Baker Woodlot

Bio-Inventory Report

Submitted to

MSU Campus Natural Areas Classroom, Curriculum and Conservation Committee Submitted August 2021 by Matthew Peña

Executive Summary and Recommendations

Baker Woodlot is an excellent representation of mature southern mesic forest. During this survey of Baker Woodlot, we only collected data on the woody species found within the woodlot (See Kolp et al. 2020 for a recent survey of woody and herbaceous species found in Baker). Even with just the woody species, we found a very rich abundance of trees, shrubs, and vines. We observed 53 total woody plants, 42 of which were native, and 11 of which were non native. While we found 11 invasive species, two species in particular are of major concern in this woodlot: amur honeysuckle and privet. These two species have formed large invasion fronts across the woodlot, especially in the southwestern corner. We observed some large heaps of concrete that appear to be a structure related to the ditch running roughly east to west across the southern portion of the woodlot. This material currently blocks a path to the southern section of the woodlot, and may also represent a hazard to walkers and runners who may try to cross the path to reach the southern area of Baker. We also took note of the wetlands within Baker and found a total of 6 vernal ponds and 2 vernal streams.

With its remarkable diversity, abundance of wetland habitats and location on central campus, Baker's highest value is for teaching, demonstration and nature appreciation. Management efforts should focus on controlling invasive species and enhancing visitor experience through trail maintenance, trash cleanup and addressing safety concerns posed by hazard trees along trails

Recommendations

1. The amur honeysuckle and privet invasions need to be taken care of as soon as possible. These species, especially amur honeysuckle, are thriving and expanding and could cause serious issues with biodiversity if not addressed.
2. Ecology and biodiversity-focused interpretive signage would be a great addition to Baker Woodlot.
3. Heavy traffic by recreational and course users mean that attention should be devoted to safety. Regular surveys of trail conditions and hazard tree identification should be conducted.

Forest Inventory

Overstory

We found a total of 22 species of trees in the overstory (>4" dbh) of our plots at Baker Woodlot. Living overstory (>4" dbh) trees at Baker Woodlot had a total basal area of 185.3 ft^2 ac^{-1} and a stem density of 108 trees per acre. Sugar maple (*Acer saccharum*) was the most important species found at Baker given that it has the highest relative dominance, density, and frequency among all the overstory species (Table 1). After sugar maple, there are 2 other important species that we observed: red oak (*Quercus rubra*) and red maple *(Acer rubrum*). Red oak has a higher relative dominance than red maple, red oak with 18.2% and red maple with 16.5%, however red maple has the higher relative density and frequency: red maple with a density of 11.7% and red oak with 7.4%, and then red maple having a relative frequency of 33.3% and red oak with 26.7%. The next most important tree species encountered throughout the woodlot include American beech (*Fagus grandifolia*), basswood *(Tilia americana*), and black cherry *(Prunus serotina*). The remaining 16 species that were only observed in low numbers. These species are: American elm (*Ulmus americana*), bitternut hickory (*Carya cordiformis*), black locust (*Robinia pseudoacacia*), black maple (*Acer nigrum*), boxelder maple (*Acer negundo*), bur oak (*Quercus macrocarpa*), chinkapin oak (*Quercus muehlenbergii*), common buckthorn (*Rhamnus cathartica*), eastern cottonwood (*Populus deltoides*), ponderosa pine (*Pinus ponderosa*), ironwood (*Ostrya virginiana*), musclewood (*Carpinus caroliniana*), sassafras (*Sassafras albidum*), tuliptree (*Liriodendron tulipifera),* white ash (*Fraxinus americana*), and white oak (*Quercus alba).*

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 Beech	4.9	10.5	43.3	19.6
American Elm	0.7	3.7	16.7	7.0
Basswood	6.4	4.3	20	10.2
Bitternut Hickory	0.1	1.2	3.3	1.6

