

SANDRA MILLER BELLROSE PRESERVE VEGETATION AND MACROINVERTEBRATE STATUS REPORT

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*Report to the Illinois Department of Natural Resources and the Logan County Soil and Water
Conservation District*

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STUDY SITE AND MONITORING BACKGROUND

The Sandra Miller Bellrose Nature Preserve is a 106-acre private nature preserve located in northern Logan County, Illinois. The preserve includes 0.8 miles of Sugar Creek (a tributary of the Sangamon River) and its surrounding floodplain habitat. This preserve is particularly notable as a nesting site for the state-threatened Henslow's sparrow (*Ammodramus henslowii*) and for its high mussel diversity, as recognized by its designation as an Illinois Natural Areas Inventory Site.

After an oil leak in 1997 damaged floodplain habitat near Broadwell, in southwestern Logan County, compensation was sought from the Natural Resource Damage Assessment (NRDA) and the funds were used in part to restore the Sandra Miller Bellrose Preserve. NRDA is a process by which compensation is sought for injuries to natural resources following the discharge of oil or a hazardous substance. The Illinois Department of Natural Resources (IDNR) and Illinois Environmental Protection Agency administer NRDA in Illinois. NRDA funds were used in 2007 in order to complete stream and wetland restoration within the preserve. Grassland and forest restoration funded by other sources has also taken place within the preserve. Three wetland basins were created in order to improve habitat for plants, birds, insects, amphibians, and reptiles. Wetland 1 is a 0.48-acre wooded, shallow water basin (Fig. 1). Wetland 2 is a 0.15-acre emergent wetland created using leftover materials from the creation of Wetlands 1 and 3. Wetland 3 is a 2.48-acre hemi-marsh with open water and emergent wetland zones (Fig. 2). Periodic monitoring of these wetlands has been ongoing since 2007. Vegetation surveys were conducted in 2007, 2008, and 2010. Macroinvertebrate surveys were conducted in 2008, 2009, 2010, and 2012. This report details monitoring of vegetation and macroinvertebrates conducted during the summer and fall of 2019.



Figure 1: Wetland 1 at Sandra Miller Bellrose Preserve, June 2019.



Figure 2: Wetland 3 at Sandra Miller Bellrose Preserve, June 2019.

METHODS

Vegetation Survey

We conducted the vegetation survey on July 30, 2019. Replicating the previous assessment (LaGesse 2010) as closely as possible, we established four sampling transects (Fig. 3): a 25-m transect across a small existing wetland below the construction zone (Transect 1), a 50-m transect across Wetland 1 (Transect 2), a 75-m transect that runs diagonally across Wetland 3 (Transect 3), and an 80-m transect that was added during 2010 sampling (Transect 4). Along each transect, we sampled total of 21 0.25-m² quadrats, which were placed along transects using the same random numbers as the previous survey (LaGesse 2010). Successive quadrats were placed on alternating sides of the transects. We visually estimated the cover of each vascular plant species and assigned a cover class based on Daubenmire (1959), as modified by Bailey and Poulton (1968). We also estimated cover of bare soil and open water. We calculated frequency, relative frequency, percent cover, and relative cover for each species along each transect. We assessed floristic quality for each transect based on the Mean Coefficient of Conservatism (mean C) and the Floristic Quality Index (FQI), as described by Taft et al. (1997). We also reported the Wetland Indicator Status values for individual species (Lichvar et al. 2014). In addition, we inventoried the plant community within each wetland in order to document occurrences of any species that were not represented within the quadrats.

Transect 1 was established at N40° 16.118' W89° 20.124', and ended at N40° 16.133' W89° 20.123'. It was amended slightly to end in a natural wooded wetland, as the previous transect end marker could not be found. Transect 2 was established at N40° 16.118' W89° 20.073', and ended at N40° 16.140' W89° 20.090'. Transect 3 was established at N40° 16.188' W89° 20.088' and ended at N40° 16.254' W89° 20.184'. Transect 4 was established at the same point as Transect 3, and continued in a straight line at 123 degrees southeast in the opposite direction from Transect 3.

