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Continuing Floristic and Quantitative Evaluations of a Prairie Project Started in 1974 in Northern Ford County, Illinois

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Abstract: Attempts to recreate tallgrass prairie are necessarily long-term efforts. Periodic floristic and quantitative surveys enhance the understanding of the development while drawing attention to potential problems on the evolving project. Prairie reconstruction work started in 1974 on a 3 ha former permanent pasture in northern Ford County. There was a floral survey of the site in 1991–92 with voucher specimens filed in the Illinois State Natural History Survey herbarium (ILLS). Point-intercept quantitative surveys were conducted in 1993, 1998 and 2004. This paper reports floral and quantitative surveys of the site that were repeated in 2012 with comparisons to the results from the earlier studies. The 1991–92 floral survey identified 189 vascular plant species, 138 were natives and 51 alien. The 2012 plant list has a total of 203 species with 158 natives and 45 aliens. The species increase is partially due to the addition of a prairie pothole to the otherwise mesic site. The recent quantitative survey encountered 84.9% native species, while in 1993 the intercepts encountered 66.2% native species. These surveys recorded data whose relative numbers were combined to assign Importance Values (IV) to the encountered species. Changes in IV rankings are reported for selected species. Comparisons are made for the top 20 ranked IV species in each of the four reporting periods. There has been a general decrease in the IV of non-native species. In the top 20 IV rankings there has been a decrease from nine alien species in 1993 to three in 2012. The results demonstrate both the improvements that occurred over time on this prairie project and also the slowness of the process of prairie reconstruction.

Introduction

The number and size of quality prairie remnants in the east central Illinois counties of Champaign, McLean, Livingston, and Ford is insignificant and is directly related to the high agricultural quality of the soils, which have been converted to row crop farming. Those four counties comprise a total of 3678.8 square miles or 652,826 ha (Illinois State Geological Survey. 2012). Only 5.6 ha of quality prairie remained of that vast, originally mostly prairie, region (White. 1978), a miniscule 0.0009% of the total land area. Thus it becomes an especially desirable area in which to attempt prairie reconstruction. Habitat restoration has been heralded as an important tool to ameliorate the tremendous impact that humans have had on natural ecosystems (Robertson 2008). It is this region, possibly more than others, that brings back images of the wide and extensive mostly treeless pre-settlement Grand Prairie of Illinois. This study undertakes a continuing floristic and quantitative appraisal of a prairie restoration project initiated in this region almost 40 years ago.

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Methods

A former 3 ha pasture in Ford County at Kempton, Illinois (T28N R9E S6; lat. 40.93366N, long. −88.23690W) with no history of tillage at least since 1900 is the site of an attempt to recreate a semblance of the prairie that once dominated east- central Illinois. The site lies within the Grand Prairie Section of the Grand Prairie Natural Division of Illinois (Schwegman et al. 1973). The soils are Swygert and Bryce, somewhat poorly drained, fine-textured silty clay loams (Fehrenbacher 1990). The topography is gently rolling with an elevation difference of about 4.6 m (15 ft.) between the high and low portions of the field. Most land in the immediate area is under corn and soybean cultivation. This field was a permanent pasture from at least 1900 until 1965 when grazing ceased and it evolved into an old field until the prairie project

Table 1: Point intercept results for the reconstruction transects.

		Summary				
		Intercept Point Locations				975
		Intercept Count: Total individuals				1524
3–8 June 2012		Species Count				53
		Intercept Count: Native individuals				1401
		% Native Species				84.9%
		% Individual Native Intercepts				91.9%
Family	Species	Density	Frequency	Rel. Density	Rel. Freq.	IV (200)
POACEAE	*Andropogon gerardii*	419	366	27.5%	26.5%	54.0
APIACEAE	*Zizia aurea*	203	167	13.3%	12.1%	25.4
SCROPHULARIACEAE	*Pedicularis canadensis*	108	108	7.1%	7.8%	14.9
FABACEAE	*Dalea candida*	75	74	4.7%	5.4%	10.3
PRIMULACEAE	*Dodecatheon meadia*	62	61	4.1%	4.4%	8.5
POACEAE	*Sorghastrum nutans*	64	56	4.2%	4.0%	8.2
FABACEAE	*Trifolium pratense**	57	49	3.7%	3.5%	7.3
ASTERACEAE	*Oligoneuron rigidum*	51	50	3.3%	3.6%	7.0
APIACEAE	*Eryngium yuccifolium*	44	44	2.9%	3.2%	6.1
POACEAE	*Sporobolus heterolepis*	44	35	2.9%	2.5%	5.4
POACEAE	*Schizachyrium scoparium*	43	35	2.8%	2.5%	5.4
ASTERACEAE	*Coreopsis tripteris*	36	36	2.4%	2.6%	5.0
ASTERACEAE	*Parthenium integrifolium*	34	29	2.2%	2.1%	4.3
FABACEAE	*Dalea purpurea*	27	27	1.8%	2.0%	3.7
FABACEAE	*Lespedeza capitata*	27	27	1.8%	2.0%	3.7
FABACEAE	*Amorpha canescens*	26	24	1.7%	1.7%	3.4
POACEAE	*Poa spp.**	22	22	1.4%	1.6%	3.0
POACEAE	*Bromus inermis**	24	19	1.6%	1.4%	2.9
ASTERACEAE	*Liatris spp.*	14	13	0.9%	0.9%	1.9
ASTERACEAE	*Helianthus pauciflorus*	13	13	0.9%	0.9%	1.8
LAMIACEAE	*Physostegia virginiana*	13	13	0.9%	0.9%	1.8
ASTERACEAE	*Echinacea pallida*	9	9	0.6%	0.7%	1.2
ASTERACEAE	*Silphium integrifolium*	10	8	0.7%	0.6%	1.2
ASTERACEAE	*Aster novae-angliae*	8	8	0.5%	0.6%	1.1
ASTERACEAE	*Aster pilosus*	8	8	0.5%	0.6%	1.1
ASTERACEAE	*Achillea millefolium**	7	7	0.5%	0.5%	1.0
FABACEAE	*Medicago lupulina**	7	7	0.5%	0.5%	1.0
ROSACEAE	*Fragaria virginiana*	6	6	0.4%	0.4%	0.8
ASTERACEAE	*Silphium laciniatum*	6	6	0.4%	0.4%	0.8
GENTIANACEAE	*Gentianella quinquifolia*	6	6	0.4%	0.4%	0.8
ASTERACEAE	*Ambrosia trifida*	5	5	0.3%	0.4%	0.7
ASTERACEAE	*Ratibida pinnata*	5	5	0.3%	0.4%	0.7
SCROPHULARIACEAE	*Veronicastrum virginicum*	5	4	0.3%	0.3%	0.6
FABACEAE	*Baptisia alba*	4	4	0.3%	0.3%	0.6
CYPERACEAE	*Carex brevior*	3	3	0.2%	0.2%	0.4
ASTERACEAE	*Leucanthemum vulgare**	3	3	0.2%	0.2%	0.4
LAMIACEAE	*Pycnanthemum pilosum*	3	3	0.2%	0.2%	0.4
CYPERACEAE	*Eleocharis verrucosa*	2	2	0.1%	0.1%	0.3
ASTERACEAE	*Lactuca canadensis*	2	2	0.1%	0.1%	0.3
POACEAE	*Phleum pratense**	2	2	0.1%	0.1%	0.3
IRIDACEAE	*Sisyrinchium albidum*	2	2	0.1%	0.1%	0.3
ASTERACEAE	*Solidago altissima*	2	2	0.1%	0.1%	0.3
FABACEAE	*Astragalus canadensis*	2	2	0.1%	0.1%	0.3

