FLORISTIC SURVEY AT BELLE ISLE AT THE DEEP FORK RIVER IN OKLAHOMA CITY, OKLAHOMA

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Keywords: Cross Timbers, Central Great Plains, iNaturalist

ABSTRACT

A floristic survey was conducted at Belle Isle at the Deep Fork River in northwest Oklahoma City. Belle Isle at the Deep Fork River is an urban semi-natural area that has been subjected to a wide array of anthropogenic disturbances. The goal of this study was to observe and document all vascular plant species within the research area. Thirty-four site visits yielded 135 plant species representing 44 plant families and 116 genera. Forty-four (32.6%) of observed species were non-native. All observed vascular plant species were posted on iNaturalist. Two county records were documented, and no species tracked by the Oklahoma Natural Heritage Inventory were observed. This baseline floristic data can be used for biodiversity studies and ecological assessments.

INTRODUCTION AND STUDY AREA

Belle Isle at the Deep Fork River (BIDFR) is in northwest Oklahoma City in central Oklahoma County, Oklahoma (Figure 1). Belle Isle is an area of Oklahoma City that encompasses the Wileman's Belle Isle Neighborhood, Penn Square Mall, Belle Isle Station (a shopping center), Rose Hill Cemetery, and various green spaces and semi-natural areas. The green spaces and semi-natural areas consist of mowed fields, forests, grasslands, two streams, a pond, and a 1.2 km section of the Deep Fork River. The southwest and northeast sections of the river are concrete drainage ditches, while the central area is a semi-natural river (Figure 2).

The BIDFR study area is approximately 83 ha. It is located between Pennsylvania Avenue on the west, Classen Boulevard on the east, Northwest 59th Street on the north, and Northwest 53rd Street on the south. The study site ranges between the latitude 35.531357 and 35.531140 and longitude -97.540018 and -97.540404.

BIDFR sits on the border of the Central Great Plains and the Cross Timbers ecoregions (Figure 1). The Cross Timbers stretches from north-central Texas through central Oklahoma to its northern reaches in southern Kansas (Omernik 1987). The Cross Timbers comprises over 4.8 million hectares, approximately half of which are in Oklahoma (Küchler 1964; Thomas and Hoagland 2011). The Cross Timbers is a mixture of diverse habitats: forest, savanna, grassland, and wetland. The predominant tree species are *Quercus stellata* Wangenh. (post oak) and *Quercus marilandica* Münchh. (blackjack oak) (Duck and Fletcher 1945). The Central Great Plains ecoregion is a mixed-grass prairie that extends from Nebraska south through Kansas, Oklahoma, and Texas (Omernik 1987). The mixed-grass prairie is a combination of tallgrass and shortgrass vegetation. The dominant

