Research Report for City of Kentwood Parks and Recreation Department

Plaster Creek Floodplain and Adjacent Ravines Near Stanaback Park: Botanical Inventory Highlights and Management Considerations

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In the summer of 2021, Calvin University faculty (Dr. David Warners and Dr. Garrett Crow) and students (Haley Weesies, Zachary Hartwig, and Lucas Walker) conducted a botanical inventory along Plaster Creek in an undeveloped region adjacent to the small recreational area maintained by the City of Kentwood at Stanaback Park. The area inventoried included the floodplain along Plaster Creek as well as an extensive ravine system bordering the floodplain. The broader undeveloped area includes a complex of parcels bordered on the north by 32nd Street and on the south by Pfeiffer Woods Drive. Plaster Creek enters the area from Shaffer Avenue on the east, and meanders through the site, exiting to the west under Breton Road. The site is accessible from Stanaback Park. The City of Kentwood owns multiple parcels that include both ravine and floodplain ecosystems. Others who own portions of this extensive natural area include G. J. & L. Martin Trust, Shaffer LLC, E. Rose Associates, and Hampton Meadows H.A. The purposes of this inventory are to inform the City of Kentwood Parks and Recreation department about the site's floristic quality, diversity, and ecological significance. This assessment also produced a comprehensive botanical inventory, as well as management suggestions for how best to care for this area into the future.

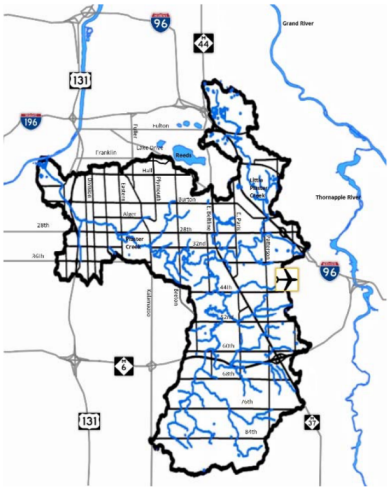
In the summer of 2021, the research team visited this area of ravines and floodplain a total of twenty-one times to conduct our field research. During our visits, we carefully walked throughout different sections of the study site, identifying each vascular plant species we saw growing there and observing how the flora developed throughout the season. In addition to keeping detailed field notes, we documented permanent records of the findings of our inventory by collecting voucher specimens that have been deposited in the Calvin University Herbarium. Additionally, we sent duplicate specimens to the Michigan State University Herbarium and/or University of Michigan Herbarium.

Background: Emma Cole Project and the Plaster Creek Watershed

The botanical inventory conducted of the Plaster Creek floodplain at this site was part of the larger Emma Cole Grand Rapids Flora Project conducted by the Calvin University Herbarium.

This project is led by Dr. Crow and Dr. Warners who, for the past seven years, have studied the work of the historic local botanist Emma Cole. Ms. Cole was a respected teacher at Grand Rapids Central High School and scientist with the Kent Scientific Institute (forerunner of the Grand Rapids Public Museum) around the turn of the 20th century. In 1901, Cole published a book entitled *Grand Rapids Flora: A Catalogue of the Flowering Plants and Ferns Growing Without Cultivation in the Vicinity of Grand Rapids, Michigan*.

The Emma Cole Grand Rapids Flora Project aims to revisit high quality remnant natural sites that still exist within the 16 townships (585 square miles) centered on downtown Grand Rapids that Cole covered in her *Grand Rapids Flora*. Although we cannot determine if Emma Cole's field work along Plaster Creek included the study area adjacent to Stanaback Park, we have encountered 101 specimens she or her colleagues collected along Plaster Creek, especially at the Plaster Creek-Madison Ave. crossing, at Plaster Creek near the Paris Town Hall (area around the Kalamazoo Ave. crossing/Ken-O-Sha Park), and Crystal Springs (Plaster Creek crossing at 68th St., just west of Dutton). The work we did at Stanaback Park complements inventories we have done at six other floodplain sites along Plaster Creek. A scientific manuscript is being prepared in which we compare these seven sites to each other and to the list of Plaster Creek specimens that Emma Cole collected.



The Plaster Creek watershed is approximately 58mi^2 and the botanical diversity and ecological aspects of its floodplain present a unique case study for examining the impact of development within the greater Grand Rapids area as it has altered the area's biodiversity in the 120+ years since Emma Cole's study of the flora. The creek itself is about 14 miles long, and its watershed occupies about 58 square miles of West Michigan. Its headwaters are located southeast of Grand Rapids in the agricultural areas of Dutton and Caledonia. The creek then meanders through present-day Kentwood and the city of Grand Rapids, including commercial, residential, and industrial areas, and it empties into the Grand River about one mile south of downtown Grand Rapids. By the time it reaches the Grand River, Plaster Creek is classified as one of the most degraded waterways in West Michigan, a sad reality that is due in large part to the impacts that agricultural development, urbanization, and industrialization have had on this watershed.

