Red Cedar South Natural Area

Bio-Inventory Report

Submitted to
MSU Campus Natural Areas Classroom, Curriculum and Conservation Committee Submitted February 2024 by Sean Ward

Executive Summary and Recommendations

Red Cedar South Natural Area is southern mesic forest on the floodplain of the Red Cedar River and holds a community of native and introduced plants and animals. With 29 tree species present in the canopy, and many native shrubs and herbs in the understory, this natural area shows the dynamism of the river floodplain. However, this native diversity is threatened by the further establishment of a few invasive species. We found a total of 135 species of vascular plants in this natural area. Of these, 109 were native species to Michigan. Based on a Floristic Quality Assessment, the plant diversity represented here is high considering and landscape context and heavy disturbances. Many non-native species were found, and abundance was high within the natural area. Most non-native species have invaded the interior and have well established populations. There is little evidence of past and ongoing research here. However, there are large camps of human activity.

From a conservation perspective, the most notable feature here is the numerous populations of a state threatened species, beak grass (*Diarrhena obovata*). It will be important to manage this natural area to maintain these populations and the natural area's high biodiversity in the canopy and in the ground layer. Research and teaching might not be

recommended with Red Cedar South Natural Area's heavy ongoing human disturbance and proximity to the public. This natural area was surveyed and sampled in May to July of 2023.

Recommendations

1. Beak grass populations should be protected and expanded. Seed should be collected to plant out in other natural areas around campus.
2. Invasion fronts of honeysuckle and buckthorn should be removed before mature populations. In the mature populations, there is little value from a conservation perspective, but there is still value in the areas being currently invaded.
3. Human disturbances should be monitored within the natural area.

Forest Inventory

Overstory

In Red Cedar South Natural Area, 29 tree species were found in the overstory (>4" dbh). Of these, 23 were encountered in a fixed-area plot inventory and the other six species were encountered during a meandering survey of the natural area. Living overstory (>4" dbh) trees had a total basal area of 180 ft^2 ac^{-1} and a stem density of 150 trees per acre. Silver maple (*Acer saccharinum*) is this natural area's most important overstory species and it has the highest relative density and dominance. However, common buckthorn (*Rhamnus cathartica*) has the highest relative dominance (Table 1). Box elder (*Acer negundo*), black maple (*Acer nigrum*), and hackberry (*Celtis occidentalis*) are also dominant throughout this natural area.

The six other overstory species which were identified during a meandering survey include tree of heaven, black alder, northern catalpa, black ash, American elm, and honey locust.

Table 1. Overstory stand composition. Relative dominance is the percentage of the total stand basal area made up by each species, relative density is the percentage of total individuals and relative frequency is the percentage of plots in which a species was found. Importance Value (IV) is a summary statistic that averages across relative dominance, density, and frequency.

Species	Rel. Dominance	Rel. Density	Rel. Frequency	Importance Value
Acer negundo	2.9	3.4	40.0	15.4
Acer nigrum	5.9	6.8	30.0	14.2

Acer rubrum	6.0	7.0	10.0	7.7
Acer saccharinum	47.9	55.3	35.0	46.0
Acer saccharum	7.5	8.6	20.0	12.0
Carpinus caroliniana	0.2	0.3	10.0	3.5
Carya cordiformis	0.1	0.1	5.0	1.7
Celtis occidentalis	4.2	4.8	30.0	13.0
Crataegus sp.	0.1	0.1	5.0	1.7
Fagus grandifolia	4.7	5.5	5.0	5.1
Fraxinus americana	0.1	0.1	5.0	1.7
Fraxinus pennsylvanica	1.2	1.4	15.0	5.9
Fraxinus sp.	0.4	0.5	10.0	3.6
Juglans nigra	2.5	2.9	5.0	3.5
Liriodendron tulipifera	0.0	0.0	10.0	3.3
Lonicera maackii	0.0	0.1	5.0	1.7
Platanus occidentalis	0.3	0.3	5.0	1.9
Populus deltoides	4.4	5.1	15.0	8.2
Prunus serotina	2.7	3.1	20.0	8.6
Quercus bicolor	0.4	0.4	10.0	3.6
Quercus macrocarpa	2.2	2.5	5.0	3.2
Rhamnus cathartica	2.2	2.6	40.0	14.9
Tilia americana	4.1	4.7	15.0	7.9
Ulmus rubra	0.1	0.1	5.0	1.7

Understory

Red Cedar South Natural Area supports an estimated 445 sapling stems per acre (at least 4.5 feet tall and </= 4" dbh). The dominant species in the sapling class are Amur honeysuckle and common buckthorn, both with 40% relative frequencies. These saplings were common in 8 of 20 plots and throughout the rest of the natural area. When present in a plot, these two species tend to dominate, often choking out native seedlings and shrubs. Morrow's honeysuckle and has a 15% relative frequency, while natives like the hawthorns (*Crataegus spp.*), and sugar maple both have a 10% relative frequency. The main components of the overstory are infrequent and have been seen at low frequencies in the understory layer, prompting concern for their regeneration. The silver maples that dominate the overstory here, for example, were not recorded at all during the sampling.

