Red Cedar North Natural Area

Bio-Inventory Report

Submitted to

MSU Campus Natural Areas Classroom, Curriculum and Conservation

Committee Submitted August 2021 by Matthew Peña

Executive Summary and Recommendations

Red Cedar North Woodlot is a decent representation of mature southern mesic forest. It has a high diversity of tree species present in the overstory as well as species diversity within the understory and seedling layer. We observed 45 total species in the woodlot that included 38 native species and 7 non-native species. Based on a Floristic Quality Assessment, the plant diversity represented at Red Cedar North is very good, but not great. Within the 7 invasive species we observed, there were 2 that were overwhelmingly dominant: amur honeysuckle and buckthorn. We also observed a tent set up with some camping supplied within the forest.

The most concerning observation from our data was the alarmingly high volume of amur honeysuckle (*Lonicera maackii*) and buckthorn (*Rhamnus cathartica*). These 2 species are very dominant, especially in the understory, and they pose a serious threat to the future of the woodlot. Native overstory trees, such as silver maple (*Acer saccharinum*) and other maple species, are heavily present throughout the natural area, and there is even a pocket of hardy mesic forest in the western half of the natural area, but the majority of the natural area remains infested with invasive species. Despite the native overstory presence, the high frequency of amur honeysuckle and buckthorn in the understory and seedling layers mean that the future of this natural area is very much in jeopardy. Ultimately, removing the invasive species here and restoring it to a healthy, native forest would be one of the most strenuous and tedious projects across all of Michigan State's Campus Natural Areas. However, this could serve as a great opportunity to use the natural area to perform research on woody invasive species removal or restoration of native mesic and/or floodplain forests.

Recommendations
1. Manage the amur honeysuckle and buckthorn within this section of Red Cedar in order to help promote biodiversity within the forest for the future.
2. Remove the camping set up that exists within the woodlot.

Forest Inventory
Overstory

In total, we encountered 22 tree species in the overstory (>4" dbh) at Red Cedar North; 18 of these were encountered in our fixed-area plot inventory, and the other 4 were found during our walking survey of the forest. The living overstory trees (>4" dbh) at Red Cedar North had a total basal area of 117.96 ft^2 ac^{-1} and a stem density of 128 trees per acre. Silver maple (*Acer saccharinum*) was the most important overstory species that we observed, largely in part due to its high relative dominance and density. It did not have the highest relative density, however, as that species is buckthorn (*Rhamnus cathartica*). Buckthorn was the second most important overstory species observed at Red Cedar North. The third most important species, boxelder maple, had the highest relative frequency among all overstory species, as it occurred in 40% of our plots. Every other species was observed in only 3 plots or less, making for a very diverse overstory with not any clear overly dominant species. While each of the other species were observed in low densities, frequencies, and dominance levels, there were still a few that had fairly significant importance values: black maple (*Acer nigrum*), American elm (*Ulmus americana*), northern hackberry *(Celties occidentalis*), and slippery elm (*Ulmus rubra*). Each of the other species found within plots were fairly insignificant to the overall overstory of Red Cedar North. The remaining species were: amur honeysuckle (*Lonicera maackii*), basswood (*Tilia americana*), black walnut (*Juglans nigra*), eastern cottonwood (*Populus deltoides*), red maple (*Acer rubrum*), red oak (*Quercus rubra*), red pine (*Pinus resinosa*), sugar maple (*Acer saccharum*), white ash (*Fraxinus pennsylvanica*), white oak (*Quercus alba*), and yellow birch (*Betula alleghaniensis)*. As stated before, we also encountered 4 species that were not found in any of our plots. These species were: bur oak (*Quercus macrocarpa*), peachleaf willow (*Salix amygdaloides*), staghorn sumac (*Rhus typhina*), and American sycamore (*Platanus occidentalis*).

