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South Loup River Valley Floristics: A Survey of Selected Sites in Buffalo County, Nebraska

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Abstract

Originating in the Nebraska Sand Hills, the South Loup River flows 30 km north of Kearney, Nebraska and traverses the northern edge of Buffalo County as it flows eastward to its confluence with the Middle Loup River in southwestern Howard County. Several diverse plant communities are associated with the South Loup Valley, including wet-meadows, wetland/oxbows, sand prairie, and riparian forest. Over a period of 6 years (2006-2012), we surveyed representative wet meadow, wetland, and sand prairie communities. We compiled an annotated vascular plant checklist that included 324 vascular plant species of which 11 were new county records. Three species of scouring rushes (Equisetophyta) were also listed. Approximately 84.1% (276 species) were native and 15.9% (52) were exotics. The mean coefficient of conservatism (Cm) values for the wet meadow, sand prairie, and wetland sites were 3.51, 3.61, and 4.25 respectively. The floristic quality indices (FQI) were 52.42 for the wet meadow, 32.49 for the sand prairie, and 34.26 for the wetland/oxbow. Several noteworthy sedge species collected in this study were bristly sedge (*Carex comosa*), shoreline sedge (*C. hyalinolepis*), ripgut sedge (*C. lacustris*), and smoothcane sedge (*C. laeviconica*). Forbs at the west edge of their range included Sullivant's milkweed (*Asclepias sullivantii*) and three-seeded mercury (*Acalypha rhomboidea*). A major objective of our study was to substantiate the significance of the South Loup River Valley to the species richness and flora of Nebraska and the Great Plains.

Key words: plant community analysis, South Loup River Valley, Nebraska flora

Introduction

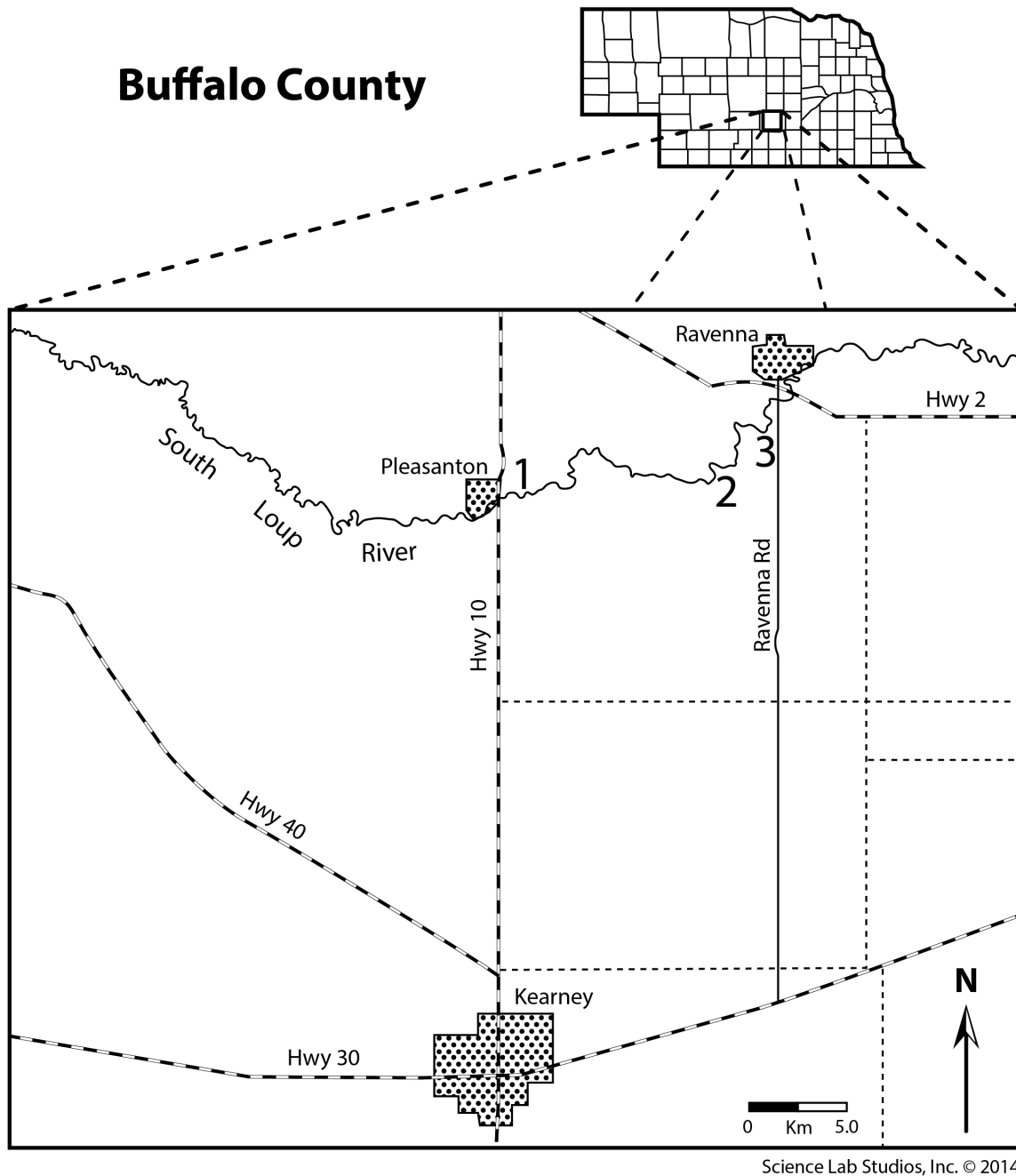
The South Loup River flows west to east through northern Buffalo County and is a tributary of the Middle Loup River. The two rivers converge ~20 km east of the study area. The Loup River system begins in the Nebraska Sand Hills, receiving water from the many lakes and aquifers in this region. The South, Middle, and North Loup Rivers are spring-fed, which allows for relatively consistent flows that are not directly dependent on precipitation (Steinauer 1998). The wetland meadows and marshes that border the Middle Loup River provide a mixture of plant communities that have been studied recently by several research groups (Veloso and Rothenberger 2008, Gutzmer and Kaul 2008, Flynn and Rothenberger 2014). Locating undisturbed study sites is difficult because a large percentage of the area bordering the river is heavily grazed, mowed, or cultivated. Higher prices for agricultural products have resulted in expansion of farming and ranching operations statewide. In fact, in 2012 Nebraska led the nation in the number of hectares (22217.2; 54,876.6 Ac) of land converted from non-cropland to cropland (Berthelsen 2014). A large percentage of this land was native grassland (Berthelsen 2014). The three areas we selected for study near the South Loup River were generally undisturbed, even though the Pleasanton meadow and the Ravenna sand prairie have been grazed more heavily since 2012. Because of this increased activity, it was important that we gather and report plant species data from the South

Loup River area as quickly as possible. Therefore, our objectives were to (1) study and compare the plant diversity at several contrasting locations in the South Loup River Valley; (2) provide plant species data that substantiates the importance of the South Loup River Valley flora; and (3) generate a species checklist, including new county records, that contributes to the known flora of central Nebraska.

Study Sites and Descriptions

We selected the three study sites because they had less disturbance and, botanically, were the most high-quality sites in this area. The following site descriptions include GPS coordinates (WGS84 datum) and legal descriptions for the three areas that we compared in this study.