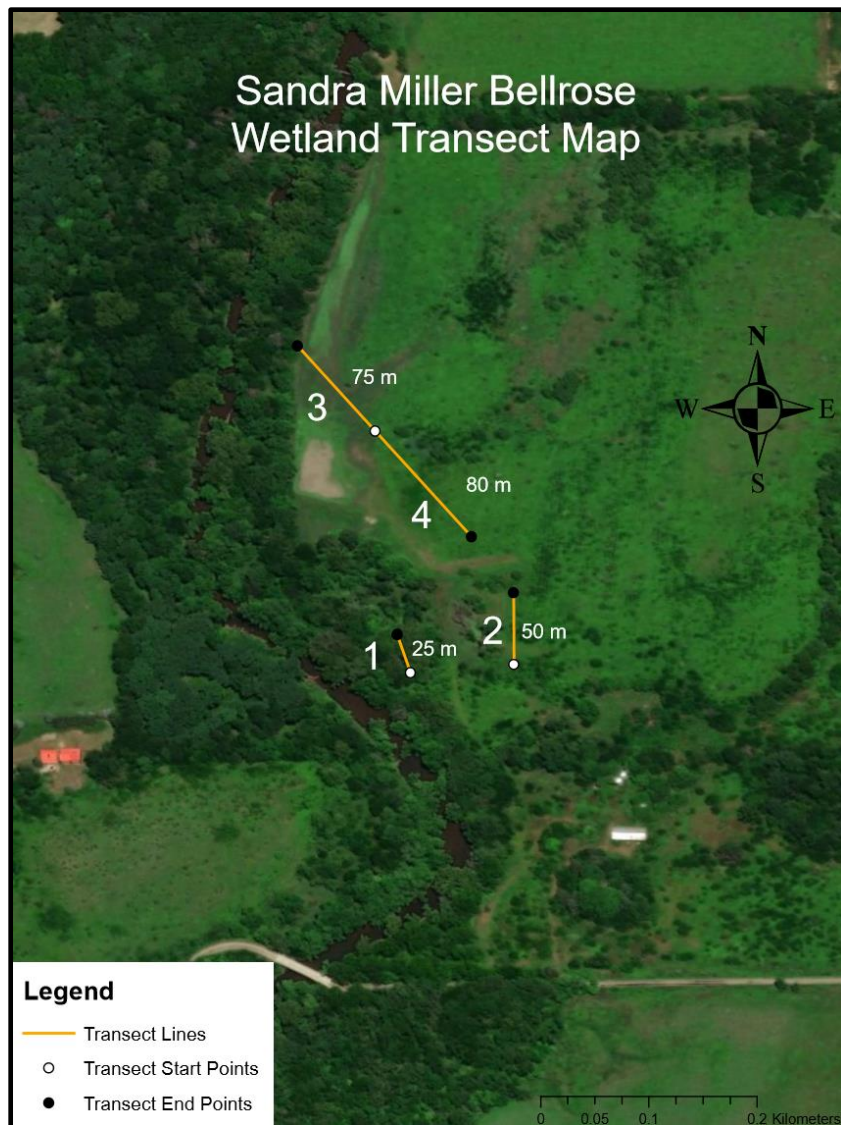


Figure 3: Map of the vegetation transect locations. Map scale 1:3,850.

Macroinvertebrate surveys

We surveyed macroinvertebrates in each of the three core wetlands on June 26 (spring), July 30 (summer), and October 1 2019 (fall). Sampling followed the methods used at this site by LaGesse (2012). We sampled macroinvertebrates by sweeping and jabbing a 600-micron mesh

D-frame dip net in preferred habitats for macroinvertebrates, including shoreline emergent vegetation, aquatic macrophyte beds, woody debris, root mats, plant and tree stems, and leaf litter. Sampling was restricted to areas less than 1-m water depth. We emptied net contents into shallow sorting pans, picked out macroinvertebrates for approximately 30 minutes with two observers or until 150-300 organisms were collected, and preserved macroinvertebrates in 95% ethanol. In the laboratory, we sorted preserved specimens and keyed them to the lowest taxonomic resolution possible.

RESULTS

Vegetation surveys

We recorded a total of 69 plant species in the plots during this survey (Tables 1-4). This represents an increase of 17 new species compared to the 2010 survey, which recorded 52.

Transect 1: We recorded a total of 26 species in plots along Transect 1 (Table 1), an increase of 4 species compared with 2010. Two non-native species, *Lysimachia nummularia* (moneywort) and *Phalaris arundinacea* (reed canarygrass) had the greatest cover. The mean C was 2.65, and the FQI was 13.5. The FQI has increased (from 10.2) since 2010, but this may be due to the small change in transect orientation. A total of 23 additional species were recorded in the wooded wetland surrounding the transect (Table 5).

Transect 2: We recorded a total of 33 species in plots along Transect 2 (Table 2), an increase of 8 species from 2010. *Phalaris arundinacea*, *Solidago canadensis* (Canada goldenrod), and *Acer saccharinum* (silver maple) had the greatest cover. The mean C was 1.85, and the FQI was 10.6. The FQI decreased slightly compared to 2010, when the FQI was 10.9. We recorded 7 non-native species, an increase from 4 species recorded in 2010. We observed a total of 32 additional species in Wetland 1, outside of the plots (Table 5).

Transect 3: We recorded a total of 10 species in plots along Transect 3, an increase from 7 species recorded in 2008. In 2010 the water was too deep to sample vegetation, and thus only open water was recorded. In 2019, open water and bare ground, combined, covered approximately 75% of the sampled area. The mean C was 2.22, and the FQI was 7.0. The FQI increased from 2008 (4.5). *Phalaris arundinacea* was the only non-native species recorded in the plots. We observed a total of 23 additional species from Wetland 3, outside of the plots (Table 5).

Transect 4: We recorded a total of 49 species in plots along Transect 4, compared to 24 species recorded in 2010. *Solidago canadensis* and *Poa pratensis* (Kentucky bluegrass) had the greatest cover. The mean C was 1.84, and the FQI was 12.9. The FQI decreased from 13.2 in the 2010 survey. We recorded 9 non-native species in the plots. Transect 4 did not quite reach Wetland 2 towards its end, and therefore we inventoried plant species within that wetland in order to ensure that the site was comprehensively surveyed. We observed a total of 40 additional species from Wetland 2 and the area surrounding the transect (Table 5).

Macroinvertebrate Surveys

Based on the limited data available from previous years, diversity of macroinvertebrates was greater in 2019 than previous years. Taxonomic richness fluctuated seasonally in all wetlands. 12 orders and 33 genera were represented overall (Table 6). Hemiptera had the greatest diversity overall, with 10 taxa represented throughout the three wetlands. Odonata was also well represented, with 9 total taxa.

Wetland 1: We recorded a total of 23 invertebrate taxa in Wetland 1 during the three sampling events. Wetland 1 had the lowest peak richness, with 9 total taxa representing 6 orders in June, 15 taxa representing 9 orders in July, and 10 taxa representing 6 orders in October. Diptera had the greatest diversity, with 3 distinct families found in July, and Ephemeroptera had the greatest abundance, with 43 small minnow mayflies (*Callibaetis* sp.) found in July.

Wetland 2: We recorded a total of 24 invertebrate taxa in Wetland 2 during the three sampling events. There were 18 taxa representing 8 orders in June, 14 taxa representing 6 orders in July, and 12 taxa representing 5 orders in October. Diptera had the greatest family richness, with 6 families represented in June, and the greatest abundance with 196 mosquitoes (*Culicidae*) collected in October.

Wetland 3: We recorded a total of 30 invertebrate taxa in Wetland 3, an increase of 2 from 28 taxa in 2010. There were 18 taxa representing 9 orders in June, 18 taxa representing 7 orders in July, and 11 taxa representing 6 orders in October. Diptera had the greatest family diversity with 4 families represented in July, and Ephemeroptera had the greatest abundance with 51 small minnow mayflies (*Callibaetis* sp.) found in July.