Table 2. Composition and size class distribution of the sapling layer in Red Cedar South Natural Area. Relative density and relative frequency for each species are expressed as a percentage of the total number of saplings, whereas individuals within each sapling size class are expressed as trees per acre.

Species	**Rel. Dens.**	**Rel. Freq.**	**1" TPA**	**2" TPA**	**3" TPA**	**4" TPA**
Acer negundo	1.1	5.0	0	0	0	1
Acer nigrum	1.1	5.0	0	1	0	0
Acer saccharum	2.3	10.0	0	1	0	1
Cephalanthus occidentalis	1.1	5.0	1	0	0	0
Crataegus sp.	4.5	5.0	0	1	2	1
Fagus grandifolia	1.1	5.0	1	0	0	0
Fraxinus nigra	1.1	5.0	0	0	1	0
Ligustrum vulgare	6.7	10.0	6	0	0	0
Lonicera maackii	33.7	40.0	13	9	5	3
Lonicera morrowii	11.2	15.0	2	5	2	1
Prunus serotina	3.4	10.0	1	0	2	1
Prunus virginiana	1.1	5.0	0	0	0	1

Rhamnus cathartica	28.1	40.0	9	5	8	3
Unknown	1.1	5	0	1	0	0
Vitis riparia	2.3	5	0	0	2	0

Regeneration Layer

13 tree species were identified in the seedling layer (<4.5 feet tall). The most frequent are butternut hickory and black maple (Table 3). The dominating species in the seedling layer are the invasive honeysuckles (*Lonicera spp.*), common buckthorn and private. All the native overstory tree species were found in low frequencies within the sampled plots. The regeneration of the overstory layer is concerning with this increased frequency and average cover of non-native and invasive species which will choke out the native ground vegetation and tree seedlings.

Table 3. Coverage and relative frequency of tree species in the seedling layer. Coverage is an estimate of the ground area of the plot covered by that species and relative frequency is the percentage of plots in which that species was found.

Species	Average % Coverage	Rel. Frequency
Acer negundo	2.5	5
Acer nigrum	2.5	25
Acer rubrum	2.5	15
Acer saccharum	2.5	5
Carpinus caroliniana	2.5	20
Carya cordiformis	2.5	40
Catalpa speciosa	2.5	5
Celtis occidentalis	2.5	20
Fraxinus pennsylvanica	2.5	20
Fraxinus sp.	2.5	5
Lonicera spp.	6.3	65

Prunus serotina	2.5	5
Rhamnus cathartica	14.5	50
Tilia americana	2.5	5
Ulmus sp.	2.5	5

Stand Condition, Snags and Coarse Woody Debris

All the inventoried overstory trees were assigned to one of three Risk Classes based on structural integrity and evidence of disease/pest issues: RC1 = very low probability of dying during the next 20 years, RC2 = moderate probability of dying over the next 20 years, and RC3 = high probability of dying over next 20 years. Of the total stand basal area of 180 ft^2 ac^{-1}, 70% (125 ft^2 ac^{-1}) was in Risk Class 1 trees, 21% (38 ft^2 ac^{-1}) was in Risk Class 2 with 17% (9 ft^2 ac^{-1}) in Risk Class 3. On an individual tree basis, 67% (104 trees per acre) were in Risk Class 1, 28% (43 trees per acre) were in Risk Class 2, and 5% (9 trees per acre) were in Risk Class 3. In addition to living trees, 17 standing dead (snags) trees were found per acre, which together accounted for 27 ft^2 ac^{-1}. Of the 17 snags per acre 11% were in Decay Class 1, 23% in Decay Class 2, 23% in Decay Class 3, 29% in Decay Class 4, and 11% in Decay Class 5.

Across the natural area, an average of 62.9 m^3 ha^{-1} of coarse woody debris (CWD) was identified. Variability across the natural area spanned from 0 to 179.8 m^2 ha^{-1} within the sampled plots. A coefficient of variation (CV) of 103.3% was recorded for this natural area.