- (1) The wet meadow at Pleasanton, 40° 58'13.11"N, 99°04'52.14"W (the NW ¼ of the NW ¼ SEC 36, T12N, R16W), is State of Nebraska school land located north of the South Loup River on the east side of U.S. Highway 10. This site consists of ~40 Ha (100 acres) of wet meadow and is leased locally for hay and for grazing. During the 2013 growing season, the grazing intensity was increased to greater than 2 animal unit months (AUM) per acre, which negatively impacted species diversity.
- (2) The sand prairie site, 40°58'34.01"N, 98°56'04.57"W (the SE ¼ of the SE 1/4 SEC. 30, T12N, R14W), is located southwest of Ravenna, Nebraska and



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Figure 1. The approximate locations of the three study sites in northern Buffalo County, Nebraska. (Site #1 = Pleasanton Meadow; Site #2 = Ravenna Sand Prairie; Site #3 = Ravenna Wetland)

consists of 65 Ha (160 Ac) of rolling uplands bordered on the west by an abandoned river channel and wetland. The sand prairie is grazed from May - August. We sampled this site ecologically during the 2011 growing season.

(3) The wetland/oxbow sites (~40 Ha; 100 Ac) are located S and SW of Ravenna, Nebraska, 41°00'19.32"N, 98°54'54.40"W (the N ½ of the NW

¼ SEC. 31, T12N, R14W) and southeast of Ravenna on the south side of the bridge, 41°02'01.78"N, 98°52'27.88"W (the NW ¼ of the SW ¼ SEC 5, T12N, R13W). Plant collections were made in wetlands adjacent to the sand prairie and in an abandoned river channel that borders the river on the south side. Important collections were made, but this area was not sampled ecologically.

Methods

We sampled the three contrasting sites from 2006-2012. The south Ravenna wetland (Site #3) was not sampled ecologically but contributed important plant collections to the study. Both grassland sites (Sites #1 and #2) were sampled ecologically and compared. We quantitatively sampled the Pleasanton meadow (Site #1) and the Ravenna sand prairie site (Site #2) using $10 \times 10 \text{ m}^2$ (1075.8-ft^2) random plots that were strategically positioned throughout each site. The Pleasanton meadow was sampled during the 2006 and the 2012 growing seasons, while the Ravenna sand prairie survey was completed in 2011. We measured and established the $10 \times 10 \text{ m}^2$ temporary plots using pre-measured cord, a Lietz-Eslon® fiberglass metric tape, and surveyor's flags. Within each plot, plant species cover was estimated using a modified Daubenmire cover-abundance scale (Class 7: 95-100%, Class 6: 75-95%, Class 5: 50-75%, Class 4: 25-50%, Class 3: 5-25%, Class 2: 1-5%, Class 1: <1%) (Mueller-Dombois and Ellenberg 1975). All plant species were documented and individually given a cover-abundance rating. We sampled a total of 16 plots at the Pleasanton Meadow site (8 in 2006; 8 in 2012) and 14 plots at the Ravenna sand prairie. To represent adequately both cool and warm-season plants in our survey, we completed half of our samples during the early part of the growing season (May-early June) and the other half during the late season (July-August).

We further documented specific plant species by placing 20 random quadrats along systematic transects within each of these plots. The quadrats each measured 0.1 m^2 (1.08 ft^2). Within each of these quadrats, forbs were counted and percentage of cover by species was estimated for both forbs and graminoids. From these data, we calculated density, relative density, frequency, relative frequency, and average percent cover. Importance values were calculated by adding the relative density, relative frequency, and relative cover for each forb species.

All 3 sites (Sites #1, #2, and #3) were extensively covered by ground reconnaissance and plant collections were made. We collected, pressed, and dried voucher specimens and deposited them in the University of Nebraska at Kearney Herbarium (NEBK). We tabulated plant species taxonomically by phylum, class, family, genus, and species (Table 1) and compiled all documented species to create a vascular plants checklist (Appendix 1). Plant nomenclature followed the *Flora of Nebraska*, Second Edition (Kaul et al. 2011) except in a few cases. We used the most acceptable common name available for species that lacked common names in the *Flora of Nebraska*. Field guides by Farrar (2011) and Johnson and Larson (1999) were also used to help facilitate plant identification. We utilized suggested standards for reporting floristic data (Palmer et al. 1995) whenever

possible. A coefficient of conservatism was assigned to each native species (Swink and Wilhelm 1994), using C-values for Nebraska as determined by Rolfsmeier and Steinauer (2003). Low C-values are assigned to plants that are adapted to a diversity of habitats, including over-grazed or disturbed sites. Higher C-values are indicative of plant species that are limited to a narrow range of environmental conditions and are sensitive to disturbance. We calculated mean C-values (C_m) and floristic quality indices separately for each site. To determine floristic quality index we used the formula $FQI = C_m \sqrt{n}$, where n equals the number of native plants at a given site. Floristic quality index of an area reflects its richness in native species and can be used to make comparisons among natural areas (Swink and Wilhelm 1994). For example, natural wetlands in North Dakota had FQIs that ranged from 8.3 to 33.8 with mean C-values from 3.4 to 4.7 (Mushet et al. 2002). Generally, sites with mean C values > 4.0 are often floristically important and should be designated as critical habitat worthy of easement or protection (Mushet et al. 2002).

Soil samples were taken in triplicate to a depth of 20 cm from 16 locations in the Pleasanton Meadow and 14 locations in the Ravenna sand prairie meadow using a step tube-type sampler (Forestry Suppliers Inc.® Jackson, Mississippi, USA). We air-dried these samples in the lab for a minimum of 28 days and then sent them to Ward Laboratories, Kearney, Nebraska, for analysis. Percent organic matter, pH, and macronutrient (NPK) content were determined. The Buffalo County soil survey (Buller et al. 1974) was consulted to determine the soil types of the three study sites.

Results and Discussion

We documented 328 plant species on the three sites combined; 276 species (84.1%) were native (Table 1) and 11 were new county records (Appendix 1). This compares closely to studies in Nance County (244 species; 81.1% native) by Flynn and Rothenberger (2014) and Sherman County (281 species; 88.5% native) by Rothenberger et al. (2010). Of the total plant species in our study, 324 (98.8%) are in the Phylum Magnoliophyta (Table 1). The exceptions are red cedar (*Juniperus virginiana*, Phylum Coniferophyta) and the three scouring rushes (*Equisetum arvense*, *E. hyemale*, and *E. laevigatum*, Phylum Equisetophyta). We recorded a low number of exotics (52; 15.9%), which was consistent with other research results in the Loup River Valley (Nagel and Rothenberger 1998, Gutzmer and Kaul 2008, Veloso and Rothenberger 2008, Rothenberger et al. 2010). Despite the high overall plant diversity of our study, we expected a low number of county records. Because of numerous botanical studies by the University of Nebraska at Kearney and other agencies (the National Audubon

Table 1. Plant species data for the study arranged by Phylum, Class, Family, and Genus.

| | Families | Genera | Species | | |
|---------------|----------|--------|---------|--------|-------|
| | | | Native | Exotic | Total |
| Coniferophyta | 1 | 1 | 1 | 0 | 1 |
| Equisetophyta | 1 | 1 | 3 | 0 | 3 |
| Magnoliophyta | | | | | |
| Liliopsida | 8 | 54 | 96 | 19 | 115 |
| Magnoliopsida | 53 | 139 | 176 | 33 | 209 |
| Total | 63 | 195 | 276 | 52 | 328 |

Society, the Nature Conservancy, the U.S. Fish and Wildlife Service), Buffalo County has been collected extensively for approximately 50 years.