DISCUSSION

Plant species diversity increased since 2010 across all transects. However, in the two transects with the greatest increase in number of species (Transects 2 and 4), FQI decreased. Seven additional non-native species were observed compared to 2010. However, 18 new native species were also recorded. Since FQI increased modestly in two transects but decreased modestly in the two others, it appears that floristic quality at the restored wetlands has been fairly stable for the past nine years, which is typical of restored wetlands of this age (Matthews et al. 2009). Fluctuations of FQI of a few points from one sampling occasion to another can be due to interannual variation in weather and differences between observers, and do not necessarily reflect directional changes in site quality. Nonetheless, the majority of the species which have recruited to the site are not species of high quality habitats – they tend to have low C values. If low-quality species continue to recruit, more native seeding may be necessary in order to augment the restoration.

Phragmites australis (common reed) is invading a patch between the north end of Transect 2 and the last 10 meters of Transect 4. The patch is sparse, and with expedient treatment it could be eradicated. This is the highest priority for treatment within the preserve, and if time and

resources permit we recommend immediate treatment. The most recent treatment guidelines for *P. australis* can be found on the Illinois DNR website (Foster and Edgin 2017).

Phalaris arundinacea (reed canarygrass) is the most abundant species along Transects 1, 2 and 3. Cover by this invasive grass has increased markedly since 2010 and will likely increase further if unchecked. This trend has been ongoing since monitoring began. Controlling this species would be costly and time consuming; however, it is a threat to the success of this preserve as a restoration site. The most recent treatment guidelines for *P. arundinacea* can be found on the Illinois DNR website (Hutchison 2017).

A few invasive plants of lesser concern are also prevalent throughout the sites. *Lysimachia nummularia* (moneywort) was frequent along Transect 1, and scattered throughout Transects 2 and 4. Even though it is mat-forming and considered invasive, control without disturbing surrounding native species would be difficult because this species grows in a dense layer beneath native species. In addition, cover has remained fairly constant through time, so no action is recommended. *Poa pratensis* (Kentucky bluegrass) is especially prevalent along Transect 4, although it does not seem to be crowding out native species. It is present in every county in Illinois and is not considered to be a high priority invasive species in restored wetlands; therefore no treatment is recommended.

Our results indicate a slight increase in taxonomic richness of invertebrates compared to past years. In 2010, Wetlands 1 and 2 were reported to have over 20 taxa each, and Wetland 3 was reported to have 28 taxa across the three sampling events (LaGesse 2012), whereas in 2019 we observed 23, 24, and 30 taxa in Wetlands 1, 2 and 3 respectively. Drought in 2012 made only one sampling trip in summer possible that year, and Wetland 2 was completely dry and thus was not sampled (none of the three wetlands dried entirely during 2019). Wetlands 1 and 3 both had significantly lower diversity in 2012 compared to 2010. Abundance data are not available for the previous sampling occasions, so any temporal comparison of invertebrate abundance is not possible. For this reason, it is difficult to evaluate the trajectories of invertebrate communities in each wetland. Invertebrates are an essential component of wetland communities. More consistent surveys are necessary to document the trajectory of invertebrate communities through time.

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Table 1. Plant species recorded in plots along transect 1 at the Sandra Miller Bellrose Preserve, July 30, 2019.

Species	Common Name	Num. plots	Relative frequency	Average cover (%)	Relative cover (%)	C-value	Wetland Indicator Status	Native	Physiognomy
<i>Acer saccharinum</i>	silver maple	18	12.6	6.3	7.8	1	FACW	yes	tree
<i>Alisma subcordatum</i>	common water plantain	11	7.7	6.5	8.1	2	OBL	yes	per. forb
<i>Bidens comosa</i>	swamp tickseed	2	1.4	0.8	1.0	2	OBL	yes	per. forb
<i>Bidens frondosa</i>	common beggar's ticks	12	8.4	4.3	5.3	1	FACW	yes	ann. forb
<i>Boehmeria cylindrica</i>	false nettle	4	2.8	1.1	1.4	3	OBL	yes	per. forb
<i>Carex frankii</i>	bristly cattail sedge	1	0.7	0.7	0.9	4	OBL	yes	per. sedge
<i>Carex granularis</i>	pale sedge	2	1.4	0.8	1.0	2	FACW	yes	per. sedge
<i>Elymus virginicus</i>	Virginia wild rye	2	1.4	0.2	0.2	4	FACW	yes	per. grass
<i>Epilobium coloratum</i>	cinnamon willow herb	1	0.7	0.1	0.1	3	OBL	yes	per. forb
<i>Fraxinus pennsylvanica</i>	green ash	1	0.7	0.1	0.1	2	FACW	yes	tree
<i>Glyceria striata</i>	fowl manna grass	2	1.4	1.9	2.4	4	OBL	yes	per. grass
<i>Leersia oryzoides</i>	rice cut grass	10	7.0	6.4	7.9	3	OBL	yes	per. grass
<i>Leersia virginica</i>	white grass	1	0.7	0.1	0.1	4	FACW	yes	per. grass
<i>Lemna minor</i>	small duckweed	13	9.1	4.5	5.6	3	OBL	yes	ann. forb
<i>Lycopus virginicus</i>	bugle weed	7	4.9	2	2.5	5	OBL	yes	per. forb
<i>Lysimachia nummularia</i>	moneywort	12	8.4	16.2	20.1	0	FACW	no	per. forb
<i>Penthorum sedoides</i>	ditch stonecrop	3	2.1	0.4	0.5	2	OBL	yes	per. forb
<i>Phalaris arundinacea</i>	reed canarygrass	12	8.4	20.7	25.7	0	FACW	no	per. grass
<i>Pilea pumila</i>	Canada clearweed	8	5.6	1.5	1.9	3	FACW	yes	ann. forb
<i>Persicaria punctata</i>	smartweed	3	2.1	1	1.2	3	OBL	yes	per. forb
<i>Ranunculus septentrionalis</i>	swamp buttercup	3	2.1	0.4	0.5	4	FAC	yes	per. forb
<i>Sagittaria latifolia</i>	common arrowhead	1	0.7	0.1	0.1	4	OBL	yes	per. forb
<i>Solidago gigantea</i>	late goldenrod	1	0.7	0.7	0.9	3	FACW	yes	per. forb
<i>Symphotrichum lanceolatum</i>	panicled aster	8	5.6	2.7	3.3	3	FAC	yes	per. forb
<i>Symphotrichum ontarionis</i>	Ontario aster	4	2.8	1.1	1.4	4	FAC	yes	per. forb
<i>Xanthium strumarium</i>	cocklebur	1	0.7	0.1	0.1	0	FAC	yes	ann. forb

Table 1. (cont.)