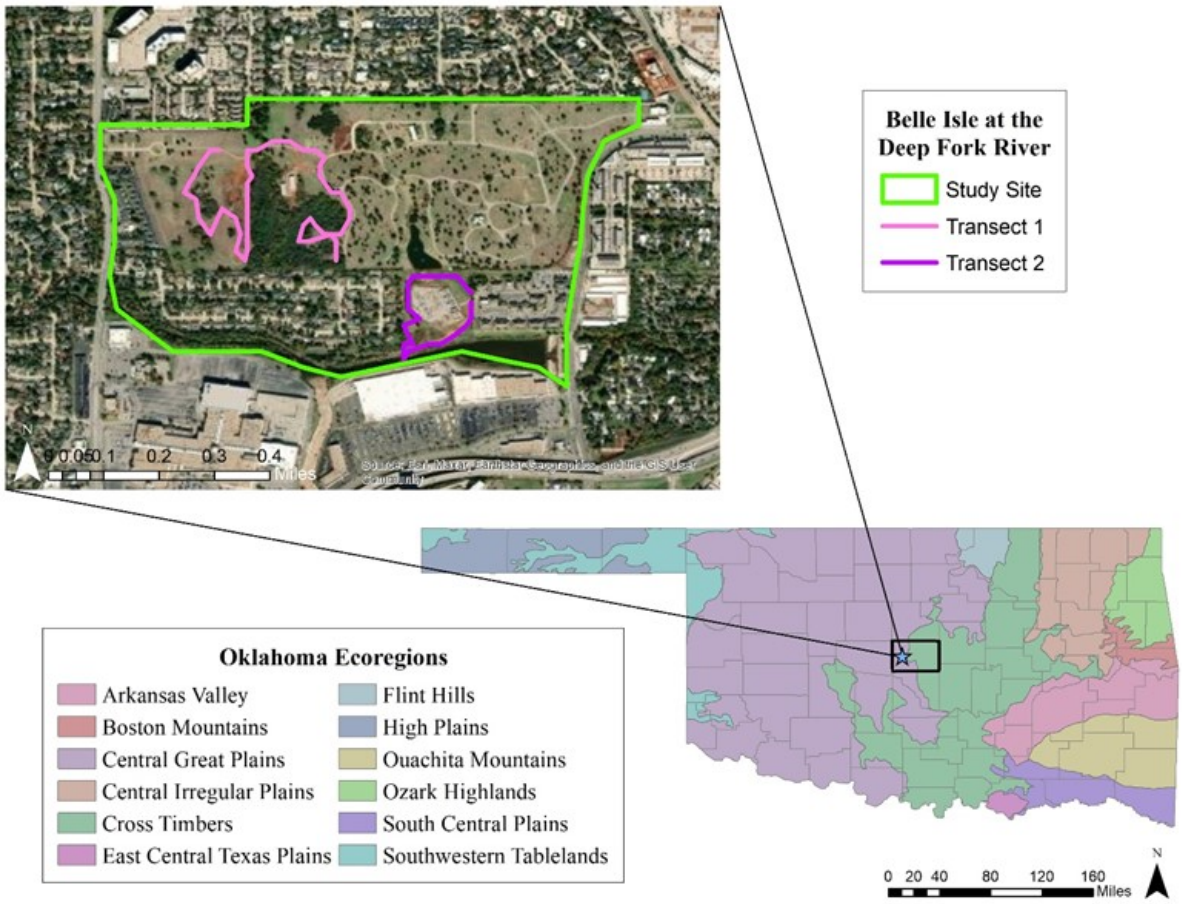

Figure 1 Oklahoma ecoregions and Belle Isle at the Deep Fork River study site.

genera are *Schizachyrium, Stipa, Elymus, Pascopyrum, Calamovilfa, Bouteloua, Sporobolus, Buchloe, Muhlenbergia, Carex, and Aristida* (Barbour and Billings 2000).

BIDFR falls within the temperate humid subtropical climate zone. This climate zone is characterized by hot and humid summers and cool to mild winters (Köppen 1936). Oklahoma County's average annual climate statistics include a growing season of 213 days, 92.4 cm of rainfall, and a temperature of 15.5°C. The average last spring freeze is April 4 and the average first fall freeze is November 2. Average annual snowfall is 17.5 cm, and average wind speed is 12.8 kph. The record high temperature is 45°C, and the record low is -26°C. The latest recorded freeze date is April 20, and the earliest is October 21 (Oklahoma Climatological Survey 2000; Mesonet 2023).

METHODS

Fieldwork was conducted from April 19, 2022 to October 23, 2023. Thirty-four site visits were made during this time. Site visit frequency was every two weeks during the growing season and once a month during winter. Two transects were designed to cover as much of the grassland, forest, and riparian habitat as possible. Transect 1 was approximately 1,329 m, and Transect 2 was 753 m (Figure 1). Most plants in the survey were observed along the two transects, but some plants were observed in the broader study area. An iNaturalist project, Belle Isle at the Deep Fork River, was created for the study site (https://www.inaturalist.org/projects/belle-isle-at-deep-fork-river).