Black Cherry	5.9	3.7	20	9.9
Black Locust	3.5	4.3	6.7	4.8
Black Maple	1.0	3.7	13.3	6.0
Boxelder Maple	0.05	0.6	3.3	1.3
Bur Oak	0.9	1.2	6.7	2.9
Chinkapin Oak	2.5	0.6	3.3	2.2
Common Buckthorn	0.04	0.6	3.3.	1.3
Eastern Cottonwood	0.9	1.2	3.3	1.8
Ponderosa Pine	0.7	0.6	3.3	1.6
Ironwood	0.1	1.9	3.3	1.8
Musclewood	0.1	1.2	6.7	2.7
Red Maple	16.5	11.7	33.3	20.5
Red Oak	18.2	7.4	26.7	17.4
Sassafras	0.8	1.9	6.7	3.1
Sugar Maple	28.3	36.4	76.7	47.1
Tuliptree	4.2	1.2	3.3	2.9
White Ash	0.04	0.6	3.3	1.3
White Oak	4.0	1.2	6.7	4.0

Understory

Based on our inventory plots we estimate that there are a total of 1523.3 stems per acre of trees recruiting into the sapling class (at least 4.5 feet tall and </= 4” dbh) at Baker Woodlot. Sugar maple dominated Baker’s sapling class with a relative density of 37.4 and a relative frequency of 63.3 (Table 2). The next most important sapling layer species was spicebush (*Lindera benzoin*) with a relative density of 18.8 and a relative frequency of 20, however the next closest tree species was white ash with a relative density of 9.4 and a relative frequency of 46.7. However, as white ash is unable to reach the overstory due to emerald ash borer, these saplings do not have the potential for future recruitment to the overstory of Baker Woodlot. Of the tree species that can reach the overstory, the next most important after sugar maple is black cherry, which has a relative density of 3.9 and a relative frequency of 26.7. The other tree species that were observed in the sapling layer of Baker were fairly uncommon: American beech, American elm, basswood, bitternut hickory, common buckthorn, dotted hawthorn (*Crataegus punctata*), ironwood, musclewood, northern hackberry (*Celtis occidentalis*), slippery elm (*Ulmus rubra*), and tuliptree. Across the 4 different diameter class groups, sugar maple was the most common species within the 1” in., 3” in., and 4” in. dbh classes. The 2” in. dbh class most frequently contained spicebush, however sugar maple was still the most frequently occurring tree species in the 2” in. dbh class. These low levels of non-sugar maple regeneration

could be worrying for the future of Baker Woodlot, however it is important to note that while sugar maple has the highest numbers, sugar maple saplings were only observed in 19 of the 30 total plots, meaning that there are plenty of areas within Baker that sugar maple is not dominating which can allow for other species to fill in the overstory.

Table 2. Composition and size class distribution of the sapling layer in Baker Woodlot. 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
Alternate Leaf Dogwood	1.3	3.3	16.7	3.3	0	0
American Beech	2.0	13.3	6.7	3.3	16.7	3.3
American Elm	0.2	3.3	3.3	0	0	0
Amur Honeysuckle	3.7	16.7	43.3	13.3	0	0
Basswood	0.2	3.3	0	3.3	0	0
Bitternut Hickory	0.4	3.3	0	3.3	3.3	0
Black Cherry	3.9	26.7	53.3	6.7	0	0
Chokecherry	2.6	13.3	40	0	0	0
Common Buckthorn	2.6	13.3	33.3	6.7	0	0
Dotted Hawthorn	0.2	3.3	3.3	0	0	0
Ironwood	1.1	6.7	6.7	10	0	0
Mapleleaf Viburnum	0.7	6.7	10	0	0	0
Musclewood	0.4	3.3	3.3	3.3	0	0
Northern Hackberry	0.2	3.3	3.3	0	0	0
Prickly Ash	6.8	13.3	96.7	6.7	0	0
Privet	4.6	10	70	0	0	0
Slippery Elm	2.8	16.7	33.3	6.7	3.3	0
Spicebush	18.8	20	193.3	93.3	0	0
Sugar Maple	37.4	63.3	446.7	73.3	40	10
Tuliptree	0.4	3.3	6.7	0	0	0
White Ash	9.4	46.7	126.7	13.3	3.3	0

Regeneration Layer

We observed 15 species regenerating in the seedling layer (<4.5 feet tall) at Baker Woodlot: American beech, basswood, bitternut hickory, black cherry, black maple, common

buckthorn, ironwood, pawpaw (*Asimina triloba)*, red maple, red oak, sassafras, slippery elm, sugar maple, swamp white oak (*Quercus bicolor*), and white ash (Table 3). Sugar maple was the most frequently observed species within the regeneration layer, as it was found in 86.67% of all plots. White ash was also found very frequently, showing up in 70% of all plots. Another fairly frequent regenerating species was black cherry, which occurred in 43.33% of the plots in Baker. All other species were observed in less than a quarter of all plots and had fairly low coverage percentages. Sugar maple had the highest average coverage percentage, with a value of 37%.

