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A Floristic Analysis and Comparison of Plant Communities in Harlan County, Nebraska

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Historically, the Republican River Valley in Harlan County, Nebraska, has been extensively explored, but the county flora has continually been under-represented and has been found to lack records for plants that are considered common. During the 2009 growing season, a taxonomic study and comparison of 3 different sites in Harlan County was made. Site #1 was pastureland and Sites #2 and #3 were both riparian, located on the north side of the Republican River. Collections were pressed, dried, identified, and deposited in the University of Nebraska at Kearney Herbarium (NEBK). Forty-eight new county records were verified, including cutleaf-cucumber (*Cyclanthera dissecta*), a Tier 2 species listed by the Nebraska Natural Legacy Program. The species composition of three sites were compared using both Jaccard's (IS_J) and Sorensen's (IS_S) indices of similarity which are based on the species in common to two given sites and species that are exclusive to each site. According to Sorensen Index values, the two riparian sites (Sites #2 and #3) had the greatest percent similarity (IS_S =56.6%), followed by Sites #1 and #3 (IS_S = 51.9%) and Sites #1 and #2 (IS_S = 47.2%). Using Jaccard's index of similarity, separation among the sites was not as apparent. The floristic quality indices (FQI) for Sites #1, #2, and #3 (25.08, 12.07, and 22.96 respectively) were somewhat low when compared to FQI values from previous studies in the Loup River Valley of Nebraska. This study helps to document the current plant diversity of the area and updates the known flora of Harlan County, which now totals 395 species.

Key words: Harlan County flora, mixed-grass prairie, Republican River, floristic analysis

Introduction

South-central Nebraska played a major role in the early botanical history of Nebraska. The Spanish traversed this region, the traditional home of the Pawnee Tribe, as early as 1540-1542 when Coronado reached central Kansas. In 1820, the Long Expedition, with botanist Edwin James, made notable records from south-central Nebraska following the big bend of the Platte River. The Wyeth Expedition of 1834 with Thomas Nuttall also passed just to the north of the Republican River Valley and contributed many additional records to the region's flora. The J.C. Fremont expedition was next and moved through parts of the Republican Valley in 1843. Although numerous important plant collections were made, the total number of reported species was far below the number of plants that presently constitute the region's known flora. Therefore, the objective of this study was to provide additions to the flora of Harlan, County, Nebraska, from surveys of three different plant communities. These included (1) upland, grazed prairie; (2) lowland riparian forest; and (3) lowland, riparian forest/riverbank communities. Initially, this project was designed to survey only natural, undisturbed sites. However, the best available upland prairie site selected for our study was subjected to seasonal grazing, and much of the riparian community had signs of exposure to limited human activity.

Harlan County, Nebraska (Figure 1), is located in south central Nebraska and has a total area of 143,547 Ha (554 mi^2). Of this total, 5587 Ha are occupied by Harlan County Reservoir, resulting in a land area of 137,960 Ha (~532 mi^2) for Harlan County (Mitchell et al. 1974). With the exception of the northeastern corner, which is