While some healthy, intact floodplain does still remain in the creek's watershed, much of it has been badly degraded or destroyed. In many places, impervious pavement carries large volumes of polluted stormwater runoff into Plaster Creek and its tributaries during each rain event. Consequently, the creek carries high sediment loads, along with toxic levels of *E. coli* and other harmful substances like road salt, pesticides, fertilizers, and animal manure (https://calvin.edu/plaster-creek-stewards/plaster-creek-watershed/).

The value of intact floodplain in the Plaster Creek watershed cannot be overstated. As we witnessed firsthand while conducting our research, healthy floodplains are areas where the creek readily overtops its banks, slowing the speed of its water, which then drops out sediment, since slow-moving water cannot carry as much suspended material as fast-moving water. Floodplains that are functioning well in upstream locations will decrease the amount of sediment that flows downstream and into the Grand River. In floodplains, much of the floodwater also percolates into the rich floodplain soils where it is captured by the roots of floodplain plants, causing lower volumes of water to pass downstream. In this way, floodplains also decrease the risk of flooding in downstream communities. In addition, healthy floodplains support a rich assemblage of native Michigan plants that enhance biodiversity and beauty in the watershed. Plaster Creek at Stanaback Park is an exceptional example of a habitat that provides all these benefits.

Plaster Creek Floodplain: Site Description and Inventory Results

The Plaster Creek floodplain in the Stanaback Park area is mostly forested and home to 29 different species of trees, 26 of which are Michigan natives. Among these are four species of Maple (*Acer saccharum, A. nigrum, A. saccharinum, A. negundo*), Pawpaw (*Asimina triloba*), Musclewood (*Carpinus caroliniana*), Redbud (*Cercis canadensis*), Hawthorn (*Crataegus succulenta*), American beech (*Fagus grandifolia*), two species of young Ash trees (*Fraxinus nigra, F. pennsylvanica*), Black walnut (*Juglans nigra*), Ironwood (*Ostrya virginiana*), Sycamore (*Platanus occidentalis*), three species of Oaks (*Quercus bicolor, Q. macrocarpa, Q. muehlenbergii),* Sassafras (*Sassafras albidum*), and Basswood (*Tilia americana*).

This site has perhaps one of the best populations of sycamore trees in the Grand Rapids area, a species typically found along rivers and streams in southern Michigan. Furthermore, high in the treetops of one cluster of sycamores is a magnificent rookery of Great Blue Herons, consisting of about 20 nests. Of the 8 shrub species present in the floodplain, 6 are native. High-quality native floodplain shrubs include Buttonbush (*Cephalanthus occidentalis*), Spicebush (*Lindera benzoin*), and Wild black currant (*Ribes americanum*). Two non-native invasive shrubs, Autumn olive (*Elaeagnus umbellata*) and Multiflora rose (*Rosa multiflora*), are widespread and common throughout the floodplain, sometimes forming dense thickets in noticeably disturbed patches.

The floodplain also boasts a wealth of graminoids (grass-like plants), including 20 different species of grass, 24 species of sedges, and 3 rushes. Sedges are an important component of Michigan's native biodiversity, especially in wetland ecosystems like floodplains. All sedge species found growing at this site are native, and a few are of notably high quality. *Carex disperma* has only been collected three times in Kent County, the most recent collection being in 1940. *Carex aquatilis*, an uncommon wetland sedge, has not been documented in Kent County since 1941. Other distinctive sedges found at the site include *Carex grayi*, *Carex lupulina*, and *Carex gracillima*. Several of the grass species found in the park's floodplain have high *C* values as well. In addition to the State Threatened Beak grass (*Diarrhena obovata*), we also found four relatively uncommon native grasses: Panic grass (*Dichanthelium lindheimeri*), Riverbank wild-rye (*Elymus riparius*), Wood reedgrass (*Cinna arundinacea*), and Satin brome (*Bromus nottowayanus*). Over half of all the plant species documented at the study site are herbaceous. In fact, the floodplain supports an impressive 115 species of herbaceous plants, many with attractive flowers. Many notable native wildflowers allegiant to floodplains were found in the study area, including Green dragon (*Arisaema dracontium*), Swamp milkweed (*Asclepias incarnata*), Golden saxifrage (*Chrysosplenium americanum*), Southern blue flag (*Iris virginica*), Cardinal flower (*Lobelia cardinalis*), Mermaid weed (*Proserpinaca palustris*), Water dock (*Rumex verticillatus*), Arum-leaved arrowhead (*Sagittaria cuneata*), Water parsnip (*Sium suave*), Common bur reed (*Sparganium eurycarpum*), Skunk cabbage (*Symplocarpus foetidus*), and four species of Violets (*Viola cucullata, V. pubescens, V. sororia V. striata*).