Forest Inventory Summary and Conclusions

Red Cedar South Natural Area contains a good representation of a mesic southern forest as defined by the Michigan Natural Features Inventory (Cohen et al. 2020). Despite supporting a biodiverse native community, many invasive species have begun to dominate some areas of this natural area. Without proper management, these invasive species will eliminate the rich native flora.

Within the natural area are distinct forest zones. The upland forested area along Kalamazoo Street supports an overstory of mature sugar maple, American beech, hophornbeam, sycamore, and silver maple with an herbaceous layer dominated by wild ginger, leeks, and wild geranium. This deeply shaded part of the natural area lacks a shrub layer and any sign of regenerating tree species. Moving closer to the Red Cedar River, the overstory composition quickly becomes dominated by silver maple and boxelder. Here the shrub layer begins to appear by large and apparently old populations of honeysuckles and common buckthorn. Some sampled plots were

almost impassable due to the thick boughs of these mature invasive species. The open air surrounding the service road and rights-of-way that cut through this natural area have quickly been eaten up by the highly invasive reed canary grass.

Botanical Assessment

Overall 135 different species of vascular plants were found in Red Cedar South Natural Area. Of the 135 species completely identified, 109 were native and 26 were non-native. Several of the native species have a high C value, indicative of fidelity to high quality native habitats. This species list resulted in a Total Floristic Quality Index (FQI) of 40.7 for Red Cedar South Natural Area. The FQI measures the botanical quality of a site from a biodiversity conservation perspective, an FQI score less than 20 indicates that the site is of insignificant value in terms of plant biodiversity, a score greater than 35 indicates an important site for plant biodiversity, and a score greater than 50 indicates a site with outstanding plant biodiversity value.

Table 4. Listing of all vascular plants identified to species in and around Red Cedar South Natural Area in May to July of 2023.

Scientific Name	**Family**	**Native**	**Physiognomy**
Acer negundo	Sapindaceae	native	tree
Acer nigrum	Sapindaceae	native	tree
Acer rubrum	Sapindaceae	native	tree
Acer saccharinum	Sapindaceae	native	tree
Acer saccharum	Sapindaceae	native	tree
Agrimonia gryposepala	Rosaceae	native	forb
Ailanthus altissima	Simaroubaceae	non-native	tree
Alliaria petiolata	Brassicaceae	non-native	forb
Allium canadense	Alliaceae	native	forb
Allium tricoccum	Alliaceae	native	forb
Alnus glutinosa	Betulaceae	non-native	tree

Apocynum cannabinum	Apocynaceae	native	forb
Arisaema dracontium	Araceae	native	forb
Arisaema triphyllum	Araceae	native	forb
Asarum canadense	Aristolochiaceae	native	forb
Asclepias incarnata	Apocynaceae	native	forb
Berberis thunbergii	Berberidaceae	non-native	shrub
Boehmeria cylindrica	Urticaceae	native	forb
Cardamine concatenata	Brassicaceae	native	forb
Carex albursina	Cyperaceae	native	sedge
Carex blanda	Cyperaceae	native	sedge
Carex cephaloidea	Cyperaceae	native	sedge
Carex davisii	Cyperaceae	native	sedge
Carex gracillima	Cyperaceae	native	sedge
Carex grayi	Cyperaceae	native	sedge
Carex grisea	Cyperaceae	native	sedge
Carex hirtifolia	Cyperaceae	native	sedge
Carex hitchcockiana	Cyperaceae	native	sedge
Carex jamesii	Cyperaceae	native	sedge
Carex muskingumensis	Cyperaceae	native	sedge
Carex rosea	Cyperaceae	native	sedge
Carex tribuloides	Cyperaceae	native	sedge
Carpinus caroliniana	Betulaceae	native	tree
Carya cordiformis	Juglandaceae	native	tree

Catalpa speciosa	Bignoniaceae	non-native	tree
Celastrus orbiculatus	Celastraceae	non-native	vine
Celtis occidentalis	Cannabaceae	native	tree
Cephalanthus occidentalis	Rubiaceae	native	shrub
Circaea canadensis	Onagraceae	native	forb
Cirsium arvense	Asteraceae	non-native	forb
Claytonia virginica	Montiaceae	native	forb
Crataegus mollis	Rosaceae	native	tree
Cyperus esculentus	Cyperaceae	native	sedge
Cystopteris protrusa	Cystopteridaceae	native	fern
Diarrhena obovata	Poaceae	native	grass
Dicentra cucullaria	Papaveraceae	native	forb
Dioscorea villosa	Dioscoreaceae	native	forb
Dryopteris carthusiana	Dryopteridaceae	native	fern
Dryopteris cristata	Dryopteridaceae	native	fern
Elymus repens	Poaceae	non-native	grass
Enemion biternatum	Ranunculaceae	native	forb
Erechtites hieraciifolius	Asteraceae	native	forb
Erythronium americanum	Liliaceae	native	forb
Euonymus obovatus	Celastraceae	native	shrub
Fagus grandifolia	Fagaceae	native	tree
Ficaria verna	Ranunculaceae	non-native	forb
Floerkea proserpinacoides	Limnanthaceae	native	forb