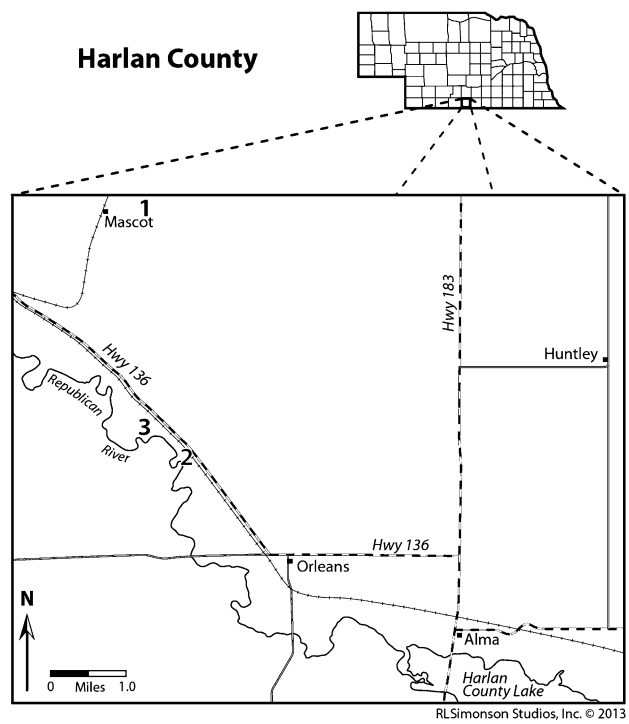

Figure 1. The study area in Harlan County, Nebraska, showing the approximate locations of Sites 1, 2, and 3.

Figure 2. A dust storm strikes Franklin, Nebraska, 26 March 1935.

nearly level, approximately 90% of the county occurs in the Republican River drainage, which runs west to east, just north of the Kansas-Nebraska state line. The presettlement vegetation was mostly mixed-grass prairie accented by scattered patches of riparian forest along the river and several spring-fed tributaries. Most of the remaining prairie is either grazed by cattle or has been converted to irrigated farmland. The river valley provides riparian communities, sand bars, riverbank sites, and occasional wetlands, which enhance the potential flora of the area. In addition to the Republican River Valley, the county's uplands are described as *Dissected Plains* with the amount of natural vegetation estimated at 15% (Kaul et al. 2011).

As a result of the sod-busting era (~1862 into the early 20th century), much of the original mixed-grass prairie bordering the valley has been converted to cropland (Kaul et al. 2011). This has provided increased opportunities for introduced, invasive, and weedy plant species to become established in the area and has added additional, but undesirable, diversity to the region's flora.

Historically, the Harlan County flora of ~347 species, has been under-reported as compared to other counties in the region. For example, Webster County, ~40 km to the east, has a minimum flora of 604 species, and Kearney County to the northeast has a reported 586 species (Kaul and Rolfsmeier 1994; Kaul et al. 2011, Kaul and Simpson 2012). In a ranking of Nebraska's 93 counties based on each county's total flora, Harlan County originally was rated 61st (Kaul and Rolfsmeier 1994).

Over the last several decades, Harlan County has experienced environmental extremes that have affected the flora. The Republican River Basin includes parts of southwest and south central Nebraska, northeastern Colorado, and northwestern Kansas. It differs from the Platte and other western river basins because its flows rely totally on groundwater (springs) and precipitation, in contrast to the snow pack in the Rocky Mountains that feeds the Platte River headwaters. Historically, fluctuations in climate have been common, with periodic drought followed by years of above-normal precipitation. It is not unusual for daily summer temperatures in the area to exceed 38° C accompanied by periods of little or no measurable precipitation. The region was greatly affected by the Great Drought of the 1930's (Figure 2) being on the northern edge of the Dust Bowl. The drought was punctuated by Black Sunday (14 April 1935) when winds and powder-dry soil created one of the largest dust storms ever reported, suffocating people and livestock. Later that same season (30 May 1935), torrential rains in the upper part of the Republican River Basin resulted in a record flood that swept down the valley and took ~113 lives. Consequently, the vegetation has undergone several shifts in species composition in fewer than 100 years.

The present day flora reflects an increase in plant species mainly as a result of invasive species and introductions that take advantage of disturbances caused by cultivation and grazing. Irrigation has mitigated the effects of periodic drought, allowing some species to persist that otherwise would not have survived. The Republican River Valley does provide habitat and the opportunity for less adaptable plant species to inhabit an area that is known for climatic extremes and wide fluctuations in temperature and precipitation.

Material and Methods

Plants were collected at three contrasting sites in Harlan County (Figure 1; Table 1) throughout the 2009 growing season as late as 9 October to insure the inclusion of early and late season species. Plants were collected to help determine the overall diversity of the county, as well as to identify any rare or previously unrecorded species for the county. All collections were pressed and dried using a standard plant press and were deposited in the University of Nebraska at Kearney Herbarium (NEBK). Nomenclature follows the *Flora of Nebraska 2nd ed.* (Kaul et al. 2011). In addition to the *Flora of Nebraska*, field guides by Farrar (2011), Johnson and Larson (1999), and Owensby (1980) were used to assist in plant identification. A species checklist of vascular plants collected at the three sites was made and new county records were designated (Appendix 1).