Some non-native herbaceous plants were common in the floodplain as well. Among the more prevalent non-native species of concern are Garlic mustard (*Alliaria petiolate*), Field garlic (*Allium vineale*), Ground-ivy (*Glechoma hederacea*), Dame's rocket (*Hesperis matronalis*), Moneywort (*Lysimachia nummularia*) – which often forms large carpets – and two species of Dock (*Rumex crispus* and *R. obtusifolius*). As previously mentioned, certain areas of the floodplain demonstrate greater evidence of disturbance than others, often marked by abundant stands of non-native species. However, we are encouraged to see many areas retaining high levels of native plant biodiversity, despite the nearby presence of non-natives.

Ravine System: Site Description and Inventory Results

The ravine system in Stanaback Park is thoroughly forested but far from homogenous throughout because of how water availability differs across the contours of this site. The ravines' highest points contain pockets of dry beech-maple forest, but seeps flow out of the ravines and create wet, marshy areas that contain wetland sedges and wildflower at the base of the slopes. Streamlets percolate from the ravine bases into the Plaster Creek floodplain and eventually empty into the creek.

In total, 20 tree species were documented in the ravine system forest, 18 of which are native. This included Sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), and a few scattered individuals of Smooth shadbush (*Amelanchier laevis*) and sassafras (*Sassafras albidum*). Other drier upland areas of the forest were dominated by Oak (*Quercus alba* and *Q. rubra*) and Hickory (*Carya cordiformis*) trees. The lower, moister to wet areas of the ravines included Sycamore (*Platanus occidentalis*), Cottonwood (*Populus deltoides*), Musclewood (*Carpinus caroliniana*), and Paw paw (*Asimina triloba*).

A total of 13 species of shrubs were documented in the ravines, 9 of which are Michigan natives. Non-native shrubs like Multiflora rose (*Rosa multiflora*), Autumn olive (*Elaeagnus umbellata*), Common privet (*Ligustrum vulgare*), and Japanese barberry (*Berberis thunbergii*) were found in patches throughout the ravines, signaling certain areas that had experienced more significant disturbance than others. A few notable native shrubs documented in the ravines include Running strawberry bush (*Euonymus obovatus*), Witch-hazel (*Hammemelis virginiana*), Prickly gooseberry (*Ribes cynosbati*), Spicebush (*Lindera benzoin*), and Maple-leaved viburnum (*Viburnum acerfolium*). The ravines contain a total of 36 graminoid species (grass-like plants), 25 of which are sedges. The diversity of micro-habitats provided by the ravine system help explain why the site supports such a wide diversity of sedges; both upland and wetland species were found in various parts of the ravine forest. Notable upland sedges found here include *Carex albursina*, a sedge with distinctively wide leaves; *Carex communis*, a sedge with deep red leaf bases; *Carex jamesii*, a sedge characteristic of rich beech-maple forests; and *Carex plantaginea*, a unique early-flowering sedge with very wide leaves and bright red leaf bases. Wetland sedges of interest in the ravines include *Carex grayi* and *Carex lupulina*, both of which have distinctive inflated fruits; *Carex prasina,* which has only been documented once before in Kent County; and *Carex scabrata*, a tall, carpet-forming sedge that favors wet areas in rich deciduous forests, including ravine bottoms.