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Table 1: Continued.

Family	Species	Density	Frequency	Rel. Density	Rel. Freq.	IV (200)
ASTERACEAE	*Silphium terebinthinaceum*	2	2	0.1%	0.1%	0.3
ASTERACEAE	*Ambrosia artemisiifolia*	1	1	0.1%	0.1%	0.1
ASCLEPIADACEAE	*Asclepias tuberosa*	1	1	0.1%	0.1%	0.1
ASTERACEAE	*Erigeron strigosus*	1	1	0.1%	0.1%	0.1
FABACEAE	*Melilotus spp.**	1	1	0.1%	0.1%	0.1
VIOLACEAE	*Viola pratincola*	1	1	0.1%	0.1%	0.1
EUPHORBIACIAE	*Euphorbia corollata*	1	1	0.1%	0.1%	0.1
ONAGRACEAE	*Oenothera biennis*	1	1	0.1%	0.1%	0.1
ROSACEAE	*Rosa carolina*	1	1	0.1%	0.1%	0.1
VIOLACEAE	*Viola pedatifida*	1	1	0.1%	0.1%	0.1
Absence of cover 24		1524	1383	100%	100%	200.0

*Alien species
Liatris spp. combines *L. Pycnostachya & L. spicata*
Melilotus spp. combines *M. alba & M. officinalis*
Poa spp. combines *P. compressa & P. pratensis*

started in 1974. It was dominated by cool season alien grasses such a *Poa pratensis* (Kentucky bluegrass).

The climate for the region is seasonally highly-variable with the hottest month being July with an average high temperature at the Pontiac reporting station for the past five years of 83.1°F. The coldest month is January with a five-year average low temperature of 14.0°F. For the 2007–2011 time period the average annual precipitation was 101 cm (39.9 in.) (Illinois State Water Survey 2012).

Regional ecotype seed was hand-collected and applied to separate plots progressively across the field. The size of the plots varied with the amount of seed available each year. The first plot was seeded in 1974 and the last in 1990 with concurrent and subsequent enrichment seeding. Methods of soil preparation, timing, plot designations, and seed application are discussed in a previous paper (Gardner 1995a). In 2001 an adjacent agricultural field was added to the site, which now totals 6.1 ha. Prairie reconstruction on that site was initiated then and continues to the present. This field is included in the floristic survey, but the quantitative survey is restricted to the original 3 ha reconstruction field as were the previous surveys in 1993 (Gardner 1995b), 1998, and 2004 (Gardner 2006). Within the field a 0.19 ha portion served as a control in all sampling periods. There was no introduction of additional species or intervention other than annual burning in this area. After 1974 the remaining part of the field was burned annually with a different portion (about 20%) left unburned each year.

Five north-south line transects totaling about 339 m were established across the field in June 1993 and were retained for the sampling in 1998, 2004, and 2012. Vegetation along these transects was identified and recorded using a point-intercept method. Point-intercept can provide accurate quantitative estimates of non-forest communities for description purposes (Becker and Crockett 1973, Mueller-Dombois and Ellenberg 1974).