Jaccard's Index of Similarity (ISj) was used to assess differences/similarities among the three sites.

$$ISj = \frac{c}{(a + b + c)} \times 100$$

where "c" is the number of common species, "a" is the number of species unique to site #1, and "b" is the number of species unique to site #2. For comparison, it was useful to apply another similarity test, Sorensen's Index of Similarity (ISs),

$$ISs = \frac{2c}{a} + b \times 100,$$

where c = the number of species common to the two sites, a = the total number of species at a given site and b = the total number of species at the other site in the comparison. Coefficient of Conservatism (C) values as determined for Nebraska by Rolfsmeier and Steinauer (2003) were assigned to all native species in the study. A mean C value (Cm), and a Floristic Quality Index (FQI) were calculated for each of the three sites. The FQI serves as a point of comparison to other floristic studies and was determined using the equation

$$FQI = Cm \times \sqrt{n},$$

where n = the total number of native species recorded at a study site (Mushet et al. 2002).

Table 1. The locations of the three study sites, Harlan County, Nebraska.

Site 1	Upland/Lowland Prairie	The W ½ SEC 36, T3N, R20W
Site 2	Riparian	The NW ¼ of the SW ¼ SEC 6, T2N, R19W
Site 3	Riparian	The SW ¼ SEC 36, T3N, R20W

Table 2. Index of Similarity Values Comparing the Three Study Sites.

	Jaccard's (ISj)	Sorensen's (ISs)
Sites 1 and 3	40.0%	51.9%
Sites 2 and 3	39.9%	56.6%
Sites 1 and 2	31.3%	47.2%

Results and Discussion

Although the 3 sites were not exceptionally diverse and each had been subjected to a degree of disturbance, a total of 48 new records for Harlan County were made, increasing the total flora to ~ 395 species of vascular plants (Appendix). Most are common throughout central Nebraska, but were not previously reported for Harlan County. One Tier 2 species listed by the Nebraska Natural Legacy Project, cut-leaf cucumber (*Cyclanthera dissecta*), was recorded at Site #2, a riparian area on the north side of the Republican River. Cut-leaf cucumber is known only from Harlan, Furnas, and Red Willow Counties in Nebraska but is likely more widely distributed in the Republican River Valley.

Dominant woody species in the riparian sites (#2 and #3) include plains cottonwood (*Populus deltoides*), green ash (*Fraxinus pennsylvanica*), box elder (*Acer negundo*) and northern catalpa (*Catalpa speciosa*). The understory consists of a mixture of herbaceous species, such as motherwort (*Leonurus cardiaca*) and poke weed (*Phytolacca americana*), along with shrubs and vines that are not subjected to continual inundation. River bank and sandbar habitats differ floristically, and support a number of opportunistic species, such as umbrella sedge (*Cyperus odoratus*), water speedwell (*Veronica anagallis aquatica*), reed canary grass (*Phalaris arundinacea*), numerous sedges (*Carex* spp.) and rushes (*Juncus* spp.) that quickly colonize newly exposed substrate.

When we applied Jaccard's Index of Similarity (ISj), our results were somewhat surprising (Table 2). The most similar sites were #1 and #3 (ISj = 40.0%) but this was essentially equal to the ISj value of the two riparian sites (#2 and #3) which = 39.9%. Sites #1 and #2 were the most dissimilar (ISj = 31.3%). Sorensen's Index of Similarity was also used because it gives greater weight than Jaccard's to the species that recur in the two test areas than to those that are unique to either area (Mueller-Dombois and Ellenberg 1974). Based on ISs values, Sites

#2 and #3 were the most similar (ISs = 56.6%), followed by Sites #1 and #3 (ISs = 51.9%), and Sites #1 and #2 (ISs = 47.2%) (Table 2).