Species	Common Name	Num. plots	Relative frequency	Average cover (%)	Relative cover (%)	C-value	Wetland Indicator Status	Native	Physiognomy
bare ground		16		41					
open water		0		0					
Native richness		25							
Mean C		2.65							
FQI		13.53							

Table 2. Plant species recorded in plots along transect 2 at the Sandra Miller Bellrose Preserve, July 30, 2019.

Species	Common Name	Num. plots	Relative frequency	Average cover (%)	Relative cover (%)	C-value	Wetland Indicator Status	Native	Physiognomy
<i>Acalypha rhomboidea</i>	three-seeded mercury	1	0.8	0.1	0.1	0	FACU	yes	ann. forb
<i>Acer saccharinum</i>	silver maple	19	14.3	11.0	11.0	1	FACW	yes	tree
<i>Agrostis gigantea</i>	red top	1	0.8	0.1	0.1	0	FACW	yes	per. grass
<i>Bidens comosa</i>	swamp tickseed	3	2.3	0.2	0.2	2	OBL	yes	per. forb
<i>Carex cristatella</i>	crested oval sedge	7	5.3	2.6	2.6	3	FACW	yes	per. sedge
<i>Carex vulpinoidea</i>	brown fox sedge	6	4.5	1.7	1.7	3	FACW	yes	per. sedge
<i>Eleocharis erythropoda</i>	red-rooted spike rush	7	5.3	4.9	4.9	3	OBL	yes	per. sedge
<i>Epilobium coloratum</i>	cinnamon willow herb	1	0.8	0.5	0.5	3	OBL	yes	per. forb
<i>Erechtites hieracifolia</i>	fireweed	3	2.3	0.2	0.2	2	FAC	yes	ann. forb
<i>Eupatorium serotinum</i>	late boneset	1	0.8	0.5	0.5	1	FAC	yes	per. forb
<i>Fraxinus pennsylvanica</i>	green ash	2	1.5	0.6	0.6	2	FACW	yes	tree
<i>Humulus japonicus</i>	Japanese hops	1	0.8	0.1	0.1	0	FACU	no	herb. vine
<i>Impatiens capensis</i>	spotted touch-me-not	4	3.0	0.3	0.3	2	FACW	yes	ann. forb
<i>Leersia oryzoides</i>	rice cut grass	1	0.8	1.2	1.2	3	OBL	yes	per. grass
<i>Lysimachia nummularia</i>	moneywort	3	2.3	1.5	1.5	0	FACW	no	per. forb
<i>Parthenocissus quinquefolia</i>	Virginia creeper	4	3.0	0.7	0.7	2	FACU	yes	woody vine

Table 2. (cont.)

Species	Common Name	Num. plots	Relative frequency	Average cover (%)	Relative cover (%)	C-value	Wetland Indicator Status	Native	Physiognomy
<i>Phalaris arundinacea</i>	reed canarygrass	20	15.0	34.8	34.8	0	FACW	no	per. grass
<i>Phyla lanceolata</i>	fog fruit	1	0.8	0.1	0.1	1	OBL	yes	per. forb
<i>Pilea pumila</i>	Canada clearweed	1	0.8	0.1	0.1	3	FACW	yes	ann. forb
<i>Poa pratensis</i>	Kentucky blue grass	7	5.3	6.5	6.5	0	FAC	no	per. grass
<i>Persicaria punctata</i>	smartweed	4	3.0	0.2	0.2	3	OBL	yes	per. forb
<i>Rosa multiflora</i>	Japanese rose	2	1.5	1.0	1.0	0	FACU	no	shrub
<i>Sagittaria latifolia</i>	common arrowhead	2	1.5	1.0	1.0	4	OBL	yes	per. forb
<i>Scirpus atrovirens</i>	dark green rush	6	4.5	6.0	6.0	4	OBL	yes	per. sedge
<i>Solidago canadensis</i>	Canada goldenrod	9	6.8	13.2	13.2	1	FACU	yes	per. forb
<i>Solidago gigantea</i>	late goldenrod	3	2.3	3.0	3.0	3	FACW	yes	per. forb
<i>Symphyotrichum lanceolatum</i>	panicled aster	1	0.8	0.1	0.1	3	FAC	yes	per. forb
<i>Teucrium canadense</i>	germander	2	1.5	0.6	0.6	3	FACW	yes	per. forb
<i>Toxicodendron radicans</i>	poison ivy	5	3.8	6.3	6.3	1	FAC	yes	woody vine
<i>Trifolium hybridum</i>	alsike clover	2	1.5	0.2	0.2	0	FACU	no	per. forb
<i>Typha x glauca</i>	hybrid cattail	2	1.5	0.6	0.6	0	OBL	no	per. forb
<i>Ulmus americana</i>	American elm	1	0.8	0.1	0.1	5	FACW	yes	tree
<i>Viola sororia</i>	woolly blue violet	1	0.8	0.1	0.1	3	FAC	yes	per. forb
bare ground		0		0					
open water		0		0					
Native richness		26							
Mean C		1.85							
FQI		10.62							

Table 3. Plant species recorded in plots along transect 3 at the Sandra Miller Bellrose Preserve, July 30, 2019.