This method was modified by using five holes spaced at 20 cm intervals in the horizontal portion of the point-intercept frame, which was supported on legs about one meter above ground level. A pointed steel rod, 3.4 mm in diameter, was passed successively through each hole. Each plant contacted by the point during descent of the rod was recorded by species. Upon completion of the five intercept readings, the frame was moved along the line transect and the process repeated at 1.5 m intervals. In 2012 readings were taken at 975 intercept points on transects in the reconstruction portion of the study site. A transect passed through the control area where there was sampling at 155 intercept points. Both the reconstruction and the control were burned in March 2012.

For this point-intercept study frequency is defined as the number of points at which a species is encountered and thus is an expression of the distribution of the species over the extent of the transects. Density is the number of times individual plants of a given species are encountered. These numbers were converted to relative density (RD) and relative frequency (RF). The sum of relative density and relative frequency (200) gives the importance value (IV) for each species (RD+RF=IV). Cover is defined as the first contact of the descending rod at each point. It provides information as to the aspect of the field, but it over-emphasizes the topmost level of the vegetation and is not recorded here or used for determining IV.

The alien grasses, *Poa pratensis* (Kentucky bluegrass) and *Poa compressa* (Canada blue grass) were combined as *Poa* spp. due to difficulty at times in differentiating them in the field. Early in the growing season it can be difficult to differentiate *Melilotus alba* (white sweet clover) and *Melilotus officinalis* (yellow sweet clover). They have been combined as *Melilotus* spp. *Liatris pycnostachya* (prairie blazing star) and *Liatris spicata* (marsh blazing star) were treated as *Liatris* spp.

RESULTS

Quantitative survey

Reconstruction Transects

On the four transects across the reconstructed part of the site there were 1524 individual plants comprising 53 species. The individual plants were 91.9% natives. The species encountered were 84.9% natives (Table 1). In 1993 the intercepts were with 66.2% native species (Gardner 1995b). The three most common families encountered were Asteraceae with 19 species, Fabaceae 9, and Poaceae 7. Contacts with individual plants within those families were Poaceae 618, Fabaceae 226, and Asteraceae 217.

Examples of changes are *Ratibida pinnata* (yellow coneflower), which decreased in IV from 4.6 in 1993 to 0.7 in 2012 and *Elymus canadensis* (nodding wild rye) that was 1.9 in 1993 and was not encountered on the transects in 2012 although they continued to occur in the field. Both of these are considered to be pioneer species whose populations would be expected to decrease over time.

During the period from 1965 until 1974 as the site succeeded into an old field, one of the prominent species was *Aster pilosus* (hairy aster). When the first survey was conducted in 1993 it was the second most prominent with an IV of 16.5 (Table 2). In subsequent years that ranking dropped and in 2012 it was 25th receiving an IV of 1.1. Similarly *Daucus carota* (wild carrot), a pervasive old field species, moved from third rank in 1993 with an IV of 11.7 to failure to be recorded on the trnsects in 2012.

Comparisons of the 20 species with the highest IV rankings in the four study periods are presented in Table 2. There has been a general decrease in the IV of alien species with a decrease from nine species in 1993 to three in 2012. An exception is *Trifolium pratense* (red clover). It maintained a substantial, but essentially unchanged IV of 5.7, 5.7, and 5.5 during the first three data collection periods. However, in 2012 there was an increase to IV 7.3. It is not apparent why this occurred, but it presents a possible problem that will require close monitoring in the future.

A continuing problem has been the presence of the aliens *Melilotus alba* (white sweet clover) and *M. officinalis* (yellow sweet clover). After rising between 1993 and 1998 from IV 2.9 to 7.8 there was a concerted control effort. In 2004 the IV fell to 3.0 and in 2012 it dropped out of the top twenty species to IV 0.1. Control of this species has involved a combination of hand pulling with removal of seed bearing plants from the field and spot applications of 2,4-D amine spray. This will continue as long as plants appear.

Bromus inermis (smooth brome) has a continued presence on the site, but very few individuals are found in the interior of the field. Review of the intercept worksheets reveals that 64% of the encounters with that species occurred within the 4.5 m perimeter area of the field. The field edge appears to be an area of competition between native and alien species. The higher populations of certain alien species in perimeter areas have been noted elsewhere (Christiansen 1990, Taft 2005).

Over the twenty-year period of the study there have been increases in IV of native species including *Pedicularis canadensis* (wood betony), *Dodecatheon meadia* (shooting star), *Dalea candida* (white prairie clover), *Dalea purpurea* (purple prairie clover), *Sporobolus heterolepis* (prairie dropseed), *Amorpha canescens* (leadplant), *Eryngium yuccifolium* (rattlesnake master), *Zizia aurea* (golden Alexander), and others (Table 2). These increases appear to have been due to a combination of natural recruitment and, to a lesser extent, enrichment seeding.

In each of the four reporting periods *Andropogon gerardii* (big bluestem) has maintained the highest IV rank reflecting the generally heavy applications of that seed. However, personal observation indicates that the height and robustness of those plants have decreased over the years and its presence has not interfered with establishment and population increases of quality prairie species (Table 2) and in the plant list found in the Appendix. Large early populations of *A. gerardii* appear to hasten the displacement of some alien species.

Control Transect

After 1974 the control area was burned annually. It received no other disturbance and there was no intervention with seed application. This survey included 155 intercept points on the transect passing through the control area. Native species accounted for 85.2% of the encounters. Individual native plant intercepts comprised 95.7% of the total contacts with individual plants (Table 3).

Over the years there have been distinct population changes on the control area. In 1993 *Poa pratensis* retained dominance with the IV of 34.5. That ranking progressively fell to an IV of 3.2 in 2012 (Table 4). Other non-native species also decreased in ranking or were no longer encountered. In 1993 there were ten non-native species in the top 20 IV ratings. In 2012 there were three.