Comparing the two methods, the results also indicate that there is not a great degree of separation or variability within the similarity values that were calculated. One explanation might be that the upland, grazed prairie (Site #1) does include a canyon and drainage area that seasonally contains standing water. A representative number of plant species that colonize this area are the same as those that occupy riverbank and sandbar communities (Sites #2 and #3).

A coefficient of conservatism value (C) as originally developed by Swink and Wilhelm (1979, 1994) was assigned to each native species in this study. We used values for Nebraska vascular plants as designated by Rolfsmeier and Steinauer (2003). These values rank native species in a given region on a scale of 0 to 10 and higher numbers give greater importance to native, endemic species that are limited to a narrow range of environmental characteristics. Low C values are assigned to plants that are highly reproductive and are adapted to a variety of habitats. By calculating an average or mean C for an area, this value can be used to assess the quality of vegetation present, or it may be incorporated into a Floristic Quality Index (FQI) for comparison to other sites in the region. Individually, the sites have relatively low Cm and FQI values. For Sites 1, 2, and 3, respectively, Cm values were 2.56, 1.82, and 2.23 and FQI values were 25.08, 12.07, and 22.96. As expected, Site #1, consisting of mixed-prairie and a seasonal wetland is the most diverse.

These values are low in comparison to recent studies that were completed in other river valleys of central Nebraska. In a plant survey of a Loup River meadow, Veloso and Rothenberger (2008) reported a mean C of 4.14 and a FQI of 64.4. Rothenberger et al. (2010) reported a mean C of 3.73 and an FQI of 50.7 resulting from a similar study of a South Loup River meadow. Although these findings are indicative of the higher species richness and floristic quality of the Loup River Valley, this study contributes significantly to the known flora of Harlan County.

Conclusion

The botanical diversity of Harlan County is mainly a result of the combination of upland mixed-grass prairie and the riparian/riverbank communities associated with the Republican River Valley that dominate the county's flora. Other plant communities of significance are the wooded uplands that extend west-east along the south side of the river, scattered wetlands, and the vegetation that borders small tributaries of the river. The Republican River Valley separates mixed-grass prairie species with both northern and southern affinities. Several species reported on limestone outcrops in Franklin and Webster Counties, such as Fendler's aster (*Aster fendleri*), Fremont's leather-flower (*Clematis fremontii*), and Fremont's evening-primrose (*Oenothera macrocarpa* ssp. *fremontii*), reach the northern edge of their range here. Therefore, additional study of prairies south of the river is recommended and the above species should be targeted. While the flora of Harlan County remains under-studied, 48 newly discovered species were collected confirming the botanical importance and significance of Harlan County.

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[Appendix 1 follows.]

Appendix 1. A Species Checklist for Harlan County Study Sites. (R = new county record; * = nonnative species)