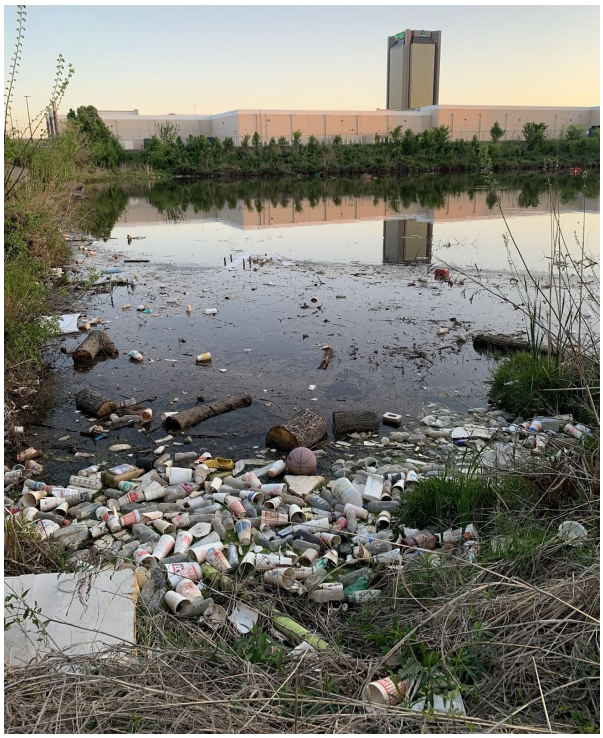

Figure 2 Semi-natural river section of Belle Isle at Deep Fork River, near Penn Square Mall. Photo by Benjamin Davis.

As each species was encountered, photos of key morphological characteristics (flower, stem, and leaves) were uploaded to iNaturalist. Only species not easily identified in the field were collected. Collected plant specimens were deposited in the University of Central Oklahoma Herbarium (CSU). All plant observations were uploaded to iNaturalist and the iNaturalist algorithm was allowed to make a suggested identification. The iNaturalist algorithm uses a vision model and nearby observations to suggest possible species identifications. This algorithm was found to be between 70 and 85% accurate when tested across all taxa. However, plant identification accuracy may be as low as 60% accurate in locales with fewer experts contributing identifications (iNaturalist 2019). All identifications were further confirmed or corrected using the *Flora of Oklahoma: Keys and Descriptions* (Ryburn et al. 2018; Fishbein et al. 2024) or the *Illustrated Flora of North Central Texas* (Diggs et al. 2000). The USDA Plants Database (2024) was used to determine nativity, duration, and growth habit. Nomenclature and classification follow the Integrated Taxonomic Information System (2024).

RESULTS AND DISCUSSION

A total of 135 individual species representing 44 plant families and 118 genera were observed and documented at BIDFR (Appendix). Forty-four (32.6%) species found at BIDFR were non-native. Plant duration statistics included 53 annuals (39.3%), 78 perennials (57.8%), and four biennials (3.0%). The growth habit statistics were 88 forbs (65.2%), 13 (9.6%) trees, 20 graminoids (14.8%), nine shrubs (6.7%), five vines (3.7%), and zero ferns. The most prominent plant families observed were Asteraceae with 29 species (21.5%), Fabaceae with 16 species (11.9%), Poaceae with 13 species (9.6%), and Cyperaceae with 6 species (4.4%). Plant families with the most observed non-native species included Fabaceae (seven species), Poaceae (six species), and Asteraceae (four species). Two county records were found: *Quercus fusiformis* Small (Texas live oak) and *Mimosa quadrivalvis* L. (fourvalve mimosa). We suspect that the *Q. fusiformis* observed is not naturally occurring and was most likely planted as the study site is outside of its range. No species tracked by the Oklahoma Natural Heritage Inventory (2024) were observed. The observed taxa constitute 5% of the 2,657 vascular plants found in Oklahoma (Fishbein et al. 2024).

Compared to four other nearby plant surveys, BIDFR had the highest percentage of non-native species and the lowest plant species richness (Table 1). This is likely due to the anthropogenic stressors affecting BIDFR: soil compaction, increased nutrient load, pollution, herbicides, pesticides, and ecosystem fragmentation. The four nearest inventories used for comparison were found in Oklahoma, Cleveland, Canadian, and McClain counties.

Table 1 The four closest plant inventories to the BIDFR study site.