Ecologically, we compared the species composition of the Pleasanton meadow (Site #1) to the plants sampled at the Ravenna sand prairie (Site #2) and discovered some distinct differences (Tables 2 and 3). Based on Importance Values, the dominant forbs/nongraminoids at Pleasanton meadow (Table 2) are scouring rush, (*E. laevigatum*), Illinois bundleflower (*Desmanthus illinoensis*), willow-leaf aster (*Aster praealtus*), fogfruit (*Lippia lanceolata*), and dogbane (*Apocynum cannabinum*). At the Ravenna sand prairie (Table 3), the dominant early season nongraminoid plants were western ragweed (*Ambrosia psilostachya*), horseweed (*Conyza*

canadensis), and Missouri goldenrod (*Solidago missouriensis*). The late season sampling (Table 3), dominated by little prickly pear (*Opuntia fragilis*), western ragweed (*Ambrosia psilostachya*), field pussy toes (*Antennaria neglecta*), and hoary vervain (*Verbena stricta*), clearly demonstrated the effects of grazing. These species are typically found in grazed pastures with sandy soil (Kaul 1989, Peyton, 2011). We also compared dominant graminoids at the two sites based on average percent cover using Daubenmire Cover Classes. Graminoid species common in moist soil were prevalent in Pleasanton meadow, including common three square (*Schoenoplectus pungens*), clustered field sedge (*Carex praegracilis*), spike sedge (*Eleocharis palustris*), Crawe’s sedge (*Carex craweii*), and inland rush (*Juncus interior*) (Table 4). The introduced grasses,

Table 2. Importance Values (Relative Density + Relative Frequency + Relative Cover) for early and late season nongraminoid plant species sampled at Site #1, Pleasanton Meadow.

| Species (Early Season) | Common Name | Importance Value | Species (Late Season) | Common Name | Importance Value |
|-------------------------------|-----------------------|------------------|--------------------------------|-----------------------|------------------|
| <i>Equisetum laevigatum</i> | scouring rush | 63.24 | <i>Desmanthus illinoensis</i> | Illinois bundleflower | 60.72 |
| <i>Lippia lanceolata</i> | fogfruit | 51.58 | <i>Ambrosia psilostachya</i> | western ragweed | 46.00 |
| <i>Desmanthus illinoensis</i> | Illinois bundleflower | 49.98 | <i>Equisetum laevigatum</i> | scouring rush | 33.76 |
| <i>Apocynum cannabinum</i> | dogbane | 36.06 | <i>Aster praealtus</i> | willowleaf aster | 33.70 |
| <i>Aster praealtus</i> | willowleaf aster | 17.42 | <i>Apocynum cannabinum</i> | dogbane | 33.56 |
| <i>Callirhoe involucrata</i> | purple poppy mallow | 14.16 | <i>Lippia lanceolata</i> | fogfruit | 27.28 |
| <i>Glycyrrhiza lepidota</i> | wild licorice | 12.57 | <i>Lobelia siphilitica</i> | blue lobelia | 12.65 |
| <i>Ulmus pumila</i> | Siberian elm | 11.30 | <i>Vernonia baldwinii</i> | ironweed | 11.19 |
| <i>Sisyrinchium montanum</i> | blue eyed grass | 9.11 | <i>Solidago canadensis</i> | Canada goldenrod | 8.60 |
| <i>Trifolium repens</i> | white clover | 7.26 | <i>Glycyrrhiza lepidota</i> | wild licorice | 5.98 |
| <i>Vernonia baldwinii</i> | ironweed | 5.86 | <i>Eustoma grandiflorum</i> | prairie gentian | 5.45 |
| <i>Eustoma grandiflorum</i> | prairie gentian | 5.61 | <i>Euphorbia marginata</i> | snow-on-the-mountain | 3.91 |
| <i>Medicago lupulina</i> | black medic | 4.01 | <i>Solidago gigantea</i> | giant goldenrod | 2.42 |
| <i>Gaura parviflora</i> | velvetweed | 3.59 | <i>Ranunculus cymbalaria</i> | shore buttercup | 2.41 |
| <i>Fraxinus pennsylvanica</i> | green ash | 1.46 | <i>Medicago lupulina</i> | black medic | 2.17 |
| <i>Viola pedatifida</i> | prairie violet | 1.36 | <i>Asclepias sullivantii</i> | Sullivant’s milkweed | 2.16 |
| <i>Solidago canadensis</i> | Canada goldenrod | 0.98 | <i>Callirhoe involucrata</i> | purple poppy mallow | 1.85 |
| <i>Trifolium pratense</i> | red clover | 0.86 | <i>Verbena hastata</i> | blue verbena | 1.85 |
| <i>Plantago rugelii</i> | Rugel’s plantain | 0.86 | <i>Ulmus pumila</i> | Siberian elm | 1.48 |
| <i>Asclepias verticillata</i> | whorled milkweed | 0.73 | <i>Fraxinus pennsylvanica</i> | green ash | 1.14 |
| <i>Nothocalais cuspidata</i> | false dandelion | 0.73 | <i>Aster ericoides</i> | heath aster | 0.57 |
| <i>Ranunculus cymbalaria</i> | shore buttercup | 0.73 | <i>Lactuca serriola</i> | prickly lettuce | 0.57 |
| <i>Lycopus asper</i> | rough bugleweed | 0.61 | <i>Ambrosia artemisiifolia</i> | common ragweed | 0.54 |

Table 3. Importance Values (Relative Density + Relative Frequency + Relative Cover) for early and late season nongraminoid plant species sampled at Site #2, Ravenna Sand Prairie.

| Early Season Species | Common Name | Importance Value | Late Season Species | Common Name | Importance Value |
|---|-----------------------|------------------|---------------------------------|--------------------------|------------------|
| <i>Ambrosia psilostachya</i> | western ragweed | 98.70 | <i>Opuntia fragilis</i> | little prickly pear | 92.45 |
| <i>Conyza canadensis</i> | horseweed | 98.30 | <i>Ambrosia psilostachya</i> | western ragweed | 83.20 |
| <i>Solidago missouriensis</i> | Missouri goldenrod | 59.00 | <i>Antennaria neglecta</i> | field pussytoes | 50.45 |
| <i>Symphoricarpos occidentalis</i> | western snowberry | 52.80 | <i>Verbena stricta</i> | hoary vervain | 35.64 |
| <i>Antennaria neglecta</i> | field pussytoes | 50.60 | <i>Dalea villosa</i> | silky prairie clover | 33.80 |
| <i>Opuntia fragilis</i> | little prickly pear | 39.58 | <i>Phemeranthus parviflorus</i> | prairie fameflower | 29.80 |
| <i>Verbena stricta</i> | hoary vervain | 38.70 | <i>Callirhoe involucrata</i> | purple poppy mallow | 22.35 |
| <i>Callirhoe involucrata</i> | purple poppy mallow | 35.34 | <i>Artemisia ludoviciana</i> | white sage | 20.30 |
| <i>Plantago patagonica</i> | Patagonian plantain | 34.90 | <i>Asclepias pumila</i> | plains milkweed | 16.30 |
| <i>Artemisia ludoviciana</i> | white sage | 28.58 | <i>Euphorbia glyptosperma</i> | ridge-seed spurge | 15.71 |
| <i>Equisetum arvense</i> | field horsetail | 19.90 | <i>Eriogonum annuum</i> | annual eriogonum | 15.30 |
| <i>Lithospermum incisum</i> | fringed puccoon | 12.67 | <i>Croton texensis</i> | Texas croton | 15.02 |
| <i>Dalea candida</i> | white prairie clover | 12.40 | <i>Psoraleidium lanceolatum</i> | lemon scurfpea | 12.95 |
| <i>Onosmodium molle</i> | western marbleseed | 12.10 | <i>Lithospermum incisum</i> | fringed puccoon | 12.32 |
| <i>Physalis heterophylla</i> | clammy ground cherry | 12.05 | <i>Liatris glabrata</i> | scaly blazingstar | 9.65 |
| <i>Cirsium undulatum</i> | wavy-leaf thistle | 10.50 | <i>Strophostyles leiosperma</i> | slick-seed bean | 9.27 |
| <i>Lepidium densiflorum</i> | peppergrass | 10.40 | <i>Linum sulcatum</i> | grooved flax | 8.50 |
| <i>Oxalis stricta</i> | yellow wood sorrel | 10.23 | <i>Physalis heterophylla</i> | clammy ground cherry | 8.50 |
| <i>Delphinium carolinianum</i> <i>ssp. virescens</i> | Carolina larkspur | 9.60 | <i>Conyza canadensis</i> | horseweed | 6.75 |
| <i>Senecio plattensis</i> | prairie ragwort | 8.20 | <i>Coryphantha vivipara</i> | purple pincushion cactus | 5.40 |
| <i>Eriogonum annuum</i> | annual eriogonum | 7.85 | <i>Oxalis stricta</i> | yellow wood sorrel | 5.35 |
| <i>Opuntia humifusa</i> | plains prickly pear | 7.70 | <i>Dalea purpurea</i> | purple prairie clover | 4.84 |
| <i>Xanthisma spinulosa</i> | spiny ironplant | 7.10 | <i>Juniperus virginiana</i> | red cedar | 3.95 |
| <i>Ratibida columnifera</i> | prairie coneflower | 5.85 | <i>Solidago missouriensis</i> | Missouri goldenrod | 3.90 |
| <i>Cannabis sativa</i> | marijuana | 4.90 | | | |
| <i>Penstemon grandiflorus</i> | large beardtongue | 4.85 | | | |
| <i>Potentilla pensylvanica</i> | cinquefoil | 4.50 | | | |
| <i>Pediomelum digitatum</i> | palm-leaved scurf pea | 3.80 | | | |
| <i>Dalea purpurea</i> | purple prairie clover | 3.10 | | | |