Scientific Name	Common Name	Site 1	Site 2	Site 3	New county record	C-value
Abutilon theophrasti Medikus	velvet-leaf	X		X		*
Acer negundo L.	box-elder	X	X	X		3
Agrostis stolonifera L.	redtop			X		*
Achillea millefolium L.	common yarrow	X				2
Amaranthus retroflexus L.	redroot pigweed	X		X		0
Ambrosia artemisiifolia L.	common ragweed	X		X	R	0
Ambrosia psilostachya DC.	western ragweed	X		X		1
Ambrosia trifida L.	giant ragweed	X	X	X		0
Ammannia robusta Heer & Regel	toothcup			X		4
Amorpha fruticosa L.	false indigo		X	X	R	5
Antennaria neglecta Greene	pussytoes	X			R	3
Apocynum cannabinum L.	Indian hemp dogbane			X		2
Arctium minus (Hill) Bernh.	common burdock		X	X		*
Argemone polyanthemos (Fedde) G.Ownbey	prickly poppy	X				1
Aristida purpurea Nutt.	purple three-awn	X				5
Asclepias incarnata L.	swamp milkweed		X	X	R	4
Asclepias pumila (A. Gray) Vail	plains milkweed	X			R	4
Asclepias syriaca L.	common milkweed			X		1
Astragalus crassicarpus Nutt.	ground-plum	X			R	7
Astragalus mollissimus Torr.	wooly locoweed	X				3
Aster ericoides L. ssp. *ericoides*	heath aster	X		X		3
Aster oblongifolius Nutt.	aromatic aster	X				5
Aster lanceolatus Willd. subsp. *lanceolatus*	willowleaf aster		X	X	R	2
Bidens cernua L.	bur-marigold		X	X		3
Bidens comosa (A.Gray) Wiegand	beggar-ticks			X		2
Bidens frondosa L.	devil's pitchfork			X	R	1
Bolboschoenus fluviatilis (Torr.) Soják	river bulrush			X	R	3
Bouteloua curtipendula (Michx.) Torr.	side-oats grama	X		X		5
Bouteloua gracilis (Kunth) Lag. *ex* Griffiths	blue grama	X		X		4
Brickellia eupatorioides (L.) Shinners var. *corymbulosa* (Torr. & A.Gray) Shinners	false boneset			X	R	4
Bromus inermis Leyss. subsp. *inermis*	smooth brome	X		X		*
Bromus japonicus Thunb. *ex* Murr.	Japanese brome	X		X		*
Bromus tectorum L.	downy brome	X				*
Buchloe dactyloides (Nutt.) Engelm.	buffalo grass	X				2
Callirhoe involucrata (Torr. & A.Gray) A.Gray	purple poppy mallow			X		2
Calystegia sepium (L.) R.Br. var. *angulata* (Brummitt) N.H. Holmgren	hedge bindweed	X				1
Cannabis sativa L.	hemp	X	X	X		*
Capsella bursa-pastoris (L.) Medik.	shepherd's purse	X	X	X		*
Carduus nutans L.	musk thistle	X		X		*
Carex blanda C. Dewey	common wood sedge			X	R	2
Carex brevior (C. Dewey) Mack. *ex* Lunell	fescue sedge	X		X		4
Carex gravida L.H. Bailey	heavy-fruit sedge	X				4
Carex laeviconica C. Dewey	smooth-cone sedge		X			4

Appendix 1. A Species Checklist for Harlan County Study Sites. (R = new county record; * = nonnative species) *(continued)*