Fragaria virginiana	Rosaceae	native	forb
Fraxinus americana	Oleaceae	native	tree
Fraxinus nigra	Oleaceae	native	tree
Fraxinus pennsylvanica	Oleaceae	native	tree
Galium aparine	Rubiaceae	native	forb
Galium odoratum	Rubiaceae	non-native	forb
Geranium maculatum	Geraniaceae	native	forb
Geum canadense	Rosaceae	native	forb
Glechoma hederacea	Lamiaceae	non-native	forb
Gleditsia triacanthos	Fabaceae	native	tree
Glyceria striata	Poaceae	native	grass
Hackelia virginiana	Boraginaceae	native	forb
Hesperis matronalis	Brassicaceae	non-native	forb
Hydrophyllum appendiculatum	Boraginaceae	native	forb
Hydrophyllum virginianum	Boraginaceae	native	forb
Iris virginica	Iridaceae	native	forb
Juglans nigra	Juglandaceae	native	tree
Laportea canadensis	Urticaceae	native	forb
Leersia virginica	Poaceae	native	grass
Ligustrum vulgare	Oleaceae	non-native	shrub
Lindera benzoin	Lauraceae	native	shrub
Liriodendron tulipifera	Magnoliaceae	native	tree
Lonicera maackii	Caprifoliaceae	non-native	shrub

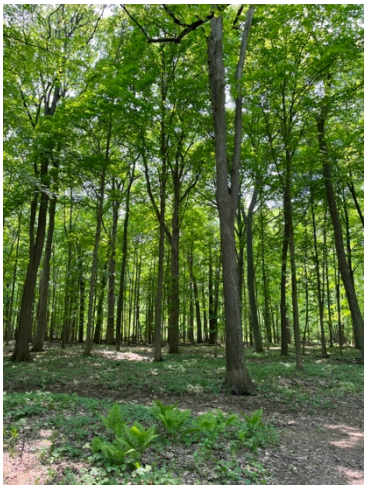
Lonicera morrowii	Caprifoliaceae	non-native	shrub
Lycopus americanus	Lamiaceae	native	forb
Lysimachia ciliata	Myrsinaceae	native	forb
Lysimachia nummularia	Myrsinaceae	non-native	forb
Maianthemum racemosum	Convallariaceae	native	forb
Maianthemum stellatum	Convallariaceae	native	forb
Matteuccia struthiopteris	Onocleaceae	native	fern
Menispermum canadense	Menispermaceae	native	vine
Mimulus ringens	Phrymaceae	native	forb
Onoclea sensibilis	Onocleaceae	native	fern
Oxalis acetosella	Oxalidaceae	native	forb
Parthenocissus inserta	Vitaceae	native	vine
Parthenocissus quinquefolia	Vitaceae	native	vine
Persicaria virginiana	Polygonaceae	native	forb
Phalaris arundinacea	Poaceae	native	grass
Pilea pumila	Urticaceae	native	forb
Pinus strobus	Pinaceae	native	tree
Platanus occidentalis	Platanaceae	native	tree
Poa pratensis	Poaceae	non-native	grass
Populus deltoides	Salicaceae	native	tree
Potentilla indica	Rosaceae	non-native	forb
Prunus serotina	Rosaceae	native	tree
Prunus virginiana	Rosaceae	native	shrub