Table 2: Comparisons of twenty species with highest importance values on reconstruction transects.

	1993	IV	1998	IV	2004	IV	2012	IV
1	*Andropogon gerardii*	51.4	*Andropogon gerardii*	73.8	*Andropogon gerardii*	68.2	*Andropogon gerardii*	54.0
2	*Aster pilosus*	16.5	***Poa* spp.**	10.4	*Zizia aurea*	18.2	*Zizia aurea*	25.4
3	***Daucus carota***	11.7	*Sporobolus heterolepis*	10.2	*Pedicularis canadensis*	15.2	*Pedicularis canadensis*	14.9
4	***Achillea millefolium***	11.5	***Bromus inermis***	9.6	*Sorghastrum nutans*	11.1	*Dalea candida*	10.3
5	*Sorghastrum nutans*	10.6	***Achillea millefolium***	9.0	***Bromus inermis***	8.2	*Dodecatheon meadia*	8.5
6	*Schizachyrium scoparium*	9.8	*Zizia aurea*	8.1	*Sporobolus heterolepis*	7.7	*Sorghastrum nutans*	8.2
7	***Poa* spp.**	6.8	***Melilotus* spp.**	7.8	***Trifolium pratense***	5.5	***Trifolium pratense***	7.3
8	*Ambrosia artemisiifolia*	6.0	*Pedicularis canadensis*	7.3	*Oligoneuron rigidum*	5.3	*Oligoneuron rigidum*	7.0
9	***Trifolium pratense***	5.7	*Fragaria virginiana*	6.5	*Dodecatheon meadia*	4.8	*Eryngium yuccifolium*	6.1
10	***Potentilla recta***	4.6	*Ratibida pinnata*	6.4	***Poa* spp.**	4.4	*Sporobolus heterolepis*	5.4
11	*Ratibida pinnata*	4.6	*Schizachyrium scoparium*	5.9	*Ratibida pinnata*	3.8	*Schizachyrium scoparium*	5.4
12	***Medicago lupulina***	4.4	***Trifolium pratense***	5.7	***Achillea millefolium***	3.5	*Coreopsis tripteris*	5.0
13	*Monarda fistulosa*	3.9	*Aster pilosus*	2.9	*Schizachyrium scoparium*	3.2	*Parthenium integrifolium*	4.3
14	***Phleum pretense***	*3.8*	*Aster ericoides*	2.9	***Melilotus* spp.**	3.0	*Dalea purpurea*	3.7
15	*Aster ericoides*	3.5	*Dodecatheon meadia*	2.7	*Dalea candida*	2.9	*Lespedeza capitata*	3.7
16	***Melilotus* spp.**	2.9	*Monarda fistulosa*	2.6	***Dactylis glomerata***	2.7	*Amorpha canescens*	3.4
17	*Helianthus pauciflorus*	2.8	*Carex brevior*	2.4	*Helianthus pauciflorus*	2.6	***Poa* spp.**	3.0
18	*Pedicularis canadensis*	2.7	*Sporobolus heterolepis*	2.4	*Amorpha canescens*	2.1	***Bromus inermis***	2.9
19	***Bromus inermis***	2.6	*Amorpha canescens*	1.6	*Eryngium yuccifolium*	2.1	*Liatris* spp.	1.9
20	*Juncus interior*	2.0	***Elytrigia repens***	1.6	*Dalea purpurea*	1.9	*Helianthus pauciflorus*	1.8
	Species encountered	71	Species encountered	67	Species encountered	63	Species encountered	53
	Native species	66.2%	Native species	71.6%	Native species	75.8%	Native species	84.90%

Bold indicates alien species
Melilotus spp.combines *M. alba* & *M. officinalis*
Liatris spp. combines *L. spicata* & *L. pycnostachya*
Poa spp. combines *P. compressa* & *P. pratensis*

Table 3: Point intercept results control transect.

	Summary	
3–8 June 2012	Intercept Point Locations	155
	Intercept Count - Total Individuals	186
	Species Count	27
	Intercept Count - Native Individuals	178
	% Native Species	85.2%
	% Individual Native Intercepts	95.7%