Scientific Name	Common Name	Site 1	Site 2	Site 3	New county record	C-value
Carex praegracilis W. Boott	clustered field sedge	X				4
Catalpa speciosa (L.) Bureau	northern catalpa		X	X		*
Celtis occidentalis L.	hackberry	X			R	4
Cenchrus longispinus (Hack.) Fernald	sandbur			X		0
Chenopodium berlandieri Moq.	pitseed goosefoot	X	X	X	R	0
Chenopodium simplex (Torr.) Raf.	maple-leaf goosefoot	X		X		1
Chloris verticillata Nutt.	windmill grass			X		0
Cirsium altissimum (L.) Spreng.	tall thistle	X		X		1
Cirsium undulatum (Nutt.) Spreng.	wavy-leaf thistle	X				4
Cirsium vulgare (Savi) Tenore	bull thistle	X		X		*
Conium maculatum L.	poison-hemlock		X			*
Convolvulus arvensis L.	field bindweed	X	X	X		*
Conyza canadensis (L.) Cronquist	horseweed	X	X	X		0
Cornus drummondii C.A. Mey.	rough-leaved dogwood	X	X	X		3
Croton texensis (Klotzsch) Müll. Arg.	Texas croton	X		X		1
Cyclanthera dissecta (Torr. & A.Gray) Arn.	cutleaf-cucumber		X		R	0
Cyclachaena xanthiifolia Fresen.	big marsh-elder		X	X		0
Cyperus odoratus L.	rusty flatsedge			X		3
Cyperus squarrosus L.	square flatsedge			X		2
Delphinium virescens Nutt.	prairie larkspur	X			R	6
Descurainia pinnata (Walter) Britton	tansy mustard			X	R	0
Descurainia sophia (L.) Webb ex Prantl	tansy mustard	X				*
Desmanthus illinoensis (Michx.) MacMillan *ex* B.L. Robinson	Illinois bundleflower			X		5
Desmodium canadense (L.) DC.	Canada tickclover			X		5
Digitaria cognata (Schult.) Pilg.	fall witchgrass			X	R	4
Digitaria sanguinalis (L.) Scop.	hairy crabgrass			X		*
Dyssodia papposa (Vent.) A.S. Hitchc.	fetid-marigold	X			R	0
Echinochloa crus-galli (L.) P. Beauv.	barnyard grass			X	R	*
Echinocystis lobata (Michx.) Torr. & A.Gray	wild-cucumber			X		3
Eclipta prostrata (L.) L.	yerba de tajo			X		2
Elaeagnus angustifolia L.	Russian olive			X		*
Eleocharis palustris (L.) Roem. & Schultes	spike-rush	X				4
Eleusine indica (L.) Gaertn.	goosegrass	X	X	X		*
Ellisia nyctelea (L.) L.	waterpod	X				0
Elymus canadensis L.	Canada wild-rye			X		5
Elymus repens (L.) Gould	quackgrass	X			R	*
Elymus smithii (Rydb.) Gould	western wheatgrass	X			R	3
Elymus virginicus L.	Virginia wild-rye	X		X		4
Eragrostis cilianensis (All.) Vignolo *ex* Janch.	stinkgrass	X	X	X		*
Eragrostis pectinacea (Michx.) Nees	Carolina lovegrass			X		0
Erigeron strigosus Muhl. *ex* Willd.	prairie fleabane	X		X	R	2
Euphorbia davidii Subils	toothed spurge			X		0
Euphorbia glyptosperma Engelm.	ridge-seed spurge			X		0

Appendix 1. A Species Checklist for Harlan County Study Sites. (R = new county record; * = nonnative species) *(continued)*

Scientific Name	Common Name	Site 1	Site 2	Site 3	New county record	C-value
Euphorbia marginata Pursh	snow-on-the-mountain	X	X			0
Fraxinus pennsylvanica Marshall	green ash	X	X	X		2
Gaura coccinea Nutt. *ex* Pursh	scarlet gaura	X				4
Gaura parviflora Dougl. *ex* Lehm.	velvety gaura	X	X	X		1
Gleditsia triacanthos L.	honey-locust			X		1
Hackelia virginiana (L.) I.M. Johnst.	stickseed			X		2
Hedeoma hispida Pursh	rough false pennyroyal	X				2
Helianthus annuus L.	common sunflower			X	R	0
Helianthus maximiliani Schrad.	Maximilian sunflower			X	R	4
Hesperis matronalis L.	dame's-rocket	X				*
Hordeum jubatum L.	foxtail barley	X		X		1
Hordeum pusillum Nutt.	little barley	X				1
Juniperus virginiana L.	red cedar	X	X	X	R	1
Kochia scoparia (L.) Schrad.	kochia	X	X	X		*
Lactuca serriola L.	prickly lettuce	X	X	X		*
Lactuca canadensis L.	wild lettuce		X	X	R	2
Lappula redowskii (Hornem.) Greene var. *cupulata* (A.Gray) M.E. Jones	cupseed	X				2
Leonurus cardiaca L.	motherwort		X	X		*
Lepidium densiflorum Schrader	pepper-grass	X	X	X		0
Leptochloa fusca (L.) Kunth subsp. *fascicularis* (Lam.) N. Snow	sprangle-top			X		1
Liatris punctata Hook.	gayfeather	X				5
Lindernia dubia (L.) Pennell	false pimpernel			X		5
Linum sulcatum Riddell	grooved flax	X			R	6
Lippia lanceolata Michx.	fogfruit			X		3
Lithospermum incisum Lehm.	fringed puccoon	X				5
Lygodesmia juncea (Pursh) D. Don *ex* Hook.	skeleton weed	X				4
Malva neglecta Wallr.	common mallow			X	R	*
Medicago lupulina L.	black medic			X		*
Medicago sativa L. subsp. *sativa*	alfalfa			X	R	*
Mentha canadensis L.	field mint			X		4
Melilotus albus Medikus.	white sweet clover			X		*
Melilotus officinalis (L.) Pallas	yellow sweet clover	X				*
Mentzelia decapetala (Pursh *ex* Sims) Urban	ten-petal stickleaf	X			R	5
Mimosa quadrivalvis L. var. *nuttallii* (DC. *ex* Standl.) Beard *ex* Barneby	sensitive brier	X				6
Mirabilis nyctaginea (Michx.) MacMill.	common four-o'clock	X	X	X		1
Morus alba L.	white mulberry	X	X	X		*
Muhlenbergia mexicana (L.) Trin.	wirestem muhly	X		X		4
Muhlenbergia racemosa (Michx.) Britton, Sterns, & Poggenb.	marsh muhly	X				4
Nasturtium officinale W.T. Aiton	water cress	X			R	*
Nepeta cataria L.	catnip		X	X		*
Oenothera biennis L.	common evening primrose	X	X	X	R	1
Opuntia humifusa (Raf.) Raf.	bigroot prickly-pear	X				5
Oxalis dillenii Jacq.	gray oxalis	X		X		0