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	IV
American Elm	5.2	6.3	30	13.8
Amur Honeysuckle	0.2	1.6	10	3.9
Basswood	1.1	3.1	10	4.7
Black Maple	8.9	7.8	30	15.6
Black Walnut	1.4	4.7	10	5.4

Boxelder	2.3	6.3	40	16.2
Buckthorn	3.5	23.4	30	18.9
Eastern Cottonwood	7.0	4.7	10	7.2
Northern Hackberry	0.9	4.7	30	11.9
Red Maple	2.9	1.6	10	4.8
Red Oak	1.3	1.6	10	4.3
Red Pine	4.2	3.1	10	5.8
Silver Maple	44.9	17.2	30	30.7
Slippery Elm	1.2	4.7	30	11.9
Sugar Maple	0.6	3.1	10	4.6
White Ash	0.6	3.1	20	7.9
White Oak	13.0	1.6	10	8.2
Yellow Birch	0.8	1.6	10	4.1

Understory

  Based on our inventory plots, we estimate that there are about 920 trees per acre in the sapling layer (at least 4.5 feet tall and a dbh less than 4") at Red Cedar North. The sapling layer here is very much dominated by 2 species: amur honeysuckle and buckthorn (Table 2). Amur honeysuckle occurred in 6 of our 10 plots while having a species TPA of 410 while buckthorn occurred in 5 of our 10 plots and had a species TPA of 300. Only one other understory species occurred in more than one plot, and that was bladdernut (*Staphylea trifolia*). The remaining understory species were observed in only one plot each, thus accounting for very little density and trees per acre within Red Cedar North: black locust (*Robinia pseudoacacia*), honeylocust (*Gleditsia triacanthos*), poison ivy (*Toxicodendron radicans*), riverbank grape (*Vitis riparia*), slippery elm (*Ulmus rubra*), and tartarian honeysuckle (*Lonicera tatarica*). There were 2 vine species that we included in our understory data, poison ivy and riverbank grade, due to their very large vine sizes. As shown in table 2, there were some poison ivy vines that reached into the 2 inch diameter class, and while there were no riverbank grapes that were this big, they were all very close to the 2 in. diameter class.

  The biggest takeaway from our data on the sapling layer is that it is being dominated by 2 very invasive species. Throughout our 9 total understory species, only honeylocust, slippery elm, and bladdernut are native trees and shrubs. This is very alarming for the future of Red Cedar North, as these native species were also observed in low quantities. Of all the important species observed in the overstory, such as silver maple, black maple, boxelder, and northern hackberry (just to name a few), none of them were found growing in the understory. While slippery elm was observed both in the understory and overstory, it is not a tree that can grow very tall. As for honeylocust, while there are individuals in the understory, we did not observe any overstory individuals of this species, suggesting that Red Cedar North is not a suitable

habitat for honeylocust to thrive in right now. This must be due to the dominance of species such as amur honeysuckle and buckthorn because this area of Red Cedar contains lots of riparian areas - perfect for honeylocust.

Table 2. Composition and size class distribution of the sapling layer in Red Cedar North. 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
Amur Honeysuckle	44.6	60	150	200	60	0
Black Locust	1.1	10	0	0	10	0
Bladdernut	3.3	20	20	0	10	0
Buckthorn	32.6	50	40	120	120	20
Honeylocust	6.5	10	0	60	0	0
Poison Ivy	6.5	10	30	30	0	0
Riverbank Grape	2.2	10	20	0	0	0
Slippery Elm	1.1	10	0	0	10	0
Tartarian Honeysuckle	2.2	10	0	20	0	0

Regeneration Layer

We observed 7 species regenerating in the seedling layer (<4.5 feet tall) of Red Cedar North: black locust, boxelder, buckthorn, chinkapin oak (*Quercus muehlenbergii)*, northern hackberry, sugar maple, and white ash. Each of these species were observed in very low numbers as Red Cedar North had a very sparse ground cover of regenerating tree species. Buckthorn had the highest average coverage % of 8.75% while all other species averaged the lowest possible value of 2.5%. Buckthorn was also observed regenerating in the most plots, occurring in 6 of our 10 total plots. Northern hackberry and white ash were found regenerating in 5 of our 10 plots, and black locust, boxelder, chinkapin oak, and sugar maple were all found regenerating in only 1 plot.