Family	Species	Density	Frequency	Rel. Density	Rel. Freq.	IV (200)
POACEAE	*Sorghastrum nutans*	60	60	32.3%	32.4%	64.7
POACEAE	*Andropogon gerardii*	33	33	17.7%	17.8%	35.6
LILIACEAE	*Smilacina stellata*	20	20	10.8%	10.8%	21.6
ASTERACEAE	*Antennaria neglecta*	14	14	7.5%	7.6%	15.1
ASTERACEAE	*Ambrosia trifida*	8	7	4.3%	3.8%	8.1
FABACEAE	*Lespedeza capitata*	7	7	3.8%	3.8%	7.5
ASTERACEAE	*Ratibida pinnata*	6	6	3.2%	3.2%	6.5
CYPERACEAE	*Carex brevior*	3	3	1.6%	1.6%	3.2
FABACEAE	*Dalea candida*	3	3	1.6%	1.6%	3.2
SCROPHULARIACEAE	*Pedicularis canadensis*	3	3	1.6%	1.6%	3.2
POACEAE	*Poa spp.**	3	3	1.6%	1.6%	3.2
RANUNCULACEAE	*Anemone virginiana*	3	3	1.6%	1.6%	3.2
LAMIACEAE	*Monarda fistulosa*	3	3	1.6%	1.6%	3.2
ASTERACEAE	*Achillea millefolium**	2	2	1.1%	1.1%	2.2
ASTERACEAE	*Liatris spp.*	2	2	1.1%	1.1%	2.2
FABACEAE	*Medicago lupulina**	2	2	1.1%	1.1%	2.2
ROSACEAE	*Rosa carolina*	2	2	1.1%	1.1%	2.2
ASTERACEAE	*Solidago altissima*	2	2	1.1%	1.1%	2.2
CONVOVULACEAE	*Calystegia sepium*	2	2	1.1%	1.1%	2.2
ASTERACEAE	*Ambrosia artemisiifolia*	1	1	0.5%	0.5%	1.1
POACEAE	*Bromus inermis**	1	1	0.5%	0.5%	1.1
CYPERACEAE	*Carex bebbii*	1	1	0.5%	0.5%	1.1
ASTERACEAE	*Echinacea pallida*	1	1	0.5%	0.5%	1.1
POACEAE	*Elymus canadensis*	1	1	0.5%	0.5%	1.1
APIACEAE	*Eryngium yuccifolium*	1	1	0.5%	0.5%	1.1
GENTIANACEAE	*Gentiana puberulenta*	1	1	0.5%	0.5%	1.1
ASTERACEAE	*Helianthus grosseseratus*	1	1	0.5%	0.5%	1.1
Absence of cover 6		186	185	100%	100%	200.0

*Alien species
Liatris spp. combines *L. pycnostachya & L. spicata*
Melilotus spp. combines *M. alba & M. officinalis*
Poa spp. combines *P. compressa & P. pratensis*

The control area is bordered by the prairie reconstruction that is present on the remainder of the site. Establishment of prairie species has been accompanied by an encroachment of native species onto the control area. This is reflected by the 48.5% native species encountered on the control in 1993 and 85.2% in 2012.

The successional changes on an evolving prairie are exemplified again by *Ratibida pinnata.* On the control this pioneering species showed an increase in IV from 3.8 in 1993 to 14.1 in 2004. In 2012 the IV dropped to 6.5, which would be expected on a site that is increasing in native species diversity and coverage.

Sorghastrum nutans (Indian grass) and *Andropogon gerardii* (big bluestem) have gained in dominance on the control area. Other native species that have appeared or moved up in ranking are *Smilacina*

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Table 4: Comparisons of twenty species with highest importance values on control transect.

	1993	IV	1998	IV	2004	IV	2012	IV
1	***Poa spp.***	34.5	*Andropogon gerardii*	64.0	*Sorghastrum nutans*	49.4	*Sorghastrum nutans*	64.7
2	***Daucus carota***	29.5	***Poa* spp.**	23.8	*Antennaria neglecta*	34.2	*Andropogon gerardii*	35.6
3	***Phleum pratense***	16.9	*Antennaria neglecta*	20.5	*Andropogon gerardii*	27.6	*Smilacina stellata*	21.6
4	*Aster pilosus*	16.4	*Sorghastrum nutans*	15.7	*Ratibida pinnata*	14.1	*Antennaria neglecta*	15.1
5	***Achillea millefolium***	10.9	*Ambrosia trifida*	11.2	*Ambrosia trifida*	13.6	*Ambrosia trifida*	8.1
6	*Dichanthelium acuminatum*	10.9	***Achillea millefolium***	10.7	***Poa* spp.**	9.7	*Lespedeza capitata*	7.5
7	***Brassica rapa***	8.7	*Ratibida pinnata*	7.7	***Achillea millefolium***	5.2	*Ratibida pinnata*	6.5
8	*Antennaria neglecta*	7.7	***Bromus inermis***	7.7	*Juncus interior*	5.2	*Carex brevior*	3.2
9	*Ambrosia artemisiifolia*	6.6	*Aster pilosus*	5.7	***Elytrigia repens***	4.8	*Dalea candida*	3.2
10	***Potentilla recta***	5.5	***Phleum pratense***	4.0	*Asclepias syriaca*	3.7	*Pedicularis canadensis*	3.2
11	***Plantago lanceolata***	4.9	*Carex brevior*	3.6	***Brassica rapa***	3.7	***Poa spp.***	3.2
12	*Andropogon gerardii*	4.4	*Asclepias verticillata*	2.9	*Carex brevior*	3.7	*Anemone virginiana*	3.2
13	*Fragaria virginiana*	4.4	*Dichanthelium acuminatum*	2.9	*Aster pilosus*	3.3	*Monarda fistulosa*	3.2
14	***Elytrigia repens***	*3.8*	*Chamaechrista fasciculata*	2.7	*Anemone virginiana*	3.0	***Achillea millefolium***	2.2
15	*Ratibida pinnata*	3.8	*Fragaria virginiana*	2.7	*Carex bebbii*	3.0	*Liatris* spp.	2.2
16	*Sorghastrum nutans*	3.8	***Brassica rapa***	2.0	*Oligoneuron rigidum*	3.0	***Medicago lupulina***	2.2
17	*Carex brevior*	3.3	***Persicaria vulgaris***	2.0	*Rosa carolina*	2.2	*Rosa carolina*	2.2
18	***Pastinaca sativa***	3.3	***Melilotus* spp.**	1.6	*Chamaechrista fasciculata*	1.5	*Solidago altissima*	2.2
19	*Aster ericoides*	2.2	*Elymus canadensis*	1.3	*Echinacea pallida*	1.5	*Calystegia sepium*	2.2
20	***Bromus inermis***	2.2	*Eupatorium altissimum*	1.3	*Asclepias verticillata*	0.7	*Ambrosia artemisiifolia*	1.1
	Species encountered	33	Species encountered	29	Species encountered	28	Species encountered	27
	Native species	48.5%	Native species	58.6%	Native species	67.9%	Native species	85.2%