Study Site	County	Reference	Size of site	Number of Taxa	Percent non-native
Arcadia Lake	Oklahoma	Friedman 2024a	274 ha	356	16.6%
E.C. Hafer Park	Oklahoma	Caddell et al. 2017	49 ha	270	22.2%
John W. Nichols Scout Ranch	Canadian	Crosswhite & Ryburn 2019	150 ha	152	13.6%
University of Oklahoma's Kessler Atmospheric and Ecological Field Station	McClain	Buthod & Hoagland 2016	146 ha	361	14.7%
Belle Isle at the Deep Fork River (plant survey)	Oklahoma	Friedman 2024b	83 ha	135	32.6%

Figure 3 Side tributary within the study area leading into the Deep Fork River, further downstream from Penn Square Mall. Photo by Micah Friedman.

Belle Isle at the Deep Fork River is a familiar landscape across US cities–a river running through a city surrounded by pockets of green space, strip malls, utility infrastructure, litter, encampments, and neighborhoods. Considering the

development and ecological damage BIDFR has sustained (Figure 2), this area still provides ecological services and supports a variety of organisms (Figure 3). Understanding the plant community composition at BIDFR will add to the region's botanical knowledge and help us understand areas that have undergone significant anthropogenic stressors. This baseline floristic data can be used for tracking invasives, monitoring rare or threatened species, climate research, and future biodiversity indices.

ACKNOWLEDGMENTS

We would like to thank Texas Oklahoma Regional Consortium of Herbaria, the Oklahoma Natural Heritage Inventory, and the University of Central Oklahoma Herbarium for assisting in plant identification and species conservation status.

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APPENDIX
List of vascular plant taxa from Belle Isle at the Deep Fork River, Oklahoma County, Oklahoma.

Taxa list with duration, growth habit, and nativity. * denotes an exotic taxa.
Duration is denoted by A = Annual, P = Perennial, and B = Biennial.
Growth habit is denoted by: F = forb, FN = fern, S = shrub, V = vine, T = tree, G = graminoid.
Nativity, duration, and growth habit were determined using the USDA Plants Database (USDA 2024).

Acanthaceae
Dicliptera brachiata (Pursh) Spreng. (false mint); A; F

Altingiaceae
Liquidambar styraciflua L. (American sweetgum); P; T

Amaryllidaceae
Allium canadense L. (Canadian meadow garlic); P; F
Allium drummondii Regel (Drummond's onion); P; F
**Allium vineale* L. (wild garlic); P; F
Nothoscordum bivalve (L.) Britton (crowpoison); P; F

Anacardiaceae
**Pistacia chinensis* Bunge (Chinese pistache); P; T
Rhus glabra L. (smooth sumac); P; S

Apiaceae
Ammoselinum popei Torr. & A. Gray (plains sandparsley); A; F
**Conium maculatum* L. (poison hemlock); B; F
**Torilis arvensis* (Huds.) Link (common hedge parsley); A; F

Apocynaceae
Asclepias viridis Walter (green antelopehorns); P; F

Aquifoliaceae
Ilex decidua Walter (possumhaw); P; S

Araceae
Lemna minor L. (common duckweed); P; F

Asparagaceae
**Muscari botryoides* (L.) Mill. (common grape hyacinth); P; F

Asteraceae
Achillea millefolium L. (common yarrow);P; F
Ambrosia psilostachya DC. (western ragweed); A; F
Amphiachyris dracunculoides (DC.) Nutt. (prairie broomweed); A; F
Artemisia ludoviciana Nutt. (silver wormwood); P; F
Bidens frondosa L. (devil's beggarticks); A; F
**Carduus nutans* L. (musk thistle); B; F