quackgrass (*Elymus repens*), redtop (*Agrostis stolonifera*), and Kentucky bluegrass (*Poa pratensis*) were also frequently encountered in our quadrat samples. A surprising result of the 2012 Pleasanton survey was the absence of fimbry (*Fimbristylis puberula* var. *interior*). We sampled and commonly collected this sedge from 2006-2010, but this species was conspicuously missing in 2012. Perhaps this was the result of drought, overgrazing, or the two factors combined. The extreme drought conditions of 2012 likely impacted the species composition of area plant communities, from wooded sites to lowland meadows (Gibbson and Hulbert 1987, Granger 2013).

From the survey of the Ravenna sand prairie, we listed the dominant graminoids (based on average percent cover) as sun sedge (*Carex heliophila*), Kentucky bluegrass (*Poa pratensis*), blue grama (*Bouteloua gracilis*), Scribner's panicum (*Panicum oligosanthos* var. *scribnerianum*), and Japanese brome (*Bromus japonicus*) respectively (Table 4). Kentucky bluegrass was one of the few dominant graminoid species that was common to

both the Ravenna and Pleasanton survey sites. Because the sites were not all sampled during the same growing season, some species differences must be attributed to seasonal variation in precipitation, temperature, and humidity. However, the sites still provided contrasting plant communities that were the major source of the diversity we encountered.

The oxbow/wetlands (Site #3) did not contain high species numbers (68 total, 2 exotics), but we made some significant collections here. These included plant species not present on Sites #1 and #2, such as river bulrush (*Bolboshoenus fluviatilis*), bristly sedge (*Carex comosa*), shoreline sedge (*Carex hyalinolepis*), ripgut sedge (*Carex lacustris*), needle spikerush (*Eleocharis acicularis*), and broad-leaf cattail (*Typha latifolia*). We also documented the following forbs that were not collected on the other sites, including clasping leaf boneset (*Eupatorium perfoliatum*), tufted loosestrife (*Lysimachia thyriflora*), field mint (*Mentha arvensis*), and wild bergamont (*Monarda fistulosa*).

Table 4. Average cumulative percent cover for graminoids (including *Equisetum*) sampled at Site # 1 (Pleasanton Meadow) and Site #2 (Ravenna Sand Prairie).

| Pleasanton Meadow | | | Ravenna Sand Prairie | | |
|----------------------------------|----------------------|-----------------|-----------------------------|--------------------------|-----------------|
| Scientific Name | Common Name | Average % Cover | Scientific Name | Common Name | Average % Cover |
| <i>Schoenoplectus pungens</i> | Common threesquare | 12.69 | <i>Carex heliophila</i> | sun sedge | 11.29 |
| <i>Equisetum laevigatum</i> | scouring rush | 9.44 | <i>Poa pratensis</i> | Kentucky bluegrass | 8.75 |
| <i>Carex praegracilis</i> | clustered fieldsedge | 5.88 | <i>Bouteloua gracilis</i> | blue grama | 7.38 |
| <i>Elymus repens</i> | quackgrass | 4.75 | <i>Panicum oligosanthos</i> | Scribner's panic grass | 5.18 |
| <i>Agrostis stolonifera</i> | redtop | 3.88 | <i>var. scribnerianum</i> | | |
| <i>Poa pratensis</i> | Kentucky bluegrass | 2.69 | <i>Bromus japonicus</i> | Japanese brome | 4.13 |
| <i>Eleocharis palustris</i> | spike sedge | 1.13 | <i>Carex brevior</i> | fescue sedge | 3.47 |
| <i>Carex craweii</i> | Crawe's sedge | 1.00 | <i>Koeleria macrantha</i> | Junegrass | 3.03 |
| <i>Andropogon gerardii</i> | big bluestem | 0.88 | <i>Stipa comata</i> | needle-and-thread | 2.25 |
| <i>Juncus interior</i> | inland rush | 0.81 | <i>Hordeum pusillum</i> | little barley | 1.53 |
| <i>Hordeum jubatum</i> | foxtail barley | 0.81 | <i>Buchloe dactyloides</i> | Buffalo grass | 1.38 |
| <i>Juncus balticus</i> | Baltic rush | 0.69 | <i>Bromus tectorum</i> | downy brome | 1.25 |
| <i>Panicum virgatum</i> | switchgrass | 0.50 | <i>Carex gravida</i> | heavy sedge | 0.25 |
| <i>Carex parryana var. unica</i> | Hall's sedge | 0.38 | <i>Juncus balticus</i> | Baltic rush | 0.20 |
| <i>Carex pellita</i> | wooley sedge | 0.26 | <i>Panicum ovale</i> | Stiff-leaved panic grass | 0.10 |
| | | | <i>var. praecocious</i> | | |

Geographically, the three sites are not widely separated (Figure 1), but differ mainly in elevation, soil texture, and available moisture. When comparing average soil nutrient/chemical values between Pleasanton meadow and the sand prairie, we discovered large differences in soil pH, organic matter (%), nitrate nitrogen (ppm), and potassium (ppm) (Table 5). Average phosphorous values (ppm) were similar at both sites. We expected differences in soil factors because of the low elevation of the Pleasanton meadow in proximity to the South Loup River. This meadow tends to be poorly drained and accumulates small amounts of standing water during years when precipitation is normal or above. The hilly grass-covered dunes of the sand prairie tend to be well-drained and support grassland species common to sandy sites in central Nebraska (Appendix 1).

The Pleasanton meadow is bordered on the north and south by stands of woody vegetation that add to the species diversity of this site. Examples of woody plants that we collected there were rough-leaf dogwood (*Cornus drummondii*), sand cherry (*Prunus pumila var. besseyi*), American elm (*Ulmus americana*), plains cottonwood (*Populus deltoides*), peach-leaf willow (*Salix amygdaloides*) and Osage orange (*Maclura pomifera*). Woody

plants were generally absent from the upland sand prairie, but at the base of several hills we documented small clusters of northern catalpa (*Catalpa speciosa*) and green ash (*Fraxinus pennsylvanica*) that formed savanna-like patches. These trees were possibly planted to provide shade for livestock, or they could have escaped from a nearby farmstead.