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	**Avg % Coverage**	**Rel Frequency**
American beech	2.5	13.33333333
basswood	2.5	6.666666667
bitternut hickory	2.5	23.33333333
black cherry	13.46153846	43.33333333
black maple	5.625	13.33333333
common buckthorn	6.666666667	10
ironwood	2.5	6.666666667
pawpaw	2.5	3.333333333
red maple	10.83333333	10
red oak	2.5	23.33333333
sassafras	2.5	6.666666667
slippery elm	18.75	20
sugar maple	37.30769231	86.66666667
swamp white oak	2.5	3.333333333
white ash	19.52380952	70

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 185.31 $ft^2\ ac^{-1}$, 87% (162 $ft^2\ ac^{-1}$) was in Risk Class 1 trees, 7% (13 $ft^2\ ac^{-1}$) was in Risk Class 2, and 6% (11 $ft^2\ ac^{-1}$) was in Risk Class 3. On an individual tree basis, 88% (95.33 trees per acre) were in Risk Class 1, 6% (6.67 trees per acre) were in Risk Class 2, and 6% (6 trees per acre) were in Risk Class 3 out of the 108 total live trees per acre. In addition to living trees, we found 8 standing dead

(snags) trees per acre, which account for 9.55 ft^2 ac^{-1}.Twelve standing dead trees were observed: 1 in decay class 1, 5 in decay class 2, 3 in decay class 3, 1 in decay class 4, and 2 in decay class 5.

Across the woodlot, we found an average of 54.72 m^3 ha^{-1} of coarse woody debris (CWD). Coarse woody debris was distributed across the woodlot with 23 of 30 plots having at least one piece of CWD. The average decay class for a piece of CWD was decay class 3.

Forest Inventory Summary and Conclusions

Baker Woodlot is an incredibly diverse forest across all 3 layers of the forest. Sugar maple is the most frequently occurring species across the overstory, understory, and seedling layer, but it is less dominant in this woodlot compared to other CNAs. On the other hand, much of the overstory basal area of Baker Woodlot is made up of mid-tolerant oaks which are unable to regenerate under current conditions. Without management intervention, oaks will decline in Baker Woodlot over time and most will be replaced by sugar maple.

Botanical Assessment

Overall we found 53 different species of woody plants in Baker Woodlot (Table 4). It is important to note that unlike all of our other woodlot surveys, we did not collect any data on herbaceous plants throughout our study of Baker Woodlot as there is already a well documented recent botanical inventory of this site (Kolp et al. 2020). Of these 53 species, 42 were native and 11 were non-native. Many of the native species have high C values, indicating that Baker Woodlot has high quality native habitats.

Table 4. Listing of all woody plants identified to species in and around Baker Woodlot in June, 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 saccharum	Sapindaceae	native	5	tree	perennial	sugar maple
Asimina triloba	Annonaceae	native	9	tree	perennial	pawpaw
Berberis thunbergii	Berberidaceae	non-native	0	shrub	perennial	japanese barberry
Carpinus caroliniana	Betulaceae	native	6	tree	perennial	blue-beech
Carya cordiformis	Juglandaceae	native	5	tree	perennial	bitternut hickory
Celtis occidentalis	Cannabaceae	native	5	tree	perennial	hackberry