Cirsium altissimum (L.) Hill (tall thistle); B; F
Coreopsis tinctoria Nutt. (plains coreopsis); P; F
Eclipta prostrata (L.) L. (false daisy); A; F
Erigeron philadelphicus L. (Philadelphia fleabane); B; F
Erigeron strigosus Muhl. ex Willd. (daisy fleabane); A; F
Eupatorium serotinum Michx. (late boneset); P; F
Gaillardia suavis (A. Gray & Engelm.) Britton & Rusby (perfumeballs); P; F
Grindelia ciliata (Nutt.) Spreng. (Spanish gold); A; F
Helenium amarum (Raf.) H. Rock (bitterweed); A; F
Helianthus annuus L. (common sunflower); A; F
**Lactuca serriola* L. (prickly lettuce); A; F
Liatris punctata Hook. (dotted gayfeather); P; F
Packera plattensis (Nutt.) W.A. Weber & Á. Löve (prairie groundsel); P; F
Pyrrhopappus pauciflorus (D. Don) DC. (smallflower desert-chicory); A; F
Ratibida columnifera (Nutt.) Woot. & Standl. (upright prairie coneflower); P; F
Solidago nemoralis Aiton (field goldenrod); P; F
**Sonchus asper* (L.) Hill (prickly sowthistle); A; F
Symphyotrichum divaricatum (Nutt.) G.L. Nesom (southern annual saltmarsh aster); A; F
Symphyotrichum drummondii (Lindl.) G.L. Nesom (Drummond's aster); P; F
Symphyotrichum oblongifolium (Nutt.) G.L. Nesom (aromatic aster); P; F
**Taraxacum officinale* F.H. Wigg. (common dandelion); P; F
Thelesperma filifolium (Hook.) A. Gray (stiff greenthread); A; F
Xanthium strumarium L. (rough cocklebur); A; F

Bignoniaceae
Catalpa speciosa (Warder) Warder ex Engelm. (northern catalpa); P; T

Boraginaceae
**Buglossoides arvensis* (L.) I.M. Johnst. (corn gromwell); A; F

Brassicaceae
**Lepidium oblongum* Small (veiny pepperweed); A; F

Caprifoliaceae
**Lonicera maackii* (Rupr.) Herder (Amur honeysuckle); P; S

Caryophyllaceae
**Arenaria serpyllifolia* L. (thyme-leaved sandwort); A; F
Dianthus armeria L. (deptford pink); A; F

Commelinaceae
**Commelina communis* L. (Asiatic dayflower); A; F

Convolvulaceae
**Convolvulus arvensis* L. (field bindweed); P; V
Cuscuta campestris Yunck. (field dodder); P; V

Cornaceae
Cornus drummondii C.A. Mey. (roughleaf dogwood); P; S

Cyperaceae
Cyperus esculentus L. (yellow nutsedge); P; G
Cyperus squarrosus L. (bearded flatsedge); A; G
Eleocharis compressa Sull. (flat-stem spikerush); P; G
Eleocharis montevidensis A. Gray (sand spikerush); P; G
Eleocharis palustris (L.) Roem. & Schult. (common spike-rush); P; G
Schoenoplectus pungens (Vahl) Palla (three-square bulrush); P; G

Ebenaceae
Diospyros virginiana L. (common persimmon); P; T

Euphorbiaceae
Croton monanthogynus Michx. (prairie tea); A; F
Euphorbia nutans Lag. (nodding spurge); A; F
Euphorbia spathulata Lam. (reticulate-seeded spurge); A; F

Fabaceae
**Albizia julibrissin* Durazz. (Persian silk tree); P; T
Amorpha fruticosa L. (false indigo bush); P; S
Dalea candida Michx. ex Willd. (white prairie clover); P; F
Desmanthus illinoensis (Michx.) MacMill. ex B.L. Rob. & Fernald (Illinois bundleflower); P; F
Desmanthus leptolobus Torr. & A. Gray (prairie bundleflower); P; F
Gleditsia triacanthos L. (honey locust); P; T
**Lathyrus hirsutus* L. (hairy vetchling); A; F
**Medicago lupulina* L. (black medick); A; F
**Melilotus officinalis* (L.) Lam. (yellow sweetclover); A; F
Mimosa quadrivalvis L. (fourvalve mimosa); P; F
Neptunia lutea (Leavenw.) Benth. (yellow puff); P; F
Psoralidium tenuiflorum (Pursh) Rydb. (slimflower scurfpea); P; F
Robinia pseudoacacia L. (black locust); P; T
**Trifolium repens* L. (white clover); P; F
**Vicia sativa* L. (common vetch); A; F
**Vicia villosa* Roth (hairy vetch); A; F