The plant communities we studied along the South Loup River represent considerably high plant diversity for Central Nebraska. Our species total of 328 plant species is approximately 16% of Nebraska's reported total flora (Kaul et al. 2011) and includes 276 (84.1%) native species. Although we did not collect or observe plant species classified as threatened or endangered, we documented examples of rare plants with high C values (≥ 7) including shoreline sedge, bulbous water hemlock (*Cicuta bulbifera*), scrambling marsh bedstraw (*Galium trifidum*), tufted loosestrife, and stitchwort (*Stellaria longifolia*). Also, several species are at the west edge of their range in Buffalo County, such as Sullivant's milkweed, shoreline sedge, smoothcone sedge, and three-seeded mercury. The lowland meadows, oxbows, and overflow areas along the river provide potential habitat that supports this diversity and botanical variety. These studies

Table 5. A comparison of mean soil nutrient/chemical values obtained from the Pleasanton Meadow and the Ravenna Sand Prairie sites.

| Site | Soil pH | Organic Matter (%) | Nitrate-Nitrogen (ppm) | Phosphorus (ppm) | Potassium (ppm) |
|----------------------|---------|--------------------|------------------------|------------------|-----------------|
| Pleasanton Meadow | 8.63 | 4.50 | 1.6 | 19.1 | 631.7 |
| Ravenna Sand Prairie | 7.10 | 2.54 | 4.2 | 15.5 | 246.5 |

reinforce the value and plant species richness of the South Loup River Valley and suggest that additional botanical exploration of the backwater and meadow areas near the river is highly recommended.

Acknowledgments

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Appendix 1. An annotated list of each species collected at three Buffalo County sites during the 2010-2012 growing seasons containing scientific name (alphabetized), common name, Coefficient of Conservatism (C) and site of occurrence: Pleasanton Meadow; Ravenna sand prairie; Ravenna wetlands. An asterisk (*) in the C value column indicates a non-native species. An asterisk (*) after the scientific name indicates a new Buffalo County record. Nomenclature follows Kaul et al. (2011) with several exceptions.

| Scientific Name | Common Name | C | Pleasanton Meadow | Ravenna Sand Prairie | Ravenna Wetlands |
|---|------------------------|---|-------------------|----------------------|------------------|
| <i>Acalypha rhomboidea</i> | three-seeded mercury | 0 | X | | |
| <i>Achillea millefolium</i> | common yarrow | 2 | X | X | |
| <i>Aegilops cylindrica</i> | jointed goatgrass | * | | X | |
| <i>Agrimonia gryposepala</i> | tall hairy agrimony | 5 | | X | |
| <i>Agrostis stolonifera</i> | redtop | * | X | X | X |
| <i>Alisma triviale</i> | water-plantain | 4 | X | | X |
| <i>Allium canadense</i> var. <i>canadense</i> | meadow garlic | 3 | X | | |
| <i>Alopecurus aequalis</i> | short-awn foxtail | 6 | | X | |
| <i>Ambrosia artemisiifolia</i> | common ragweed | 0 | X | | |
| <i>Ambrosia psilostachya</i> | western ragweed | 1 | X | X | |
| <i>Ambrosia trifida</i> | giant ragweed | 0 | X | | |
| <i>Amorpha canescens</i> | leadplant | 6 | X | | |
| <i>Amorpha fruticosa</i> | false indigo bush | 5 | X | | |
| <i>Andropogon gerardii</i> | big bluestem | 5 | X | | |
| <i>Anemone canadensis</i> | meadow anemone | 4 | X | | |
| <i>Anemone cylindrica</i> | candle anemone | 4 | X | | |
| <i>Antennaria neglecta</i> | field pussytoes | 3 | X | X | X |
| <i>Apocynum cannabinum</i> | Indian hemp dogbane | 2 | X | | |
| <i>Aristida oligantha</i> | prairie three awn | 3 | X | | |
| <i>Artemisia ludoviciana</i> | white sage | 4 | X | X | |
| <i>Asclepias incarnata</i> | swamp milkweed | 4 | X | | |
| <i>Asclepias pumila</i> | dwarf milkweed | 4 | | X | |
| <i>Asclepias speciosa</i> | showy milkweed | 1 | X | | |
| <i>Asclepias sullivantii</i> | smooth milkweed | 7 | X | | |
| <i>Asclepias syriaca</i> | common milkweed | 1 | X | | |
| <i>Asclepias verticillata</i> | whorled milkweed | 3 | X | | |
| <i>Asparagus officinalis</i> | garden asparagus | * | X | | |
| <i>Aster (Symphyotrichum) ericoides</i> | heath aster | 3 | X | | |
| <i>Aster (Symphyotrichum) praealtus</i> * | willowleaf aster | 5 | X | | |
| <i>Astragalus crassicaarpus</i> | ground-plum | 7 | | X | |
| <i>Berula erecta</i> var. <i>incisum</i> | cutleaf water-parsnip | 6 | X | | |
| <i>Bidens frondosa</i> | devil's pitchfork | 1 | X | | |
| <i>Bidens connata</i> | beggar-ticks | 4 | X | | |
| <i>Boehmeria cylindrica</i> | false nettle | 6 | X | | |
| <i>Bolboschoenus fluviatilis</i> | river bulrush | 3 | | | X |
| <i>Bouteloua curtipendula</i> | side-oats grama | 5 | X | X | |
| <i>Bouteloua gracilis</i> | blue grama | 4 | X | X | |
| <i>Bouteloua hirsuta</i> | hairy grama | 6 | | X | |
| <i>Bromus inermis</i> | smooth brome | * | X | | |
| <i>Bromus japonicus</i> | Japanese brome | * | X | X | |
| <i>Bromus tectorum</i> | downy brome | * | | X | |
| <i>Buchloe dactyloides</i> | buffalo grass | 2 | | X | |
| <i>Calamagrostis canadensis</i> | bluejoint grass | 6 | X | | |
| <i>Calamagrostis stricta</i> | northern reedgrass | 6 | | | X |
| <i>Calamovilfa longifolia</i> | prairie sandreed | 5 | X | X | |
| <i>Callirhoë alcaeoides</i> | pink poppy-mallow | 5 | X | | |
| <i>Callirhoë involucrata</i> | purple poppy-mallow | 2 | X | X | |
| <i>Calylophus serrulatus</i> | plains yellow primrose | 5 | X | | |
| <i>Calystegia sepium</i> subsp. <i>angulata</i> | hedge bindweed | 1 | X | | |
| <i>Cannabis sativa</i> | hemp | * | | X | |
| <i>Carex blanda</i> | woodland sedge | 2 | X | | X |
| <i>Carex brevior</i> | short-beak sedge | 4 | X | X | |