Cornus alternifolia	Cornaceae	native	5	tree	perennial	alternate-leaved dogwood
Crataegus punctata; c. nitidula	Rosaceae	native	1	tree	perennial	dotted hawthorn
Euonymus alatus	Celastraceae	non-native	0	shrub	perennial	winged euonymus
Euonymus obovatus	Celastraceae	native	5	shrub	perennial	running strawberry-bush
Fagus grandifolia	Fagaceae	native	6	tree	perennial	american beech
Frangula alnus; rhamnus frangula	Rhamnaceae	non-native	0	shrub	perennial	glossy buckthorn
Fraxinus americana	Oleaceae	native	5	tree	perennial	white ash
Hamamelis virginiana	Hamamelidaceae	native	5	shrub	perennial	witch-hazel
Hedera helix	Araliaceae	non-native	0	vine	perennial	english ivy
Ligustrum vulgare	Oleaceae	non-native	0	shrub	perennial	common privet
Lindera benzoin	Lauraceae	native	7	shrub	perennial	spicebush
Liriodendron tulipifera	Magnoliaceae	native	9	tree	perennial	tulip tree
Lonicera japonica	Caprifoliaceae	non-native	0	vine	perennial	japanese honeysuckle
Lonicera maackii	Caprifoliaceae	non-native	0	shrub	perennial	amur honeysuckle
Menispermum canadense	Menispermaceae	native	5	vine	perennial	moonseed
Ostrya virginiana	Betulaceae	native	5	tree	perennial	ironwood; hop-hornbeam
Parthenocissus inserta	Vitaceae	native	4	vine	perennial	thicket creeper
Parthenocissus quinquefolia	Vitaceae	native	5	vine	perennial	virginia creeper
Pinus ponderosa	Pinaceae	native	3	tree	perennial	ponderosa pine
Populus deltoides	Salicaceae	native	1	tree	perennial	cottonwood

Prunus serotina	Rosaceae	native	2	tree	perennial	wild black cherry
Prunus virginiana	Rosaceae	native	2	shrub	perennial	chokecherry
Quercus alba	Fagaceae	native	5	tree	perennial	white oak
Quercus bicolor	Fagaceae	native	8	tree	perennial	swamp 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
Ribes cynosbati	Grossulariaceae	native	4	shrub	perennial	prickly or wild gooseberry
Ribes nigrum	Grossulariaceae	non-native	0	shrub	perennial	black currant
Robinia pseudoacacia	Fabaceae	non-native	0	tree	perennial	black locust
Rosa multiflora	Rosaceae	non-native	0	shrub	perennial	multiflora rose
Sambucus racemosa	Adoxaceae	native	3	shrub	perennial	red-berried elder
Sassafras albidum	Lauraceae	native	5	tree	perennial	sassafras
Smilax hispida; s. tamnoides	Smilacaceae	native	5	vine	perennial	bristly greenbrier
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
Viburnum acerifolium	Adoxaceae	native	6	shrub	perennial	maple-leaved viburnum
Viburnum rafinesquianum	Adoxaceae	native	5	shrub	perennial	downy arrow-wood
Viburnum trilobum; v. opulus	Adoxaceae	native	5	shrub	perennial	american highbush-cranberry

Vitis riparia	Vitaceae	native	3	vine	perennial	river-bank grape
Zanthoxylum americanum	Rutaceae	native	3	shrub	perennial	prickly-ash