Species	Common Name	Num. plots	Relative Frequency	Average cover (%)	Relative cover (%)	C-value	Wetland Indicator Status	Native	Physiognomy
<i>Acer saccharinum</i>	silver maple	2	6.5	0.3	1.5	1	FACW	yes	tree
<i>Alisma subcordatum</i>	common water plantain	8	25.8	5.3	26.0	2	OBL	yes	per. forb
<i>Fraxinus pennsylvanica</i>	green ash	4	12.9	3.5	17.2	5	FACW	yes	tree
<i>Leersia oryzoides</i>	rice cut grass	2	6.5	0.3	1.5	3	OBL	yes	per. grass
<i>Phalaris arundinacea</i>	reed canarygrass	5	16.1	6.7	32.8	0	FACW	no	per. grass
<i>Phyla lanceolata</i>	fog fruit	1	3.2	0.1	0.5	1	OBL	yes	per. forb
<i>Potamogeton</i> sp.	pondweed	2	6.5	0.3	1.5	NA	OBL	yes	per. forb
<i>Stuckenia pectinata</i>	comb pondweed	3	9.7	2.8	13.7	5	OBL	yes	per. forb
<i>Symphotrichum lanceolatum</i>	panicked aster	1	3.2	0.1	0.5	3	FAC	yes	per. forb
<i>Xanthium strumarium</i>	cocklebur	3	9.7	1.0	4.9	0	FAC	yes	ann. forb
bare ground		5		12					
open water		15		67.7					
Native richness		9							
Mean C		2.22							
FQI		7.03							

Table 4. Plant species recorded in plots along transect 4 at the Sandra Miller Bellrose Preserve, July 30, 2019.

Species	Common Name	Num. plots	Relative frequency	Average cover (%)	Relative cover (%)	C-value	Wetland Indicator Status	Native	Physiognomy
<i>Acalypha rhomboidea</i>	three-seeded mercury	10	4.5	1.1	1.1	0	FACU	yes	ann. forb
<i>Acer saccharinum</i>	silver maple	17	7.6	7.6	7.6	1	FACW	yes	tree
<i>Ambrosia artemisiifolia</i>	common ragweed	2	0.9	0.5	0.5	0	FACU	yes	ann. forb
<i>Apocynum cannabinum</i>	dogbane	2	0.9	0.2	0.2	2	FAC	yes	per. forb
<i>Bidens frondosa</i>	common beggar's ticks	2	0.9	0.9	0.9	1	FACW	yes	ann. forb
<i>Boehmeria cylindrica</i>	false nettle	1	0.4	0.1	0.1	3	OBL	yes	per. forb
<i>Carex cristatella</i>	crested oval sedge	4	1.8	1.4	1.4	3	FACW	yes	per. sedge

Table 4. (cont.)

Species	Common Name	Num. plots	Relative frequency	Average cover (%)	Relative cover (%)	C-value	Wetland Indicator Status	Native	Physiognomy
<i>Carex granularis</i>	pale sedge	6	2.7	1.2	1.2	2	FACW	yes	per. sedge
<i>Carex vulpinoidea</i>	brown fox sedge	10	4.5	4.1	4.1	3	FACW	yes	per. sedge
<i>Cinna arundinacea</i>	common wood reed	1	0.4	0.1	0.1	5	FACW	yes	per. grass
<i>Cirsium discolor</i>	pasture thistle	2	0.9	0.2	0.2	3	FACU	yes	bien. forb
<i>Cuscuta gronovii</i>	common dodder	3	1.3	0.2	0.2	2	UPL	yes	ann. forb
<i>Daucus carota</i>	Queen Anne's lace	1	0.4	0.1	0.1	0	UPL	no	bien. forb
<i>Elymus virginicus</i>	Virginia wild rye	6	2.7	1.2	1.2	4	FACW	yes	per. grass
<i>Epilobium coloratum</i>	cinnamon willow herb	2	0.9	0.2	0.2	3	OBL	yes	per. forb
<i>Eupatorium serotinum</i>	late boneset	2	0.9	0.5	0.5	1	FAC	yes	per. forb
<i>Fraxinus pennsylvanica</i>	green ash	14	6.3	10.2	10.2	2	FACW	yes	tree
<i>Geum canadense</i>	white avens	3	1.3	1.0	1.0	2	FAC	yes	per. forb
<i>Humulus japonicus</i>	Japanese hops	1	0.4	0.1	0.1	0	FACU	no	herb. vine
<i>Ipomoea lacunosa</i>	small morning glory	1	0.4	0.1	0.1	1	FACW	yes	ann. forb
<i>Juncus tenuis</i>	path rush	9	4.0	1.4	1.4	0	FAC	yes	per. forb
<i>Leersia oryzoides</i>	rice cut grass	1	0.4	0.1	0.1	3	OBL	yes	per. grass
<i>Leersia virginica</i>	white grass	1	0.4	0.1	0.1	4	FACW	yes	per. grass
<i>Lespedeza cuneata</i>	silky bush clover	2	0.9	0.2	0.2	0	UPL	no	per. forb
<i>Lycopus americanus</i>	common water horehound	7	3.1	1.7	1.7	3	OBL	yes	per. forb
<i>Lysimachia nummularia</i>	moneywort	5	2.2	5.4	5.4	0	FACW	no	per. forb
<i>Oxalis stricta</i>	common wood sorrel	1	0.4	0.1	0.1	0	FACU	yes	per. forb
<i>Panicum virgatum</i>	prairie switch grass	1	0.4	0.5	0.5	4	FAC	yes	per. grass
<i>Phalaris arundinacea</i>	reed canarygrass	5	2.2	1.9	1.9	0	FACW	no	per. grass
<i>Pilea pumila</i>	Canada clearweed	1	0.4	0.1	0.1	3	FACW	yes	ann. forb
<i>Plantago rugelii</i>	red-stalked plantain	2	0.9	0.5	0.5	0	FAC	yes	ann. forb
<i>Platanus occidentalis</i>	sycamore	1	0.4	0.2	0.2	3	FACW	yes	tree
<i>Poa pratensis</i>	Kentucky blue grass	15	6.7	14.5	14.4	0	FAC	no	per. grass
<i>Persicaria punctata</i>	smartweed	3	1.3	0.2	0.2	3	OBL	yes	per. forb
<i>Prunella vulgaris</i>	lawn prunella	1	0.4	0.5	0.5	0	FAC	no	per. forb
<i>Ranunculus abortivus</i>	little-leaf buttercup	1	0.4	0.1	0.1	1	FACW	yes	ann. forb
<i>Rosa multiflora</i>	Japanese rose	1	0.4	0.1	0.1	0	FACU	no	shrub
<i>Rubus occidentalis</i>	black raspberry	1	0.4	0.5	0.5	2	UPL	yes	shrub
<i>Scirpus atrovirens</i>	dark green rush	4	1.8	0.3	0.3	4	OBL	yes	per. sedge
<i>Solidago canadensis</i>	Canada goldenrod	17	7.6	17.9	17.8	1	FACU	yes	per. forb
<i>Solidago gigantea</i>	late goldenrod	13	5.8	9.1	9.1	3	FACW	yes	per. forb
<i>Symphotrichum lanceolatum</i>	panicled aster	3	1.3	0.2	0.2	3	FAC	yes	per. forb
<i>Symphotrichum lateriflorum</i>	side-flowering aster	12	5.4	1.2	1.2	2	FACW	yes	per. forb