Appendix 1. Continued

| Scientific Name | Common Name | C | Pleasanton Meadow | Ravenna Sand Prairie | Ravenna Wetlands |
|--|--------------------------|---|-------------------|----------------------|------------------|
| <i>Carex comosa</i> | bristly sedge | 5 | | | X |
| <i>Carex crawei</i> | Crawe's sedge | 6 | X | | X |
| <i>Carex cristatella</i> | crested sedge | 5 | X | | X |
| <i>Carex emoryi</i> | Emory's sedge | 5 | X | | X |
| <i>Carex granularis</i> var. <i>haleana</i> | Hale's meadow sedge | 6 | | | X |
| <i>Carex gravida</i> | heavy-fruit sedge | 4 | X | X | X |
| <i>Carex heliophila</i> | sun sedge | 5 | | X | |
| <i>Carex hyalinolepis</i> | shoreline sedge | 7 | | | X |
| <i>Carex lacustris</i> * | ripgut sedge | 6 | | | X |
| <i>Carex laeviconica</i> | smoothcone sedge | 4 | X | | X |
| <i>Carex parryana</i> var. <i>unica</i> | deer sedge | 7 | X | | |
| <i>Carex pellita</i> | wooly sedge | 4 | X | | X |
| <i>Carex praegracilis</i> | clustered field sedge | 4 | X | | X |
| <i>Carex sartwellii</i> * | Sartwell's sedge | 6 | X | | |
| <i>Carex scoparia</i> | broom sedge | 5 | X | | X |
| <i>Carex stipata</i> | sawbeak sedge | 5 | | | X |
| <i>Carex tetanica</i> | rigid sedge | 7 | X | | X |
| <i>Carex vulpinoidea</i> | fox sedge | 4 | X | | X |
| <i>Catalpa speciosa</i> | northern catalpa | * | | X | |
| <i>Celastrus scandens</i> * | bittersweet | 4 | X | | |
| <i>Chenopodium album</i> | lamb's quarters | * | X | | |
| <i>Chloris verticillata</i> | tumble windmill grass | 0 | X | X | |
| <i>Cicuta bulbifera</i> * | bulbous water hemlock | 7 | X | | |
| <i>Cicuta maculata</i> | common water hemlock | 5 | X | | X |
| <i>Cirsium altissimum</i> | tall thistle | 1 | X | | |
| <i>Cirsium flodmanii</i> | Flodman's thistle | 4 | X | | |
| <i>Cirsium undulatum</i> | wavy-leaf thistle | 4 | X | X | |
| <i>Cirsium vulgare</i> | bull thistle | * | X | | |
| <i>Conium maculatum</i> | poison hemlock | * | X | | |
| <i>Convolvulus arvensis</i> | field bindweed | * | X | | |
| <i>Conyza canadensis</i> | horseweed | 0 | X | X | |
| <i>Coreopsis tinctoria</i> | plains coreopsis | 1 | X | | |
| <i>Cornus drummondii</i> | rough-leaf dogwood | 3 | X | | |
| <i>Coryphantha vivipara</i> * | purple pincushion cactus | 6 | | X | |
| <i>Crepis runcinata</i> | dandelion hawk's-beard | 5 | X | | |
| <i>Croton texensis</i> | Texas croton | 1 | X | X | |
| <i>Cyperus lupulinus</i> subsp. <i>lupulinus</i> | Great Plains flat-sedge | 1 | X | X | |
| <i>Cyperus odoratus</i> | rusty flatsedge | 3 | X | | |
| <i>Cyperus schweinitzii</i> | sand flatsedge | 4 | X | X | |
| <i>Cyperus squarrosus</i> | awned flatsedge | 2 | X | | |
| <i>Cyperus strigosus</i> | strawcolored flatsedge | 4 | | X | X |
| <i>Dalea candida</i> | white prairie clover | 6 | X | | |
| <i>Dalea purpurea</i> | purple prairie clover | 6 | X | X | |
| <i>Dalea villosa</i> | silky prairie clover | 5 | | X | |
| <i>Delphinium. virescens</i> | prairie larkspur | 6 | | X | |
| <i>Descurainia sophia</i> | flix-weed | * | X | | |
| <i>Desmanthus illinoensis</i> | Illinois bundleflower | 5 | X | | |
| <i>Desmodium canadense</i> | Canada tickclover | 5 | X | X | |
| <i>Digitaria cognata</i> | fall witchgrass | 4 | X | X | |
| <i>Echinacea angustifolia</i> | purple coneflower | 5 | X | | |
| <i>Eleocharis acicularis</i> | needle spikerush | 4 | | | X |
| <i>Eleocharis elliptica</i> | bog spikerush | 7 | X | | |
| <i>Eleocharis erythropoda</i> | red-stem bald spikerush | 5 | X | | |
| <i>Eleocharis palustris</i> | common spikerush | 4 | X | | X |
| <i>Eleusine indica</i> | goosegrass | * | X | | |

Appendix 1. Continued

| Scientific Name | Common Name | C | Pleasanton Meadow | Ravenna Sand Prairie | Ravenna Wetlands |
|--|----------------------------|---|-------------------|----------------------|------------------|
| <i>Ellisia nyctelea</i> | waterpod | 0 | | | X |
| <i>xElyhordeum macounii*</i> | Macoun's hybrid wheatgrass | 4 | X | | |
| <i>Elymus canadensis</i> | Canadian wildrye | 5 | X | | |
| <i>Elymus hispidus</i> | intermediate wheatgrass | * | X | | |
| <i>Elymus repens</i> | quackgrass | * | X | | |
| <i>Elymus smithii</i> | western wheatgrass | 3 | X | | |
| <i>Elymus trachycaulus ssp. trachycaulus</i> | slender wheatgrass | 5 | X | | |
| <i>Epilobium coloratum</i> | purple-leaved willow-herb | 5 | X | | |
| <i>Equisetum arvense</i> | field horsetail | 4 | X | X | X |
| <i>Equisetum hyemale</i> | common scouring rush | 4 | X | | X |
| <i>Equisetum laevigatum</i> | smooth scouring-rush | 4 | X | | |
| <i>Eragrostis cilianensis</i> | stinkgrass | * | X | | |
| <i>Eragrostis hypnoides</i> | teal lovegrass | 5 | X | | |
| <i>Eragrostis pectinacea</i> | tufted lovegrass | 0 | X | | |
| <i>Eragrostis spectabilis</i> | purple lovegrass | 3 | X | X | |
| <i>Erigeron philadelphicus</i> | marsh fleabane | 3 | X | | |
| <i>Erigeron strigosus</i> | daisy fleabane | 2 | X | | |
| <i>Eriogonum annuum</i> | annual buckwheat | 3 | X | X | |
| <i>Erysimum asperum</i> | western wallflower | 4 | | X | |
| <i>Eupatorium perfoliatum</i> | clasping leaf boneset | 5 | | | X |
| <i>Eupatorium purpureum</i> | sweet joe-pye weed | 7 | X | | |
| <i>Euphorbia davidii</i> | toothed spurge | 0 | X | | |
| <i>Euphorbia esula</i> | leafy spurge | * | | X | |
| <i>Euphorbia glyptosperma</i> | ridge-seed spurge | 0 | X | X | |
| <i>Euphorbia hexagona</i> | six-angle spurge | 1 | | X | |
| <i>Euphorbia marginata</i> | snow-on-the-mountain | 0 | X | X | |
| <i>Eustoma grandiflorum</i> | prairie gentian | 4 | X | | |
| <i>Fimbristylis puberula var. interior</i> | hairy fimbry | 7 | X | | |
| <i>Fraxinus pennsylvanica</i> | green ash | 2 | X | | X |
| <i>Froelichia gracilis</i> | slender snake-cotton | 3 | | X | |
| <i>Galium aparine</i> | catchweed bedstraw | 0 | X | | |
| <i>Galium trifidum</i> | scrambling marsh bedstraw | 8 | X | | X |
| <i>Galium triflorum</i> | sweet-scented bedstraw | 4 | X | | |
| <i>Geum canadense</i> | white avens | 3 | X | | X |
| <i>Gleditsia triacanthos</i> | honey-locust | 1 | | X | |
| <i>Glyceria grandis</i> | tall manna-grass | 7 | | | X |
| <i>Glyceria striata</i> | fowl manna-grass | 5 | X | | |
| <i>Glycyrrhiza lepidota</i> | wild licorice | 4 | X | | |
| <i>Gnaphalium obtusifolium</i> | fragrant cudweed | 3 | | X | |
| <i>Grindelia squarrosa</i> | curly cup gumweed | 1 | | X | |
| <i>Hedeoma hispida</i> | rough false pennyroyal | 2 | X | | |
| <i>Helianthus annuus</i> | common sunflower | 0 | X | | |
| <i>Helianthus grosse-serratus</i> | sawtooth sunflower | 4 | X | | X |
| <i>Helianthus maximiliani</i> | Maximilian sunflower | 4 | X | | |
| <i>Helianthus petiolaris</i> | plains sunflower | 1 | X | | |
| <i>Hesperis matronalis</i> | dame's-rocket | * | X | | |
| <i>Hordeum jubatum</i> | foxtail barley | 1 | X | | |
| <i>Hordeum pusillum</i> | little barley | 1 | X | X | |
| <i>Hypericum perforatum</i> | common St. John's wort | * | X | | |
| <i>Hypoxis hirsuta</i> | yellow star-grass | 7 | X | | |
| <i>Impatiens capensis</i> | spotted touch-me-not; | 4 | X | | X |
| <i>Iva annua</i> | annual marsh-elder | 1 | X | | |
| <i>Iva xanthifolia</i> | big marsh-elder | 0 | X | | |
| <i>Juncus balticus</i> | Baltic rush | 6 | X | X | |
| <i>Juncus dudleyi</i> | Dudley rush | 5 | X | | X |