Appendix 1. A Species Checklist for Harlan County Study Sites. (R = new county record; * = nonnative species) *(continued)*

Scientific Name	Common Name	Site 1	Site 2	Site 3	New county record	C-value
Oxytropis lambertii Pursh	purple locoweed	X				6
Panicum capillare L.	witchgrass	X	X	X	R	0
Panicum dichotomiflorum Michx.	fall panicum	X	X	X		0
Panicum oligosanthes Schult. var. *scribnerianum* (Nash) Fernald	Scribner panicum	X				4
Panicum virgatum L.	switchgrass	X	X	X		4
Parthenocissus vitacea (Knerr) A. Hitchc.	woodbine	X	X	X		4
Pediomelum digitatum (Nutt. *ex* Torr.& A.Gray) Isely	palm-leaf scurfpea	X			R	6
Phalaris arundinacea L.	reed canarygrass	X	X	X		0
Physalis heterophylla Nees	clammy ground cherry			X		4
Physalis longifolia Nutt.	common ground-cherry	X		X		0
Phytolacca americana L.	pokeweed		X	X	R	0
Plantago patagonica Jacq.	wooly plantain	X				1
Poa pratensis L.	Kentucky bluegrass	X	X	X		*
Polygonum aviculare L. subsp. *depressum* (Meissn.) Arcang.	knotweed			X		*
Polygonum bicorne Raf.	pink smartweed	X		X		0
Polygonum lapathifolium L.	pale smartweed		X	X		2
Polygonum pensylvanicum L.	Pennsylvania smartweed	X	X	X	R	0
Polygonum persicaria L.	lady's thumb			X		*
Polygonum scandens L.	climbing false buckwheat	X	X			1
Populus deltoides Bartr. *ex* Marsh.subsp. *monilifera* (Aiton) Eckenwalder	Plains cottonwood	X	X	X		3
Prunus virginiana L.	choke cherry			X	R	3
Psoralidium tenuiflorum (Pursh) Rydb.	slender-flowered scurf-pea	X				5
Ranunculus sceleratus L. var. *sceleratus*	cursed crowfoot			X		*
Rhus glabra L.	smooth sumac			X		2
Ribes missouriense Nutt.	Missouri gooseberry			X	R	4
Ribes odoratum H.L. Wendl.	buffalo currant			X		4
Rorippa palustris (L.) Bess. var. *glabra* (O.E. Schulz) Roy L. Taylor & MacBryde	bog yellow cress		X	X		4
Rosa woodsii Lindl.	western wild rose		X	X	R	4
Rudbeckia hirta L. var. *pulcherrima* Farw.	black-eyed susan			X	R	4
Rumex altissimus A.W. Wood	pale dock			X		0
Rumex crispus L.	curly dock		X	X		*
Salix amygdaloides N.J. Andersson	peach-leaf willow	X		X		4
Salix exigua Nutt. subsp. *interior* (Rowlee) Cronquist	coyote willow			X		3
Salsola tragus L.	Russian thistle	X				*
Salvia reflexa Hornem.	Rocky Mountain sage	X			R	0
Sambucus canadensis L.	elderberry	X	X	X		2
Schizachyrium scoparium (Michx.) Nash	little bluestem	X				4
Setaria faberi R.A.W. Herrm.	Chinese foxtail			X	R	*
Setaria pumila (Poir.) Roem. & Schult.	yellow foxtail	X		X		*
Setaria verticillata (L.) P.Beauv.	bristly foxtail	X	X	X		*
Setaria viridis (L.) P. Beauv.	green foxtail	X	X	X		*
Sicyos angulatus L.	bur-cucumber			X		1
Sisymbrium loeselii L.	tall hedge mustard			X	R	*