Quercus bicolor	Fagaceae	native	tree
Quercus macrocarpa	Fagaceae	native	tree
Ranunculus abortivus	Ranunculaceae	native	forb
Ranunculus hispidus	Ranunculaceae	native	forb
Ranunculus recurvatus	Ranunculaceae	native	forb
Rhamnus cathartica	Rhamnaceae	non-native	tree
Ribes cynosbati	Grossulariaceae	native	shrub
Rosa multiflora	Rosaceae	non-native	shrub
Rubus occidentalis	Rosaceae	native	shrub
Rumex acetosella	Polygonaceae	non-native	forb
Rumex verticillatus	Polygonaceae	native	forb
Scrophularia marilandica	Scrophulariaceae	native	forb
Scutellaria lateriflora	Lamiaceae	native	forb
Solanum dulcamara	Solanaceae	non-native	vine
Teucrium canadense	Lamiaceae	native	forb
Thalictrum dioicum	Ranunculaceae	native	forb
Tilia americana	Malvaceae	native	tree
Torilis japonica	Apiaceae	non-native	forb
Toxicodendron radicans	Anacardiaceae	native	vine
Trillium flexipes	Trilliaceae	native	forb
Trillium grandiflorum	Trilliaceae	native	forb
Ulmus americana	Ulmaceae	native	tree
Ulmus rubra	Ulmaceae	native	tree

Verbena urticifolia	Verbenaceae	native	forb
Veronica chamaedrys	Plantaginaceae	non-native	forb
Veronica serpyllifolia	Plantaginaceae	non-native	forb
Viburnum opulus	Adoxaceae	non-native	shrub
Viola canadensis	Violaceae	native	forb
Viola pubescens	Violaceae	native	forb
Viola sororia	Violaceae	native	forb
Viola striata	Violaceae	native	forb
Vitis riparia	Vitaceae	native	vine

Many non-native plants were identified within Red Cedar South Natural Area. Non-native species may likely be amplified by the Red Cedar River running through this Natural Area. The invasive species most observed in the forest interior were honeysuckles (*Lonicera spp.*), buckthorns (*Rhamnus cathartica*), and garlic mustard (Alliaria petiolata), which appeared throughout the natural area. Most invasive shrubs occurred as widely spaced populations with no apparent invasion front. However, some areas were overrun with these large invasive shrubs. These populations are mature and their invasion deep into the natural area makes removal difficult. Garlic mustard was very dense along the service roads but were widespread throughout the whole natural area. The service road and electrical right-of-way that cross the natural area open the understory to high levels of light and these areas have become overrun with the invasive reed canary grass. These areas harbored individuals of the highly invasive tree of heaven. It will be important to manage the invasives to preserve the high biodiversity here and the sensitive species like beak grass (*Diarrhena obovata*) for the

Figure 1. Mature canopy supporting a rich abundance of leek, wild ginger, and ostrich ferns



Concerns, Threats, and Human Impacts

Research/Teaching Artifacts

There is little to no evidence of research and/or teaching activities within Red Cedar South Natural Area. Any trash present seems unlikely to be from research projects.

Trash, Structures or Other Human Disturbance

Homeless camps are present throughout Red Cedar South Natural Area. These were most common along the service road that cuts through the natural area. Trash was also common throughout. Waste seemed to be dumped by the well-established wet area in the northeast corner of the natural area. Various elevated, covered manhole structures were also present. These are likely connected to the sewer system.

Figure 2. Images of human disturbances and camps. The right image shows one example of an elevated structure.



Biotic Concerns

This natural area is prone to invasion by non-native species as seen by mature and widespread populations of honeysuckles, buckthorn, and garlic mustard. These species threaten the native flora, especially sensitive species like beak grass (*Diarrhena obovata*). Many deer were observed, and over browsing by them might contribute to a lack of understory representatives.

Water Features

The meandering Red Cedar River bounds this natural area and many of its arms cut through the wooded upland. These branches are generally stagnant or intermittent. During the sampling season, many existed as dried depressions. However, during the winter months these same channels were inundated. A large vernal pool/pond is well established in the northeast corner of the natural area. Despite harboring many native species like Iris, American bugleweed, and green dragon, unwanted invasive species like creeping Jenny and multiflora rose are also becoming established.

Figure 3. Water Features: Well established water feature, stagnant branch of the Red Cedar, and the main branch of the Red Cedar River.

Figure 4. Map. Natural area outlined in black. The blue markings indicate water features. The pink outlined area indicated electrical right-of-way. Service road in lighter black wavy line.

Acknowledgements

Alison Staelgraeve, Lindsay Karow, Dannielle Galang, Alaina Maniscalco, and the Beal Botanical Garden Scholars Program for helping to survey the natural area.

References

Cohen, J.G., M.A. Kost, B.S. Slaughter, D.A. Albert, J.M. Lincoln, A.P. Kortenhoven, C.M. Wilton, H.D. Enander, and K.M. Korroch. 2020. Michigan Natural Community Classification [web application]. Michigan Natural Features Inventory, Michigan State University Extension, Lansing, Michigan. Available https://mnfi.anr.msu.edu/communities/classification. (Accessed: May 21, 2021).