Appendix 1. Continued

| Scientific Name | Common Name | C | Pleasanton Meadow | Ravenna Sand Prairie | Ravenna Wetlands |
|---|-----------------------------|---|-------------------|----------------------|------------------|
| <i>Juncus interior</i> | inland rush | 4 | X | | |
| <i>Juncus nodosus</i> | knotted rush | 6 | X | | |
| <i>Juncus torreyi</i> | Torrey's rush | 4 | X | | |
| <i>Juniperus virginiana</i> | eastern red-cedar | 1 | X | X | |
| <i>Koeleria macrantha</i> | Junegrass | 6 | X | X | |
| <i>Lactuca ludoviciana</i> | western wild lettuce | 3 | X | | |
| <i>Lactuca serriola</i> | prickly lettuce | * | X | | |
| <i>Leersia oryzoides</i> | rice cutgrass | 4 | X | | |
| <i>Leonurus cardiaca</i> | motherwort | * | X | | |
| <i>Lepidium densiflorum</i> | prairie peppergrass | 0 | X | X | |
| <i>Lespedeza capitata</i> | round head bush-clover | 5 | X | | |
| <i>Liatis glabrata</i> | scaly blazingstar | 5 | | X | |
| <i>Liatis lancifolia</i> | lance-leaf gayfeather | 8 | X | | |
| <i>Liatis punctata</i> | dotted gayfeather | 5 | | X | |
| <i>Lindernia dubia</i> | false pimpernel | 5 | X | | X |
| <i>Linum sulcatum</i> | grooved flax | | X | X | |
| <i>Lippia lanceolata</i> | northern fogfruit | 3 | X | | X |
| <i>Lithospermum carolinense</i> | hairy puccoon | 6 | | X | |
| <i>Lithospermum incisum</i> | fringed puccoon | 5 | X | X | |
| <i>Lobelia siphilitica</i> | great blue lobelia | 6 | X | | X |
| <i>Lobelia spicata</i> | pale-spike lobelia | 6 | X | | |
| <i>Lolium arundinaceum</i> | tall fescue | * | X | | |
| <i>Lycopus americanus</i> | American water-horehound | 4 | X | | X |
| <i>Lycopus asper</i> | western water-horehound | 5 | X | | |
| <i>Lysimachia ciliata</i> | fringed loosestrife | 5 | X | | |
| <i>Lysimachia thyrsoflora</i> | tufted loosestrife | 7 | | | X |
| <i>Lythrum alatum</i> | winged loosestrife | 6 | X | | |
| <i>Maclura pomifera</i> | Osage orange | | X | | |
| <i>Maianthemum stellatum</i> | starry false Solomon's-seal | 4 | X | | |
| <i>Medicago lupulina</i> | black medic | * | X | | |
| <i>Melilotus albus</i> | white sweet clover | * | X | | |
| <i>Melilotus officinalis</i> | yellow sweet-clover | * | X | | |
| <i>Mentha arvensis</i> | field mint | 4 | | | X |
| <i>Mimosa quadrivalvis</i> | sensitive briar | 6 | X | | |
| <i>Mimulus ringens</i> | Alleghany monkey-flower | 6 | X | | X |
| <i>Mirabilis nyctaginea</i> | wild four-o'clock | 1 | X | | |
| <i>Monarda fistulosa</i> | wild bergamot | 4 | | | X |
| <i>Morus alba</i> | white mulberry | * | X | | X |
| <i>Muhlenbergia asperifolia</i> | scratchgrass | 5 | X | | |
| <i>Muhlenbergia mexicana</i> | Mexican muhly | 4 | X | | |
| <i>Muhlenbergia racemosa</i> | marsh muhly | 4 | X | | |
| <i>Nothocalais cuspidata</i> | prairie-dandelion | 6 | X | | |
| <i>Nepeta cataria</i> | catnip | * | X | | |
| <i>Oenothera biennis</i> | eastern evening primrose | 1 | X | | |
| <i>Oenothera laciniata</i> | cut-leaf evening primrose | 1 | | X | |
| <i>Oenothera rhombipetala</i> | fourpoint evening primrose | 2 | X | X | |
| <i>Onosmodium molle</i> var. <i>occidentale</i> | false gromwell | 4 | | X | |
| <i>Opuntia fragilis</i> | little prickly-pear | 3 | X | X | |
| <i>Opuntia humifusa</i> | eastern prickly-pear | 5 | | X | |
| <i>Oxalis stricta</i> | yellow wood sorrel | 0 | X | X | |
| <i>Panicum capillare</i> | common witchgrass | 0 | X | | |
| <i>Panicum dichotomiflorum</i> | fall panicum | 0 | X | | |
| <i>Panicum oligosanthes</i> var. <i>scribnerianum</i> | Scribner's panic grass | 4 | | X | |
| <i>Panicum ovale</i> var. <i>praecocius</i> * | stiff-leaved panic grass | 6 | | X | |
| <i>Panicum virgatum</i> | switchgrass | 4 | X | X | |