About 40% (54 spp.) of the total number of species documented in the ravine system are herbaceous flowering plants, many of which are high-quality native spring and summer wildflowers. Some notable attractive wildflowers that characterize the dry, upland forest include Dolls-eyes (*Actaea pachypoda*), Wild leek (*Allium tricoccum*), Yellow trout lily (*Erythronium americanum*), Beech drops (*Epifagus virginiana*), Sharp-lobed hepatica (*Hepatica acutiloba*), three species of *Maianthemum* (*M. canadense*, *M. racemosum*, and *M. stellatum*), Bishop's-cap (*Mitella diphylla*), May-apple (*Podophyllum peltatum*), Bloodroot (*Sanguinaria canadensis*), Bluestem goldenrod (*Solidago caesia*), Zigzag goldenrod (*Solidago flexicaulis*), Early meadow-rue (*Thalictrum dioicum*), and Vommon trillium (*Trillium grandiflorum*). Some notable wildflowers characteristic of the wet, seepy, marshy areas of the ravines include Swamp milkweed (*Asclepias incarnata*), False-rue anemone (*Enemion biternatum*), two species of Touch-me-not (*Impatiens capensis* and *I. pallida*), three species of Smartweed *(P. punctata*, *P. sagittata*, and *P. virginiana*), Hooked crowfoot (*Ranunculus recurvatus*), and Skunk cabbage (*Symplocarpus foetidus*).

Analysis of Floristic Quality

Utilizing the species lists we compiled during the 2021 growing season, we performed a floristic quality assessment of the floodplain and ravine forest using a quantitative tool called the Universal FQA Calculator (https://universalfqa.org). The purpose of this assessment is to estimate the overall floristic quality of a parcel of land. This is done by using the Coefficient of Conservatism values (*C*) for each of the plant species growing in a site to produce a statistical measure called the Floristic Quality Index (FQI).

A Coefficient of Conservatism (*C*) value is a number from 0–10 that is assigned to each Michigan native plant species. The *C* value indicates how allegiant that particular species is to its natural habitat in Michigan. Thus, species with low *C* values tend to thrive in a wide variety of habitats, often growing in disturbed areas, and can become weedy. On the other hand, species with high *C* values typically only grow in a rather narrow range of habitats that have experienced little disturbance, like an unaltered prairie, bog, or old-growth forest. Consequently, species with high *C* values tend to be "uncommon" or "rare" because so much of the Michigan landscape has experienced considerable disturbance over time. In other words, the pristine habitats that those species require are now few and far between. All non-native species automatically receive a *C* value of zero for the calculations.

The Floristic Quality Index (FQI) provides a quantitative measure of the floristic quality of a site. We can calculate it both for native species alone and for the total flora at the site (combined native and non-native). In the state of Michigan, since most habitats have experienced some level of disturbance over the years, most sites will have relatively low FQI scores of 20-25. Scores above 35 indicate that a particular parcel is of such high natural quality that it is worthy of preservation; such a site could not be restored to its pre-settlement condition. These sites are also considered "unmitigable", meaning that restorationists don't know how to make a site with that much natural quality. The highest FQI threshold set by the state is 50. Sites with FQI scores above 50 represent the rare, nearly pre-settlement condition of the state and should receive priority for conservation efforts (see Table 1).

The floodplain at Stanaback Park is impressive in size and floristic quality. Although evidence of disturbance is present, especially in some localized patches, the site as a whole contains a wealth of Michigan's native floodplain floral diversity. A total of 217 species were documented at the site, 80.6 percent of which (175 spp.) are native. The total mean *C* value at the site was 3.2, and 9 different species have *C* values of 8-10 were found growing in the Stanaback floodplain (see Table 2). A couple of species with high *C* values of special interest are Virginia bluebells (*Mertensia virginica*) a state-endangered spring wildflower—pictured left—, and beak grass (*Diarrhena obovata*), a state-threatened grass that only grows in floodplain forests.

Our analysis of the floodplain at Stanaback Park shows the site to be of above average natural quality, representing an important remnant of the intact Plaster Creek floodplain that serves an important functional role for the creek and its watershed and supports an impressive representation of Michigan's native flora. The Total FQI score of the floodplain is 48.4, far exceeding the state's threshold for sites that are floristically important statewide and coming close to its highest threshold (see Table 1). The Native FQI of the floodplain, which removes non-native species from the calculations, is an impressive 52.8, topping the highest threshold outlined by the state to define a parcel's floristic quality (Herman et al. 2001). When taken together, these two FQI values illustrate that the floodplain supports a robust diversity of Michigan native plants that make it worthy of protection and ongoing management.

The Ravine System: was likewise found to be of high floristic quality according to our analysis. A total of 137 species were documented in the ravines, 86.9% (119 spp.) of which are native. The total mean *C* value of the ravines is higher than that of the floodplain, at 3.7. And there are also 9 species here with a *C* value of 8-10 (see Table 3).