Appendix 1. A Species Checklist for Harlan County Study Sites. (R = new county record; * = nonnative species) *(continued)*

Scientific Name	Common Name	Site 1	Site 2	Site 3	New county record	C-value
Solanum carolinense L.	Carolina nightshade	X		X		2
Solanum interius Rydb.	plains black nightshade	X		X		0
Solanum rostratum Dunal	buffalo-bur	X	X	X		0
Solidago canadensis L.	Canada goldenrod	X	X	X		2
Solidago gigantea Aiton	late goldenrod	X	X	X		3
Solidago missouriensis Nutt.	Missouri goldenrod	X				5
Sonchus asper (L.) Hill	prickly sow-thistle		X			*
Sorghastrum nutans (L.) Nash	Indian grass	X	X	X		5
Spartina pectinata Link	prairie cordgrass		X	X		5
Sporobolus compositus (Poir.) Merr.	rough dropseed	X		X		3
Sporobolus cryptandrus (Torr.) A. Gray	sand dropseed			X		2
Stipa viridula Trin.	green needle grass	X			R	4
Symphoricarpos orbiculatus Moench	coralberry	X	X	X		2
Taraxacum officinale F.H. Wigg.	common dandelion	X	X	X	R	*
Teucrium canadense L. var. *occidentale* (A.Gray) McClint.& Epling	American germander			X		4
Thelesperma megapotamicum (Spreng.) Kuntze	greenthread	X				4
Toxicodendron radicans (L.) Kuntze var. *rydbergii* (J.K. Small *ex* Rydb.) Erskine	poison ivy	X	X	X		2
Tragopogon dubius Scop.	goatsbeard	X			R	*
Tribulus terrestris L.	puncture-vine	X	X	X		*
Tridens flavus (L.) A.S. Hitchc.	purpletop			X	R	2
Ulmus americana L.	American elm	X	X	X		3
Ulmus pumila L.	Siberian elm	X	X	X		*
Urtica dioica L. subsp. *gracilis* (Aiton) Selander	stinging nettle	X	X	X		1
Verbascum thapsus L.	mullein	X	X	X		*
Verbena bipinnatifida Nutt.	fernleaf vervain	X				4
Verbena bracteata Lag. & J.D. Rodriguez	prostrate vervain	X				0
Verbena hastata L.	blue vervain			X		4
Verbena stricta Vent.	hoary vervain	X		X		2
Verbena urticifolia L.	white vervain			X		3
Vernonia baldwinii Torr.	western ironweed	X			R	3
Veronica anagallis-aquatica L.	water speedwell			X		*
Vitis riparia Michx.	river-bank grape	X	X	X		3
Vulpia octoflora (Walter) Rydb.	sixweeks-fescue	X				3
Xanthium strumarium L. var. *canadense* (P. Mill.)Torr. & A. Gray	cocklebur	X	X	X		1