Appendix 1. Continued

| Scientific Name | Common Name | C | Pleasanton Meadow | Ravenna Sand Prairie | Ravenna Wetlands |
|---|------------------------------|---|----------------------|-------------------------|---------------------|
| <i>Parietaria pensylvanica</i> | Pennsylvania pellitory | 0 | | | X |
| <i>Parthenocissus vitacea</i> | woodbine | 4 | X | | |
| <i>Paspalum setaceum</i> var. <i>stramineum</i> | yellow sand paspalum | 2 | X | X | |
| <i>Pediomelum argophyllum</i> | silver-leaf scurf-pea | 6 | X | X | |
| <i>Pediomelum digitatum</i> | palm-leaf scurf-pea | 6 | | X | |
| <i>Penstemon grandiflorus</i> | large beardtongue | 5 | X | X | |
| <i>Penthorum sedoides</i> | ditch stonecrop | 4 | X | | |
| <i>Phalaris arundinacea</i> | reed canary grass | 0 | X | | X |
| <i>Phalaris canariensis</i> | annual canary grass | * | X | | |
| <i>Phemeranthus parviflorus</i> * | prairie fame-flower | 5 | | X | |
| <i>Phleum pratense</i> | timothy grass | * | X | | |
| <i>Phragmites australis</i> | common reed | 3 | X | | |
| <i>Physalis heterophylla</i> | clammy ground-cherry | 4 | X | X | |
| <i>Physalis longifolia</i> | common ground-cherry | 0 | | X | |
| <i>Physalis virginiana</i> | Virginia ground-cherry | 6 | X | | |
| <i>Pilea pumila</i> | green fruit clearweed | 4 | X | | |
| <i>Plantago patagonica</i> | Patagonian woolly plantain | 1 | X | X | |
| <i>Plantago rugelii</i> | American black-seed plantain | 0 | X | | |
| <i>Poa compressa</i> | Canada bluegrass | * | | X | |
| <i>Poa pratensis</i> | Kentucky bluegrass | * | X | X | |
| <i>Polygonum aviculare</i> subsp. <i>depressum</i> | knotweed | * | X | | |
| <i>Polygonum coccineum</i> | scarlet smartweed | 2 | X | | |
| <i>Polygonum lapathifolium</i> | pale smartweed | 2 | X | | |
| <i>Polygonum pensylvanicum</i> | Pennsylvania smartweed | 0 | X | | |
| <i>Polygonum persicaria</i> | smartweed | * | X | | |
| <i>Polygonum punctatum</i> | water smartweed | 4 | X | | X |
| <i>Populus deltoides</i> | plains cottonwood | 3 | | | X |
| <i>Potentilla pensylvanica</i> | Pennsylvania cinquefoil | 6 | X | X | |
| <i>Potentilla recta</i> | sulphur cinquefoil | * | X | | X |
| <i>Prunella vulgaris</i> | self-heal | * | X | | |
| <i>Prunus americana</i> | wild plum | 3 | X | | X |
| <i>Prunus pumila</i> var. <i>besseyi</i> | sand cherry | 6 | X | | |
| <i>Psoraleidum lanceolatum</i> | lemon scurf-pea | 6 | | X | |
| <i>Pycnanthemum virginianum</i> | Virginia mountain-mint | 6 | X | | |
| <i>Quercus macrocarpa</i> | bur oak | 5 | | | X |
| <i>Ranunculus abortivus</i> | kidney-leaf buttercup | 1 | X | | X |
| <i>Ranunculus cymbalaria</i> | shore buttercup | 3 | X | | |
| <i>Ranunculus flabellaris</i> * | yellow water-crowfoot | 7 | | | X |
| <i>Ranunculus sceleratus</i> var. <i>sceleratus</i> * | cursed crowfoot | * | X | | X |
| <i>Ratibida columnifera</i> | prairie coneflower | 4 | X | X | |
| <i>Rhamnus cathartica</i> | common buckthorn | * | X | | |
| <i>Rhus glabra</i> | smooth sumac | 2 | X | | |
| <i>Ribes missouriense</i> | Missouri gooseberry | 4 | X | | |
| <i>Ribes odoratum</i> | buffalo current | 4 | X | | |
| <i>Rorippa palustris</i> var. <i>glabra</i> | bog yellow cress | 4 | | | X |
| <i>Rosa arkansana</i> | prairie wild rose | 4 | X | | |
| <i>Rudbeckia laciniata</i> | goldenglow | 4 | | | X |
| <i>Rudbeckia hirta</i> var. <i>pulcherrima</i> | black-eyed Susan | 4 | X | | |
| <i>Rumex crispus</i> | curly dock | * | X | | |
| <i>Rumex patientia</i> | patience dock | * | X | | |
| <i>Sagittaria brevirostra</i> | short beak arrowhead | 4 | | | X |
| <i>Sagittaria latifolia</i> | broad leaf arrowhead | 5 | X | | X |
| <i>Salix amygdaloides</i> | peach-leaf willow | 4 | X | | |
| <i>Salix exigua</i> subsp. <i>interior</i> | sandbar willow | 3 | X | | |
| <i>Sambucus canadensis</i> | elderberry | 2 | X | | X |

Appendix 1. Continued

| Scientific Name | Common Name | C | Pleasanton Meadow | Ravenna Sand Prairie | Ravenna Wetlands |
|---|--------------------------------|---|----------------------|-------------------------|---------------------|
| <i>Schizachyrium scoparium</i> | little bluestem | 4 | X | X | |
| <i>Schoenoplectus pungens</i> | three-square bullrush | 4 | X | | X |
| <i>Schoenoplectus tabernaemontani</i> | softstem bullrush | 5 | X | | X |
| <i>Scirpus pallidus</i> | pale bulrush | 5 | X | | X |
| <i>Senecio plattensis</i> | prairie ragwort | 5 | X | X | |
| <i>Setaria pumila</i> | yellow foxtail | * | X | | |
| <i>Setaria verticillata</i> | bristly foxtail | * | X | | |
| <i>Setaria viridis</i> | green foxtail | * | X | | |
| <i>Sisymbrium loeselii</i> | tall hedge mustard | * | X | | |
| <i>Sisyrinchium montanum</i> | meadow blue-eyed grass | 5 | X | X | |
| <i>Solidago canadensis</i> | Canada goldenrod | 2 | X | | |
| <i>Solidago gigantea</i> | late goldenrod | 3 | X | | |
| <i>Solidago missouriensis</i> | Missouri goldenrod | 5 | | X | |
| <i>Solidago rigida</i> | rigid goldenrod | 3 | X | | |
| <i>Sorghastrum nutans</i> | Indian grass | 5 | X | | |
| <i>Sparganium eurycarpum</i> | large fruit bur-reed | 5 | X | | X |
| <i>Spartina pectinata</i> | prairie cordgrass | 5 | X | | |
| <i>Sphenopholis obtusata</i> var. <i>obtusata</i> | prairie wedgrass | 5 | X | | X |
| <i>Spiranthes cernua</i> | nodding ladies' tresses orchid | 6 | X | | |
| <i>Sporobolus compositus</i> | tall dropseed | 3 | X | | |
| <i>Sporobolus cryptandrus</i> | sand dropseed | 2 | X | X | |
| <i>Stellaria longifolia</i> | stitchwort | 7 | X | | |
| <i>Stipa comata</i> | needle-and-thread | 6 | X | X | |
| <i>Strophostyles leiosperma</i> | slick-seed wild-bean | 4 | | X | |
| <i>Symphoricarpos occidentalis</i> | wolfberry | 2 | | X | |
| <i>Symphoricarpos orbiculatus</i> | coralberry | 2 | X | | |
| <i>Taraxacum officinale</i> | common dandelion | * | X | | |
| <i>Teucrium canadense</i> | American germander | 4 | X | | X |
| <i>Thalictrum dasycarpum</i> | purple meadow rue | 4 | X | | |
| <i>Toxicodendron radicans</i> var. <i>rydbergii</i> | poison ivy | 1 | X | | |
| <i>Tradescantia bracteata</i> | long bracted spiderwort | 5 | X | | |
| <i>Tradescantia occidentalis</i> | western spiderwort | 5 | | X | |
| <i>Tragopogon dubius</i> | goat's beard | * | X | | |
| <i>Tridens flavus</i> | purpletop | 2 | X | | |
| <i>Trifolium pratense</i> | red clover | * | X | | |
| <i>Trifolium repens</i> | white clover | * | X | | |
| <i>Triodanis perfoliata</i> | Venus's looking glass | 2 | X | | |
| <i>Typha augustifolia</i> | narrow-leaf cattail | * | X | | |
| <i>Typha latifolia</i> | broad-leaf cattail | 1 | | | X |
| <i>Ulmus americana</i> | American elm | 3 | X | | |
| <i>Ulmus pumila</i> | Siberian elm | * | X | | |
| <i>Urtica dioica</i> var. <i>gracilis</i> | stinging nettle | 1 | X | | |
| <i>Verbascum thapsus</i> | mullein | * | X | | |
| <i>Verbena bracteata</i> | prostrate vervain | 0 | X | | |
| <i>Verbena hastata</i> | blue vervain | 4 | X | | X |
| <i>Verbena stricta</i> | hoary vervain | 2 | X | X | |
| <i>Verbena urticifolia</i> | white vervain | 3 | X | | |
| <i>Vernonia baldwinii</i> | western ironweed | 3 | X | X | |
| <i>Vernonia fasciculata</i> | common prairie ironweed | 4 | X | | |
| <i>Veronica anagallis-aquatica</i> | water speedwell | * | X | | |
| <i>Viola pedatifida</i> | prairie violet | 6 | X | | |
| <i>Viola sororia</i> | downy blue wood violet | 3 | X | | |
| <i>Vitis riparia</i> | river-bank grape | 3 | X | | |
| <i>Vulpia octoflora</i> | sixweeks-fescue | 3 | X | | |
| <i>Xanthisma spinulosum</i> | cutleaf ironplant | 4 | X | | |
| <i>Xanthium strumarium</i> var. <i>canadense</i> | cocklebur | 1 | X | | |