Table 4. (cont.)

Species	Common Name	Num. plots	Relative frequency	Average cover (%)	Relative cover (%)	C-value	Wetland Indicator Status	Native	Physiognomy
<i>Symphytotrichum ontarionis</i>	Ontario aster	2	0.9	0.1	0.1	4	FAC	yes	per. forb
<i>Symphytotrichum pilosum</i>	hairy aster	4	1.8	0.3	0.3	0	FACU	yes	per. forb
<i>Toxicodendron radicans</i>	poison ivy	3	1.3	2.4	2.4	1	FAC	yes	woody vine
<i>Trifolium hybridum</i>	alsike clover	15	6.7	9.2	9.2	0	FACU	no	per. forb
<i>Ulmus americana</i>	American elm	1	0.4	0.5	0.5	5	FACW	yes	tree
<i>Viola sororia</i>	woolly blue violet	1	0.4	0.1	0.1	3	FAC	yes	per. forb
bare ground		0		0					
open water		0		0					
Native richness		41							
Mean C		1.84							
FQI		12.86							

Table 5. Cumulative plant species lists for all surveyed wetland areas at the Sandra Miller Bellrose Preserve, July 30, 2019

Wooded wetland surrounding transect 1	Wetland 1 and the area surrounding transect 2	Wetland 3 and the area surrounding transect 3	Wetland 2 and the area surrounding transect 4
<i>Acer saccharinum</i>	<i>Acalypha rhomboidea</i>	<i>Acer saccharinum</i>	<i>Acalypha rhomboidea</i>
<i>Ageratina altissima</i>	<i>Acer saccharinum</i>	<i>Alisma plantago-aquatica</i>	<i>Acer saccharinum</i>
<i>Alisma plantago-aquatica</i>	<i>Ageratina altissima</i>	<i>Apocynum cannabinum</i>	<i>Agrostis gigantea</i>
<i>Bidens cernua</i>	<i>Agrostis alba</i>	<i>Bidens comosa</i>	<i>Alisma subcordatum</i>
<i>Bidens comosa</i>	<i>Alisma subcordatum</i>	<i>Calystegia sepium</i>	<i>Ambrosia artemisiifolia</i>
<i>Bidens frondosa</i>	<i>Asclepias syriaca</i>	<i>Ceratophyllum demersum</i>	<i>Apocynum cannabinum</i>
<i>Boehmeria cylindrica</i>	<i>Bidens comosa</i>	<i>Eryngium yuccifolium</i>	<i>Asclepias syriaca</i>
<i>Carex frankii</i>	<i>Bidens frondosa</i>	<i>Eupatorium serotinum</i>	<i>Bidens frondosa</i>
<i>Carex granularis</i>	<i>Boehmeria cylindrica</i>	<i>Fraxinus pennsylvanica</i>	<i>Boehmeria cylindrica</i>
<i>Carex shortiana</i>	<i>Bromus inermis</i>	<i>Gleditsia triacanthos</i>	<i>Bromus inermis</i>
<i>Carex stipata</i>	<i>Carex cristatella</i>	<i>Humulus japonicus</i>	<i>Carex cristatella</i>
<i>Cinna arundinacea</i>	<i>Carex vulpinoidea</i>	<i>Leersia oryzoides</i>	<i>Carex granularis</i>

Table 5. (cont.)