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
Black Locust	2.5	10
Boxelder	2.5	10

Buckthorn	8.75	60
Chinkapin Oak	2.5	10
Northern Hackberry	2.5	50
Sugar Maple	2.5	10
White Ash	2.5	50

Stand Condition, Snags, and Coarse Woody Debris

All of 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 basal area of 117.96 ft^2 ac^{-1}, 89% (105 ft^2 ac^{-1}) was in Risk Class 1 trees, 2% (2 ft^2 ac^{-1}) was in Risk Class 2, and 9% (11 ft^2 ac^{-1}) was in Risk Class 3. On an individual tree basis, 84% (108 trees per acre) were in Risk Class 1, 5% (6 trees per acre) were in Risk Class 2, and 11% (14 trees per acre) were in Risk Class 3 in the total 128 trees per acre. In addition to living trees, we found 22 standing dead (snags) trees per acre, which account for 23.7 ft^2 ac^{-1}. Eleven standing dead trees were observed, with 4 of them being in decay class 1, 2 in decay class 2, 3 in decay class 3, and 2 in decay class 4. We did not observe any standing dead trees in decay class 5.

Across the woodlot, we found an average of 47.3 m^3 ha^{-1} of coarse woody debris (CWD). Coarse woody debris was distributed across the woodlot with 8 of 10 plots having at least one piece of CWD. We observed 4 logs in decay class 2, 12 in decay class 3, 4 in decay class 4, and 2 in decay class 5. No logs in decay class 1 were observed.

Forest Inventory Summary and Conclusions

While Red Cedar North has a variety of species across all forest layers, the forest is largely dominated by invasive species, especially buckthorn and amur honeysuckle. These 2 species are overwhelmingly dominant in the sapling layer and are preventing other species from growing into their full sizes. The seedling layer also contains very little quantity of tree species, providing further evidence that if the buckthorn and amur honeysuckle are not exterminated, they will push out all of the native species from this section of Red Cedar. Action against these 2 invasive species must be taken as soon as possible.

Botanical Assessment

Overall, we found 45 species of vascular plants in Red Cedar North. Of these species, 38 of them are native species and 7 are non-native species. Several of the native species have high C values, indicating that Red Cedar North has high quality native habitats. The species list overall resulted in a Floristic Quality Index (FQI) of 23.5. 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 North in July, 2021.

Scientific Name	Family	Native?	C	Form	Duration	Common Name
Acer negundo	Sapindaceae	native	0	tree	perennial	box-elder
Acer nigrum; a. saccharum	Sapindaceae	native	4	tree	perennial	black maple
Acer rubrum	Sapindaceae	native	1	tree	perennial	red maple
Acer saccharinum	Sapindaceae	native	2	tree	perennial	silver maple
Acer saccharum	Sapindaceae	native	5	tree	perennial	sugar maple
Allium tricoccum	Alliaceae	native	5	forb	perennial	wild leek
Arisaema dracontium	Araceae	native	8	forb	perennial	green dragon
Arisaema triphyllum	Araceae	native	5	forb	perennial	jack-in-the-pulpit
Asarum canadense	Aristolochiaceae	native	5	forb	perennial	wild-ginger
Betula alleghaniensis	Betulaceae	native	7	tree	perennial	yellow birch
Boehmeria cylindrica	Urticaceae	native	5	forb	perennial	false nettle
Celtis occidentalis	Cannabaceae	native	5	tree	perennial	hackberry
Circaea canadensis; c. lutetiana	Onagraceae	native	2	forb	perennial	enchanters-nightshade
Euonymus obovatus	Celastraceae	native	5	shrub	perennial	running strawberry-bush
Fraxinus americana	Oleaceae	native	5	tree	perennial	white ash
Geranium maculatum	Geraniaceae	native	4	forb	perennial	wild geranium
Geum canadense	Rosaceae	native	1	forb	perennial	white avens
Gleditsia triacanthos	Fabaceae	native	8	tree	perennial	honey locust
Hieracium murorum	Asteraceae	non-native	0	forb	perennial	hawkweed
Hydrophyllum virginianum	Boraginaceae	native	4	forb	perennial	virginia waterleaf
Juglans nigra	Juglandaceae	native	5	tree	perennial	black walnut
Ligustrum vulgare	Oleaceae	non-native	0	shrub	perennial	common privet
Lonicera maackii	Caprifoliaceae	non-native	0	shrub	perennial	amur honeysuckle
Lonicera tatarica	Caprifoliaceae	non-native	0	shrub	perennial	tartarian honeysuckle
Lysimachia nummularia	Myrsinaceae	non-native	0	forb	perennial	moneywort