Bold indicates alien species
Melilotus spp. combines *M. alba* & *M. officinalis*
Poa spp. combines *P. compressa* & *P. pratensis*
Liatris spp. combines *L. spicata* & *L. pycnostachya*

stellata (starry false Solomon's seal), *Lespedeza capitata* (round-headed bush clover), *Pedicularis canadensis* (wood betony), *Dalea candida* (white prairie clover), and *Liatris spicata* (marsh blazing star) among others. *Antennaria neglecta* (cat's-foot) was on the site when it was a pasture and has retained that presence.

The changes in species on the control area over the twenty-year period of the surveys appear to reinforce the personal observation that prairie can develop satisfactorily when three conditions are met: 1) the elimination of disturbances such as cultivation, intensive grazing, and repeated close mowing; 2) the occurrence of periodic fire; and 3) the proximity or introduction of a diverse and abundant native seed source.

Floristic survey

A floristic survey was conducted on the site in 1991–92 (Gardner 1995a) with voucher specimens filed in the Illinois Natural History Survey herbarium (ILLS). A current revised plant list accompanies this paper. This list includes plant species now established in the adjacent field that was added in 2001 had been largely destroyed through attempts at surface drainage. In 2001 it was altered in order to restore the seasonal wetland, which has a small prairie pothole. This wetland area increases the number of species suitable for the site. Those species are identified in the current plant list presented in the Appendix. Nomenclature and designation follows Mohlenbrock (2002).

The 1991–92 survey recorded 189 vascular plant species, 138 were natives and 51 alien. There were 37 families represented. The current list has a total of 203 species with 158 natives and 45 aliens in 43 families.

Additions to the established natives include *Gentiana* spp., *Lobelia spicata* (spiked lobelia) and *Potentilla arguta* (prairie cinquefoil), which were introduced in original seeding, but had not appeared at the time of the earlier plant list. Several of the additions are species adapted to the seasonally wetter conditions found in the wetland. Examples of these include *Lathyrus palustris* (marsh vetchling), *Spiraea alba* (meadow sweet), *Lobelia cardinalis* (cardinal flower), *Carex pellita* (wooly sedge), *Carex haydenei* (Hayden's sedge), and *Asclepias incarnata* (swamp milkweed). These were introduced transplants. *Schoenoplectus tabernaemontani* (soft-stem bulrush) appeared and was possibly introduced by waterfowl.

Among the natives that are no longer present are *Bouteloua curtipendula* (side-oats grama). Although present for several years after introduction the population decreased and it has not been observed for the past two or three years. This may be due to the competition on the heavy mesic soils on the site. *Heliopsis helianthoides* (ox-eye sunflower), *Koeleria macrantha* (June grass), and *Hierochloe odorata* (sweet grass) were introductions that are also no longer found on the site. *Perideridia americana* (perideridia) was initially present, but has disappeared.

An alien sedge, *Carex hirta* (hairy sedge) started to invade the northwest corner of the site, possibly from a nearby railroad. Continuing efforts have been made to remove the species using spot applications of glyphosate spray and it appears that extirpation has been successful, but until there is repeated confirmation it continues to be included on the plant list. There have been successful efforts through spot spraying and physical removal to extirpate from the field the infrequently found aliens *Rosa multiflora* (multiflora rose) and *Ornithogalum umbellatum* (star-of-Bethlehem).

Some annual species have been displaced through successional change and are no longer present on the original core part of the site, but are included on the list since they continue to occur on the more recently disturbed portions of the field added after 2001. These include the native annual grasses *Panicum capillare* (witch grass) and *Panicum dichotomiflorum* (fall panicum). Among alien annuals that are not found on the older part of the site and are disappearing elsewhere are *Mollugo verticillatus* (carpet weed) and *Cerastium fontanum* (common mouse-eared chickweed).

DISCUSSION

This project exemplifies the slow progress in attempting to recreate prairie. There has been the gratifying increase in established native species to 158, but 45 non-natives continue to be present. Because of that continuing, though decreasing, presence it is unlikely that total recreation of pre-settlement prairie will ever occur. That should in no way discourage the attempt. Black soil prairie remnants in the region are small and infrequent, but they can serve as models and guides for reconstruction efforts (Robertson 2004). By setting expectations high it is more likely that satisfactory results will be achieved over time.

Periodic surveys such as these and maintenance of annual notes are helpful in providing an objective view of how the project is developing and encourage staying focused on the project. They may identify and permit early attention to problems that appear such as a gradual increase in populations of invasive species as well as providing the satisfaction of quantifying what is hoped will be the long-term improvement of prairie plant populations.