Wooded wetland surrounding transect 1	Wetland 1 and the area surrounding transect 2	Wetland 3 and the area surrounding transect 3	Wetland 2 and the area surrounding transect 4
<i>Cirsium discolor</i>	<i>Celtis occidentalis</i>	<i>Lycopus virginicus</i>	<i>Carex vulpinoidea</i>
<i>Cryptotaenia canadensis</i>	<i>Elaeagnus umbellata</i>	<i>Mentha arvensis</i> var. <i>villosa</i>	<i>Carya illinoensis</i>
<i>Elymus virginicus</i>	<i>Eleocharis erythropoda</i>	<i>Mimulus ringens</i>	<i>Cinna arundinacea</i>
<i>Epilobium coloratum</i>	<i>Elodea canadensis</i>	<i>Penthorum sedoides</i>	<i>Cirsium discolor</i>
<i>Eupatorium serotinum</i>	<i>Elymus virginicus</i>	<i>Persicaria amphibium</i>	<i>Cuscuta gronovii</i>
<i>Fraxinus pennsylvanica</i>	<i>Epilobium coloratum</i>	<i>Phalaris arundinacea</i>	<i>Cyperus strigosus</i>
<i>Geum canadense</i>	<i>Erechtites hieracifolia</i>	<i>Phyla lanceolata</i>	<i>Daucus carota</i>
<i>Glechoma hederacea</i>	<i>Eupatorium serotinum</i>	<i>Pilea pumila</i>	<i>Echinochloa muricata</i>
<i>Gleditsia triacanthos</i>	<i>Fraxinus pennsylvanica</i>	<i>Platanus occidentalis</i>	<i>Elymus canadensis</i>
<i>Glyceria striata</i>	<i>Gleditsia triacanthos</i>	<i>Potamogeton</i> sp.	<i>Elymus virginicus</i>
<i>Humulus japonicus</i>	<i>Humulus japonicus</i>	<i>Rudbeckia laciniata</i>	<i>Epilobium coloratum</i>
<i>Leersia oryzoides</i>	<i>Impatiens capensis</i>	<i>Sagittaria latifolia</i>	<i>Erigeron annuus</i>
<i>Leersia virginica</i>	<i>Leersia oryzoides</i>	<i>Schoenoplectus tabernaemontani</i>	<i>Eupatorium serotinum</i>
<i>Lemna minor</i>	<i>Lemna minor</i>	<i>Scirpus atrovirens</i>	<i>Fraxinus pennsylvanica</i>
<i>Lycopus virginicus</i>	<i>Lycopus americanus</i>	<i>Solidago gigantea</i>	<i>Geum canadense</i>
<i>Lysimachia nummularia</i>	<i>Lycopus virginicus</i>	<i>Stuckenia pectinata</i>	<i>Humulus japonicus</i>
<i>Penthorum sedoides</i>	<i>Lysimachia nummularia</i>	<i>Symphotrichum lanceolatum</i>	<i>Ipomoea lacunosa</i>
<i>Persicaria punctata</i>	<i>Mimulus ringens</i>	<i>Typha x glauca</i>	<i>Juncus tenuis</i>
<i>Phalaris arundinacea</i>	<i>Morus alba</i>	<i>Verbesina alternifolia</i>	<i>Juncus torreyi</i>
<i>Phyla lanceolata</i>	<i>Parthenocissus quinquefolia</i>	<i>Xanthium Strumarium</i>	<i>Leersia oryzoides</i>
<i>Pilea pumila</i>	<i>Penthorum sedoides</i>		<i>Leersia virginica</i>
<i>Platanus occidentalis</i>	<i>Persicaria punctata</i>		<i>Lespedeza cuneata</i>
<i>Prunella vulgaris</i>	<i>Phalaris arundinacea</i>		<i>Lycopus americanus</i>
<i>Ranunculus septentrionalis</i>	<i>Phragmites australis</i>		<i>Lysimachia nummularia</i>
<i>Rosa multiflora</i>	<i>Phyla lanceolata</i>		<i>Mimulus ringens</i>
<i>Rudbeckia laciniata</i>	<i>Pilea pumila</i>		<i>Oxalis stricta</i>
<i>Sagittaria latifolia</i>	<i>Platanus occidentalis</i>		<i>Panicum virgatum</i>
<i>Salix nigra</i>	<i>Poa pratensis</i>		<i>Persicaria punctata</i>

Table 5. (cont.)

Wooded wetland surrounding transect 1	Wetland 1 and the area surrounding transect 2	Wetland 3 and the area surrounding transect 3	Wetland 2 and the area surrounding transect 4
<i>Scirpus atrovirens</i>	<i>Populus deltoides</i>		<i>Persicaria</i> sp.
<i>Solidago gigantea</i>	<i>Rosa multiflora</i>		<i>Phalaris arundinacea</i>
<i>Stachys palustris</i>	<i>Rudbeckia laciniata</i>		<i>Phragmites australis</i>
<i>Symphyotrichum lanceolatum</i>	<i>Sagittaria latifolia</i>		<i>Phyla lanceolata</i>
<i>Symphyotrichum ontarionis</i>	<i>Salix nigra</i>		<i>Pilea pumila</i>
<i>Toxicodendron radicans</i>	<i>Scirpus atrovirens</i>		<i>Plantago rugelii</i>
<i>Verbena urticifolia</i>	<i>Scutellaria lateriflora</i>		<i>Platanus occidentalis</i>
<i>Viola sororia</i>	<i>Sicyos angulatus</i>		<i>Poa pratensis</i>
<i>Xanthium strumarium</i>	<i>Solanum carolinense</i>		<i>Prunella vulgaris</i>
	<i>Solidago canadensis</i>		<i>Quercus bicolor</i>
	<i>Solidago gigantea</i>		<i>Ranunculus abortivus</i>
	<i>Stachys palustris</i>		<i>Rosa multiflora</i>
	<i>Symphyotrichum lanceolatum</i>		<i>Rubus occidentalis</i>
	<i>Teucrium canadense</i>		<i>Rumex crispus</i>
	<i>Toxicodendron radicans</i>		<i>Rumex verticillatus</i>
	<i>Trifolium hybridum</i>		<i>Salix nigra</i>
	<i>Typha x glauca</i>		<i>Scirpus atrovirens</i>
	<i>Ulmus americana</i>		<i>Setaria viridis</i>
	<i>Verbena urticifolia</i>		<i>Solidago canadensis</i>
	<i>Verbesina alternifolia</i>		<i>Solidago gigantea</i>
	<i>Viola sororia</i>		<i>Symphyotrichum lanceolatum</i>
	<i>Vitis riparia</i>		<i>Symphyotrichum lateriflorum</i>
	<i>Wolffia columbiana</i>		<i>Symphyotrichum ontarionis</i>
			<i>Symphyotrichum pilosa</i>
			<i>Toxicodendron radicans</i>
			<i>Trifolium hybridum</i>
			<i>Typha x glauca</i>
			<i>Ulmus americana</i>

Table 5. (cont.)