Onoclea sensibilis	Onocleaceae	native	2	fern	perennial	sensitive fern
Parthenocissus quinquefolia	Vitaceae	native	5	vine	perennial	virginia creeper
Persicaria virginiana; polygonum v.	Polygonaceae	native	4	forb	perennial	jumpseed
Pinus resinosa	Pinaceae	native	6	tree	perennial	red pine
Platanus occidentalis	Platanaceae	native	7	tree	perennial	sycamore
Populus deltoides	Salicaceae	native	1	tree	perennial	cottonwood
Quercus alba	Fagaceae	native	5	tree	perennial	white oak
Quercus macrocarpa	Fagaceae	native	5	tree	perennial	bur oak
Quercus muehlenbergii	Fagaceae	native	5	tree	perennial	chinquapin oak
Quercus rubra	Fagaceae	native	5	tree	perennial	red oak
Rhamnus cathartica	Rhamnaceae	non-native	0	tree	perennial	common buckthorn
Rhus typhina	Anacardiaceae	native	2	shrub	perennial	staghorn sumac
Robinia pseudoacacia	Fabaceae	non-native	0	tree	perennial	black locust
Salix amygdaloides	Salicaceae	native	3	tree	perennial	peach-leaved willow
Staphylea trifolia	Staphyleaceae	native	9	shrub	perennial	bladdernut
Tilia americana	Malvaceae	native	5	tree	perennial	basswood
Toxicodendron radicans	Anacardiaceae	native	2	vine	perennial	poison-ivy
Ulmus americana	Ulmaceae	native	1	tree	perennial	american elm
Ulmus rubra	Ulmaceae	native	2	tree	perennial	slippery elm
Vitis riparia	Vitaceae	native	3	vine	perennial	river-bank grape

Invasive Species

We identified 7 non-native species within Red Cedar North. Five of these species were observed occasionally throughout the forest, but 2 of them were observed very frequently. Amur honeysuckle and buckthorn were observed all throughout the woodlot, with buckthorn occurring in each forest layer and amur honeysuckle being observed in the overstory and understory. Especially in the sapling layer, these 2 species are incredibly dominant and are outcompeting the native species. The fact that they dominate the understory is very alarming for the future of the woodlot as well. If nothing is done to diminish these populations, the forest could be fully taken over once the current overstory dies off. The remaining invasive species we observed were wall hawkweed (*Hieracium murorum*), privet (*Ligustrum vulgare*), tartarian honeysuckle (*Lonicera tatarica*), creeping jenny (*Lysimachia nummularia*), and black locust.

Figure 1. Dense thickets of honeysuckle (*Lonicera spp.*) that are found all over the natural area.

Human Impacts
Trash, Structures or Other Human Disturbance

Within Red Cedar North, there is lots of evidence of human impact, such as an abandoned campsite, lots of old tarps/clothes on the forest floor, and other various forms of trash.

Figure 2. Photo of abandoned campsite

Boundary Issues

The main issue with the fencing at Red Cedar North is the eastern fence. Half of this fence line is compromised as there are fallen trees/branches on top of the fence, and the other half of the fence line is completely absent. Slightly further east there is another fence that is intact, but it's unknown whether this section of forest fenced off is meant to be part of the natural area or not. The fence along the southern border is perfectly fine with the exception of a hole that someone cut in the fence.

Water Features

We found 3 water features within Red Cedar North Natural Area. Two of them were smaller vernal pools while the third was a larger seasonally flooded area near the easternmost entrance. There are lots of wetland areas within this natural area, but these 3 were the only features observed to seasonally flood.