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APPENDIX

Plant List Revised 2012
Gardner Prairie Project. Kempton, Illinois.
Mona Township. Ford County
Sec 6 T28N R9E: Lat.40.93366 N, Long.88.23690 W
Nomenclature and native-alien designations follow Mohlenbrock, R.H. 2002.
Vascular Flora of Illinois.
Carbondale:Southern Illinois University Press.
Asterisk indicates alien species.
Bold indicates species increases from added wetland

MONOCOTS

COMMELINACEAE	*Tradescantia ohiensis*	Ohio Spiderwort
CYPERACEAE	*Carex bebbii*	Bebb's Sedge
	Carex bicknellii	Bicknell's Sedge
	Carex blanda	
	Carex brevior	
	Carex cristatella	Round-spiklet sedge
	Carex frankii	Frank's Sedge
	Carex gravida	
	Carex haydenii	Hayden's Sedge
	*Carex hirta**	Hairy Sedge
	Carex meadii	Mead's Sedge
	Carex mesochorea	Midland Sedge
	Carex molesta	
	Carex muhlenbergii	Muhlenberg's Sedge
	Carex pellita	Wooly sedge
	Carex vulpinoidea	Foxtail Sedge
	Cyperus acuminatus	Pointed Flatsedge
	Cyperus esculentus	Yellow Nut Sedge
	Eleocharis compressa	Flat-stemmed Spikerush
	Eleocharis verrucosa	Warty Spikerush
	Schoenoplectus tabernaemontani	Soft-stem Bulrush
	Scirpus atrovirens	Dark Green Bulrush
	Scirpus pendulus	Nodding Bulrush
IRIDACEAE	*Iris shrevei*	Blue Flag
	Sisyrinchium albidum	Blue-eyed Grass
JUNCACEAE	*Juncus dudleyi*	Dudley's Rush
	Juncus interior	Inland Rush
	Juncus tennuis	Path Rush
	Juncus torreyi	Torrey's rush
LILIACEAE	*Asparagus officinalis**	Asparagus
	Smilacina stellata	Starry Solomon's-seal
POACEAE	*Agrostis gigantea**	Red Top
	Andropogon gerardii	Big Bluestem
	Aristida oligantha	Three-Awn
	*Bromus inermis**	Smooth Brome
	Calamagrostis canadensis	Blue Joint Grass
	*Dactylis glomerata**	Orchard Grass
	Dichanthelium acuminatum	Panic Grass
	*Echinochloa crus-galli**	Barnyard Grass

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	Elymus canadensis	Nodding Wild Rye
	Elymus virginicus	Virginia Wild Rye
	*Elytrigia repens**	Quack Grass
	*Festuca pratensis**	Meadow Fescue
	Heterostipa spartea	Porcupine Grass
	*Hordeum jubatum**	Squirrel-tail Grass
	Leersia oryzoides	Rice Cutgrass
	Panicum virgatum	Switch Grass
	*Phleum pratense**	Timothy
	*Poa compressa**	Canada Blue Grass
	*Poa pratensis**	Kentucky Blue Grass
	Schizachyrium scoparium	Little Bluestem
	Sorghastrum nutans	Indian Grass
	Spartina pectinata	Cord Grass
	Sporobolus compositus	Dropseed
	Sporobolus heterolepis	Prairie Dropseed
TYPHACEAE	*Typha latifolia*	Common Cat-tail
DICOTS		
ACANTHACEAE	*Ruellia humilis*	Wild Petunia
AMARANTHACEAE	*Amaranthus retroflexus**	Rough Pigweed
APIACEAE	*Daucus carota**	Wild Carrot
	Eryngium yuccifolium	Rattlesnake Master
	*Pastinaca sativa**	Parsnip
	Zizea aurea	Golden Alexanders
ASCLEPIADACEAE	***Asclepias incarnata***	Swamp Milkweed
	Asclepias sullivantii	Prairie Milkweed
	Asclepias syriaca	Common Milkweed
	Asclepias tuberosa	Butterfly-weed
	Asclepias verticillata	Horsetail Milkweed
ASTERACEAE	*Achillea millefolium**	Yarrow
	Ambrosia artemisiifolia	Common Ragweed
	Ambrosia trifida	Giant Ragweed
	Antennaria neglecta	Pussy-toes
	*Arctium minus**	Common Burdock
	Aster ericoides	Heath Aster
	Aster laevis	Smooth Aster
	Aster novae-angliae	New England Aster
	Aster pilosus	Hairy Aster
	Aster praealtus	Willow Aster
	Bidens frondosa	Common Beggar's Ticks
	*Cichorium intybus**	Chicory
	Cirsium discolor	Pasture Thistle
	Coreopsis palmata	Prairie Coreopsis
	Coreopsis tripteris	Tall Coreopsis
	Echinacea pallida	Pale Coneflower
	Echinacea purpurea	Purple Coneflower
	Erigeron strigosus	Fleabane
	Eupatorium altissimum	Tall Boneset
	Euthamia graminifolia	Grass-leaved goldenrod
	Helianthus grosseserratus	Sawtooth Sunflower
	Helianthus pauciflorus	Prairie Sunflower
	Lactuca canadensis	Wild Lettuce
	*Lactuca serriola**	Prickly Lettuce
	*Leucanthemum vulgare**	Ox-eye Daisy
	Liatris aspera	Rough Blazing-star