Fagaceae
Quercus fusiformis Small (Texas live oak); P; T

Gentianaceae
Sabatia campestris Nutt. (meadow pink); A; F

Geraniaceae
**Erodium cicutarium* (L.) L'Hér. ex Aiton (redstem stork's-bill); A; F
**Geranium dissectum* L. (cut-leaved crane's-bill); A; F

Iridaceae
Sisyrinchium angustifolium Mill. (narrow-leaved blue-eyed grass); P; F

Juncaceae
Juncus torreyi Coville (Torrey's rush); P; G

Lamiaceae
**Lamium amplexicaule* L. (henbit deadnettle); A; F
Lycopus americanus Muhl. ex W.P.C. Barton (American bugleweed); P; F
Teucrium canadense L. (American germander); P; F

Lythraceae
Ammannia coccinea Rottb. (scarlet toothcup); A; F

Moraceae
Maclura pomifera (Raf.) C.K.Schneid. (Osage-orange); P; T

Oleaceae
Fraxinus pennsylvanica Marsh. (green ash); P; T
**Ligustrum quihoui* Carrière (quihoui privet); P; S
**Ligustrum sinense* Lour. (Chinese privet); P; S

Onagraceae
Oenothera suffulta (Engelm. ex A. Gray) W.L. Wagner & Hoch (roadside gaura); A; F

Oxalidaceae
Oxalis violacea L. (violet woodsorrel); P; F

Plantaginaceae
**Callitriche heterophylla* Pursh (large water-starwort); P; F
Plantago patagonica Jacq. (ribwort plantain); A; F
Plantago virginica L. (dwarf plantain); A; F
**Veronica arvensis* L. (corn speedwell); A; F
**Veronica peregrina* L. (purslane speedwell); A; F
**Veronica polita* Fr. (grey field-speedwell); A; F

Poaceae
Andropogon glomeratus (Walter) Britton, Sterns & Poggenb. (maritime bluestem); P; G
**Arundo donax* L. (giant reed); P; G
Bothriochloa laguroides (DC.) Herter (silver bluestem); P; G
**Bromus catharticus* Vahl (rescue brome); A; G
**Cynodon dactylon* (L.) Pers. (Bermuda grass); P; G
Dichanthelium oligosanthes (Schult.) Gould (Scribner's panicgrass); P; G
**Echinochloa crus-galli* (L.) P. Beauv. (barnyardgrass); A; G
Elymus canadensis L. (Canada wild rye); P; G
Eragrostis spectabilis (Pursh) Steud. (purple lovegrass); P; G
Hordeum pusillum Nutt. (little barley); A; G
**Paspalum dilatatum* Poir. (Dallis grass); P; G
Poa arachnifera Torr. (Texas bluegrass); P; G
**Secale cereale* L. (rye); A; G

Polygonaceae
**Rumex crispus* L. (curly dock); P; F

Ranunculaceae
Anemone caroliniana Walter (carolina anemone); P; F
**Clematis terniflora* DC. (autumn clematis); P; V
Ranunculus sceleratus L. (cursed crowfoot); A; F

Rosaceae
Prunus angustifolia Marshall (Chickasaw plum); P; S
**Pyrus calleryana* Decne. (callery pear); P; T
**Spiraea cantoniensis* Lour. (Reeve's spirea); P; S

Rubiaceae
**Cruciata pedemontana* (Bellardi) Ehrend. (piedmont bedstraw); A; F
Galium aparine L. (stickwilly); A; F
Houstonia pusilla Schoepf (tiny bluet); A; F
**Sherardia arvensis* L. (field madder); A; F

Salicaceae
Populus deltoides W. Bartram ex Marshall (eastern cottonwood); P; T
Salix nigra Marshall (black willow); P; T

Solanaceae
Solanum dimidiatum Raf. (western horsenettle); P; F
Solanum elaeagnifolium Cav. (silverleaf nightshade); P; F
Solanum rostratum Dunal (buffalo-bur); A; F

Verbenaceae
Phyla lanceolata (Michx.) Greene (lanceleaf frogfruit); P; F

Vitaceae
Ampelopsis cordata Michx. (heart leaf peppervine); P; V
Vitis rotundifolia Michx. (muscadine); P; V

Zygophyllaceae
**Tribulus terrestris* L. (puncture vine); A; F