Figure 3. Map of the fenceline, wetlands, and notable features of Red Cedar North Natural Area
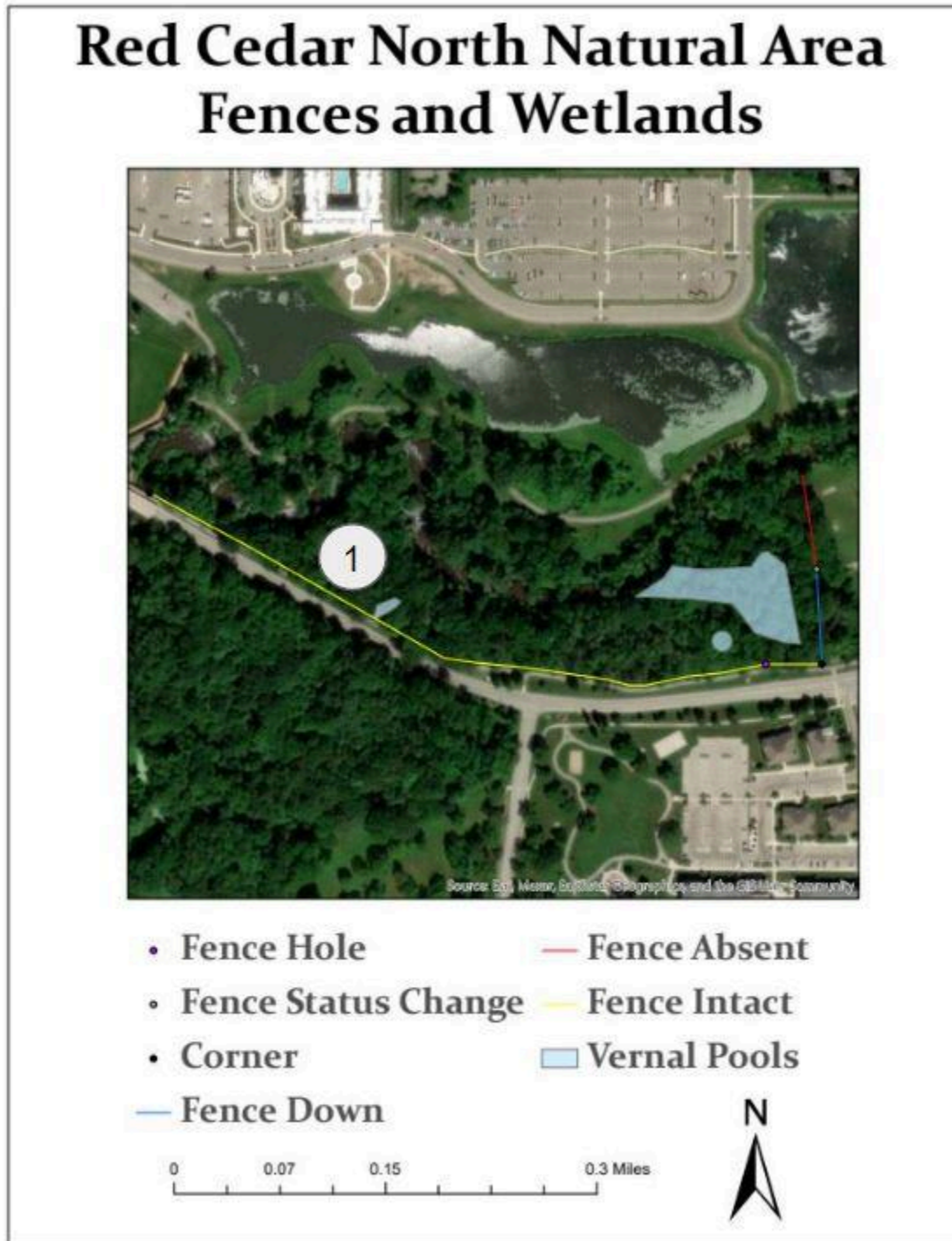
1. This section of the forest is the highest quality area as it is mostly comprised of native overstory trees, shrubs, and herbaceous species