	Liatris pycnostachya	Prairie Blazing-star
	Liatris spicata	Marsh Blazing-star
	Oligoneuron album	Stiff Aster
	Oligoneuron rigidum	Stiff Goldenrod
	Parthenium integrifolium	Wild Quinine
	Prenanthes aspera	Rough White Lettuce
	Ratibida pinnata	Yellow Coneflower
	Rudbeckia hirta	Black-Eyed Susan
	Rudbeckia triloba	Brown-eyed Susan
	Silphium integrifolium	Rosin Weed
	Silphium laciniatum	Compass-plant
	Silphium perfoliatum	Cup-plant
	Silphium terebinthinaceum	Prairie Dock
	Solidago altissima	Tall Goldenrod
	Solidago juncea	Early Goldenrod
	Solidago nemoralis	Gray goldenrod
	*Sonchus oleraceus**	Common Sow Thistle
	*Taraxacum officinale**	Common Dandelion
BORAGINACEAE	*Lithospermum canescens*	Hoary Puccoon
BRASSICACEAE	*Brassica rapa**	Field Mustard
	*Lepidium campestre**	Field Pepper-grass
	Rorippa palustris	Marsh Yellow Cress
	*Syanapis arvensis**	Charlock
	*Thlaspi arvense**	Penny Cress
CAESALPINIACEAE	*Chamaechrista fasciculata*	Partridge Pea
CAMPANULACEAE	***Lobelia cardinalis***	Cardinal Flower
	Lobelia spicata	Spiked Lobelia
CAROPHYLLACEAE	*Cerastium fontanum**	Mouse-Ear Chickweed
	*Silene pratensis**	White Campion
CHENOPODIACEAE	*Chenopodium album**	Lamb's Quarters
CONVOLVULACEAE	*Calystegia sepium*	Bindweed
	*Ipomoea hederacea**	Ivy-leaved Morning-glory
FABACEAE	*Amorpha canescens*	Lead Plant
	Apios americana	Groundnut
	Astragalus canadensis	Canadian Milk Vetch
	Baptisia alba	White Wild Indigo
	Baptisia bracteata	Cream Wild Indigo
	Dalea candida	White Prairie Clover
	Dalea purpurea	Purple Prairie Clover
	Lathyrus palustris	Marsh Vetchling
	Lespedeza capitata	Round-headed Bush Clover
	*Medicago lupulina**	Black Medick
	*Melilotus albus**	White Sweet Clover
	*Melilotus officinalis**	Yellow Sweet Clover
	Orbexilum onobrychis	French Grass
	*Trifolium hybridum**	Alsike Clover
	*Trifolium pratense**	Red Clover
	*Trifolium repens**	White Clover
GENTIANACEAE	*Gentiana alba*	Yellow Gentian
	Gentiana andrewsii	Closed Gentian
	Gentiana puberulenta	Downy Gentian
	Gentianella quinquefolia	Stiff Gentian
HYPERICACEAE	*Hypericum sphaerocarpum*	Round-fruited St.Johns-wort
LAMIACEAE	*Leonurus cardiaca**	Motherwort
	Monarda fistulosa	Wild Bergamot
	Physostegia virginiana	False Dragonhead

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	Prunella vulgaris	Self-heal
	Pycnanthemum pilosum	Hairy Mountain Mint
	Pycnanthemum tenuifolium	Slender Mountain Mint
	Pycnanthemum virginianum	Common Mountain Mint
LYTHRACEAE	***Ammania robusta***	Tooth-cup
MIMOSACEAE	*Desmanthes illinoensis*	Illinois Mimosa
MOLLUGINACEAE	*Mollugo verticillatus**	Carpetweed
ONAGRACEAE	*Oenothera biennis*	Evening Primrose
	Oenothera pilosella	Prairie Sundrops
OXALIDACEAE	*Oxalis stricta*	Yellow Wood Sorrel
	Oxalis violacea	Purple Wood Sorrel
PLANTAGINACEAE	*Plantago lanceolata**	Buckhorn
	Plantago rugelii	Rugel's Plantain
POLEMONIACEAE	*Phlox glaberrima*	Smooth Phlox
	Phlox pilosa	Downy phlox
POLYGALACEAE	*Polygala sanguinea*	Field Milkwort
	Polygala verticillata	Whorled Milkwort
	Persicaria pensylvanica	Pinkweed
	*Persicaria vulgaris**	Lady's Thumb-print
	*Rumex crispus**	Curly Dock
PRIMULACEAE	*Dodecatheon meadia*	Shooting Star
	Lysimachia lanceolata	Loosestrife
RANUNCULACEAE	*Anemone canadensis*	Meadow Anemone
	Anemone cylindrica	Thimbleweed
	Anemone virginiana	Tall Anemone
	Ranunculus abortivus	Small-flowered Crowfoot
	Thalictrum dasycarpum	Purple Meadow Rue
RHAMNACEAE	*Ceanothus americanus*	New Jersey Tea
ROSACEAE	*Filipendula rubra*	Queen of the Prairie
	Fragaria virginiana	Wild Strawberry
	Geum canadense	White Avens
	Geum laciniatum	Rough Avens
	Potentilla arguta	Prairie Cinquefoil
	*Potentilla recta**	Sulfur Cinquefoil
	Potentilla simplex	Common Cinquefoil
	Rosa carolina	Pasture Rose
	Rubus sp.	Blackberry
	Spiraea alba	Meadow-sweet
RUBIACEAE	*Galium aparine*	Cleavers
	Galium boreale	Northern Bedstraw
SANTALACEAE	*Comandra umbellata*	False Toadflax
SAXIFRAGACEAE	*Heuchera richardsonii*	Prairie Alumroot
SCROPHULARIACEAE	*Pedicularis canadensis*	Lousewort
	Veronicastrum virginicum	Culver's-root
SOLANACEAE	*Physalis heterophylla*	Ground Cherry
	*Physalis longifolia**	Ground Cherry
	*Solanum carolinense**	Horse-nettle
	*Solanum dulcamara**	Bittersweet Nightshade
VERBENACEAE	*Verbena urticifolia*	White Vervain
VIOLACEAE	*Viola pedatifida*	Prairie Violet
	Viola pratincola	Common Blue Violet
VITACEAE	*Vitis aestivalis*	Summer Grape