Wooded wetland surrounding transect 1	Wetland 1 and the area surrounding transect 2	Wetland 3 and the area surrounding transect 3	Wetland 2 and the area surrounding transect 4
			<i>Vernonia missurica</i>
			<i>Viola sororia</i>

Table 6. Macroinvertebrate sampling data from constructed wetland basins at the Sandra Miller Bellrose Preserve.

Order	Family	Scientific name	Common Name	Wetland 1			Wetland 2			Wetland 3		
				Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall
Amphipoda	-	-	Amphipod	12	3	-	-	-	-	2	1	-
(Clitellata)	(Hirudinea)	-	Leech	4	1	-	-	-	-	-	-	-
Cladocera	Daphniidae	<i>Daphnia sp.</i>	Water Flea	-	1	-	13	-	-	2	-	-
Coleoptera	Carabidae	-	Aquatic Ground Beetle	-	-	1	-	-	-	-	-	-
Coleoptera	Dytiscidae	<i>Laccophilus sp.</i>	Diving Beetle	-	-	1	6	1	-	-	-	-
Coleoptera	Gyrinidae	<i>Dineutus sp.</i>	Whirligig Beetle	-	-	-	-	-	-	1	-	-
Coleoptera	Haliplidae	<i>Peltodytes sp.</i>	Crawling Water Beetle	-	3	5	-	1	6	2	-	2
Coleoptera	Hydrophilidae	<i>Tropisternus sp.</i>	Water Scavenger Beetle	-	6	1	11	19	1	-	3	-
Coleoptera	Noteridae	<i>Hydrocanthus sp.</i>	Burrowing Water Beetle	-	-	-	-	-	-	-	1	-
Decapoda	Cambaridae	<i>Lacunicambarus diogenes</i>	Devil Crayfish	-	-	-	-	-	11	-	-	-
Diptera	-	-	-	-	-	-	2	-	-	1	-	-
Diptera	Ceratopogonidae	-	Biting Midge	24	5	-	29	1	-	2	10	-
Diptera	Chaoboridae	<i>Chaoborus sp.</i>	Phantom Midge	-	-	-	5	15	-	-	-	-
Diptera	Chironomidae	-	Non-biting Midge	5	11	-	69	30	-	23	5	5
Diptera	Culicidae	-	Mosquito	-	1	-	4	3	196	4	7	2
Diptera	Stratiomyidae	-	Soldier Fly	-	-	-	-	-	1	-	3	-
Diptera	Tipulidae	-	Crane Fly	-	-	1	2	-	2	-	-	-
Ephemeroptera	Baetidae	-	Small Minnow Mayfly	7	-	1	-	9	-	-	-	-
Ephemeroptera	Baetidae	<i>Callibaetis sp.</i>	Small Minnow Mayfly	-	43	-	5	-	-	5	51	-

Table 6. (cont.)

Order	Family	Scientific name	Common Name	Wetland 1			Wetland 2			Wetland 3		
				Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall
Ephemeroptera	Caenidae	<i>Caenis sp.</i>	Small Squaregill Mayfly	3	1	-	-	-	-	1	1	10
(Gastropoda)	-	-	-	2	-	-	-	-	33	-	3	-
(Gastropoda)	Physidae	-	-	-	6	-	2	9	-	2	-	-
(Gastropoda)	Physidae	<i>Physa sp.</i>	Physa Snail	4	-	7	-	-	5	-	1	8
(Gastropoda)	Planorbidae	<i>Helisoma anceps</i>	Two-ridge Rams-horn	-	1	-	-	-	-	13	3	26
Hemiptera	Belostomatidae	<i>Belostoma sp.</i>	Giant Water Bug	-	-	-	-	-	-	-	5	-
Hemiptera	Corixidae	<i>Hesperocorixa sp.</i>	Water Boatman	-	5	-	-	-	8	4	-	6
Hemiptera	Gerridae	-	Water Strider	-	-	-	-	-	-	-	-	1
Hemiptera	Gerridae	<i>Aquarius sp.</i>	Water Strider	-	-	-	-	-	-	1	-	-
Hemiptera	Mesoveliidae	<i>Mesovelia sp.</i>	Water Treader	-	-	1	-	-	1	-	-	1
Hemiptera	Naucoridae	<i>Limnocoris sp.</i>	Creeping Water Bug	-	-	-	-	-	-	-	-	1
Hemiptera	Notonectidae	<i>Notonecta sp.</i>	Backswimmer	-	-	-	4	14	1	-	-	-
Hemiptera	Pleidae	<i>Neoplea striola</i>	Pygmy Backswimmer	-	-	1	-	-	-	-	-	-
Hemiptera	Nepidae	<i>Ranatra sp.</i>	Water Scorpion	-	-	-	-	-	-	-	1	-
Hemiptera	Saldidae	-	Shore Bug	-	-	-	-	-	1	-	-	-
Isopoda	-	-	Isopod	-	-	-	-	-	-	1	-	-
Lepidoptera	Cossidae	-	Miller Moth	-	-	-	1	-	-	-	-	-
Odonata	Aeshnidae	<i>Anax sp.</i>	Darner	-	-	-	8	1	-	3	-	-
Odonata	Coenagrionidae	-	-	-	-	-	15	-	-	-	-	-
Odonata	Coenagrionidae	<i>Enallagma sp.</i>	Bluet	-	-	-	-	-	-	41	25	-
Odonata	Coenagrionidae	<i>Ischnura sp.</i>	Forktail	6	11	5	8	31	-	3	16	6
Odonata	Lestidae	<i>Lestes sp.</i>	Spreadwing	-	-	-	3	-	-	-	-	-
Odonata	Libellulidae	-	Skimmer	-	3	-	-	1	-	-	2	-
Odonata	Libellulidae	<i>Erythemis sp.</i>	Pondhawk	-	-	-	-	-	-	-	3	-
Odonata	Libellulidae	<i>Libellula sp.</i>	Skimmer	-	-	-	9	-	-	-	-	-
Odonata	Libellulidae	<i>Pachydiplax longipennis</i>	Blue Dasher	-	-	-	-	31	-	-	-	-
Taxa Total				9	15	10	18	14	12	18	18	11