July 7, 2020. From origin northward (top) and from terminus southward (bottom).



Figure 5. Plot 4: July 7, 2020. From origin northward (top) and from terminus southward (bottom).



Figure 6. Plot 5: July 7, 2020. From origin northward (top) and from terminus southward (bottom).

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