Ravine systems have often survived because they are difficult to farm or convert to housing. Their challenging topography continues to provide important refugia for Michigan's native biodiversity. The ravine system at Stanaback Park is no exception. Its total FQI score is 43.3, rising slightly to 45.8 when non-native species are removed from the calculation (indicating a very low level of invasion by non-natives). Similar to the floodplain, this site exceeds the state's threshold for being floristically important statewide and cannot be re-created through mitigation efforts (Herman et al. 2001). It is also important to note that although we conducted separate botanical inventories of the ravines and the floodplain and treated them as two separate sites for the purposes of our research, the two localities are entirely congruent. Thus, the floristic significance of the undeveloped site in its entirety is greater than either of these two habitat areas on their own. Indeed, the site contains an impressive amount of native biodiversity because of the diversity of its topography and the variety of ecosystems it supports.

Commented [HW1]: DeBoer et al (2011) uses FQI values for 1 square meter quadrats, so their FQI values are much lower. Can we still compare them and cite it here? We could compare mean *C* values, because they use those as well. But it's not full inventory results.

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Management Considerations

Because the City of Kentwood owns a significant portion of the Plaster Creek floodplain and ravine habitat at Stanaback Park, it is important for the City to know that this is an exceptional site in terms of habitat quality and native biodiversity, worthy of careful and focused conservation efforts. Additionally, the fact that a significant portion of the Plaster Creek floodplain is City-owned gives the site even greater value in our eyes. As discussed above, Plaster Creek and its watershed have been severely damaged over the years due to a variety of human impacts. All remaining floodplains in the watershed are helping to contribute to the creek's health, which benefits people and ecosystems downstream. Additionally, allowing the healthy floodplain to persist provides the creek with space to overtop its banks in the park, decreasing the intensity of flooding in developed areas downstream. Floodplain soils that are populated by diverse floodplain vegetation soak up water like a sponge.

Thus, our strongest management recommendation is to protect and preserve the floodplain habitat. The floodplain and the ecosystem services it provides to the City of Kentwood and the

greater community in the Plaster Creek watershed are invaluable. Mitigated wetland sites tend to have low FQI scores and low average *C* values, especially when compared to natural sites (DeBoer et al. 2011). It is important not only to mitigate other lost wetlands but also to preserve sites like this one, which are irreplaceable.

Likewise, we recommend that the ravine system be preserved in its current state as well. These ravines represent a unique collection of Michigan's biodiversity that has remained undisturbed for many years. For the safety of park visitors and to protect the integrity of this habitat, we recommend that any park visitors are at most provided with views of the ravines and floodplain below, but are kept from entering these fragile ecosystems themselves.

Conclusion

We are grateful to the City of Kentwood for allowing us to do this work and to provide our recommendations for the park's wise management and preservation. It was a joy to do this work with practical applications for the City of Kentwood. Additionally, this project provided an excellent learning opportunity for summer student researchers, and the botanical inventory is a valuable contribution to our ongoing research for the Calvin University Emma Cole Grand Rapids Flora project.

TABLE 1. Significance of the Michigan Floristic Quality Assessment System for determining the value of individual natural habitats in reflecting Michigan's native biodiversity and natural landscapes, based on Herman et al. (2001).

Native FQI	Significance of habitat quality to Michigan	Value of site to Michigan
< 20	Minimal indication of natural quality	Low value
> 35	Important representation of native flora; unmitigable	Floristically important statewide
> 50	Significant component of Michigan's remaining native biodiversity	Extremely high value worthy of protection and conservation

TABLE 2. Species in the Plaster Creek floodplain at Stanaback Park having a *C* value of 8–10, indicating a high level of fidelity to a narrow range of undisturbed ecological conditions.

Species	Common Name	*C* value
Arisaema dracontium	Green Dragon	8
Asimina triloba	Paw Paw	9
Carex disperma	Sedge	10
Cercis canadensis	Redbud	8
Dichanthelium lindheimeri	Panic Grass	8
Diarrhena obovata	Beak Grass	9
Elymus riparius	Riverbank Wild Rye	8
Quercus bicolor	Swamp White Oak	8
Mertensia virginica	Virginia Bluebells	10
	Total	**9**

TABLE 3. Species in the ravine system at Stanaback Park having a *C* value of 8–10, indicating a high level of fidelity to a narrow range of undisturbed ecological conditions.

Species	Common Name	*C* value
Asimina triloba	Paw Paw	9
Carex jamesii	James Sedge	8
Carex laxiflora	Sedge	8
Carex plantaginea	Sedge	8
Carex prasina	Sedge	10
Enemion biternatum	False rue-anemone	8
Epifagus virginiana	Beech-drops	10
Hepatica acutiloba	Sharp-lobed Hepatica	8
Mitella diphylla	Bishop's Cap	8
	Total	**9**