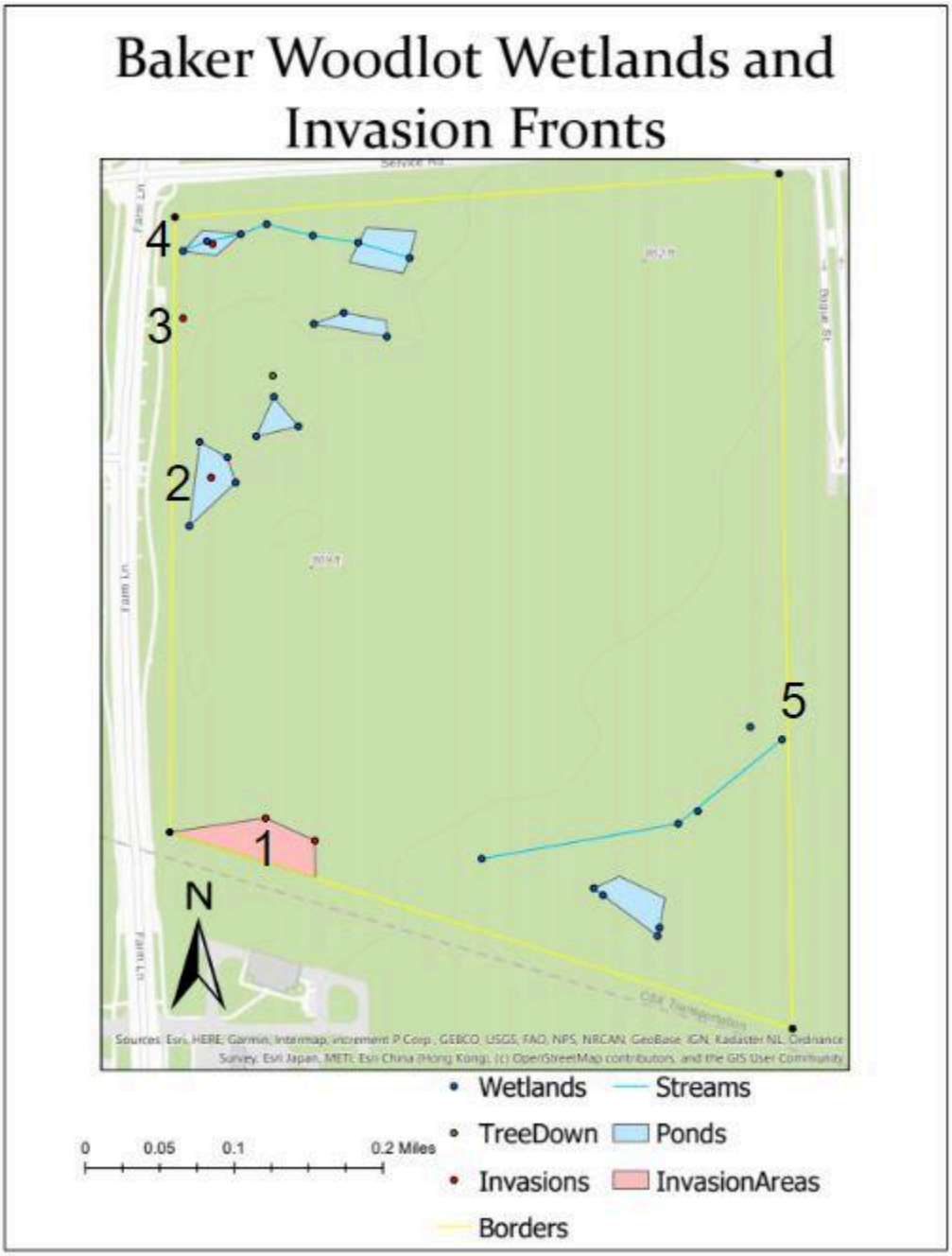
Invasive Species

In Baker Woodlot, we identified 11 non-native species. Among these species, there are 2 that appear to represent significant threats: amur honeysuckle and privet. These 2 species are very abundant and management to control or get rid of them is very much needed. The biggest areas of invasion are in the northwestern and southwestern corners, with the southwestern corner and border containing the highest volume of honeysuckle and privet (Figure 1). Amur honeysuckle is also the much more invasive of these 2 species as each of the invasion areas is predominantly amur honeysuckle. These honeysuckles are thriving as well, with some individuals reaching 4 inch dbh or higher. Japanese honeysuckle (*Lonicera japonica*) and Japanese barberry (*Berberis thunbergii*) were also observed a fair number of times, but neither are the cause of a massive invasion. Common buckthorn is another aggressive invader; however, common buckthorn was observed in only 4 plots. The other invasive species that we observed are winged euonymus (*Euonymus alatus*), common ivy (*Hedera helix),* black currant (*Ribes nigrum*), and multiflora rose (*Rosa multiflora*).

Water Features

Within Baker Woodlot, we found a total of 8 different water features. Two of these are apparently human-created drainage ditches. In addition, we found five ponds, most of them without water at the time of this study. Most of these occurred within the northwestern area of Baker.

Figure 1. Map of fenceline: SW corner (42.71434N 84.47798W); NW corner (42.71872N 84.47793W); NE corner (42.71903N 84.47206W); SE corner (42.71294N 84.47193W)



1. Has a very large invasion of amur honeysuckle and privet. The honeysuckle here is thriving with some of the stems observed to be near a 4” in. dbh. Definitely the most concerning area observed
2. This area has the least amount of honeysuckle of the 4 observed invasion fronts. As shown on the map, it also occurs within a vernal pond
3. Lots of amur honeysuckle and privet that are along the fence at this point and heading up north as well.
4. The invasion here surrounds a vernal pond and consists largely of amur honeysuckle
5. There is a stream that begins on the southeastern edge, but the biggest concern with it

is the presence of what appears to be unfinished bridge construction. These should either be built up or removed in order to remove a potential threat to curious walkers who may head into the southern area of Baker.

Human Impacts

Trash, Structures or Other Human Disturbance

In the southern third of the woodlot, there are some remnants of concrete structures that appear either unfinished or long destroyed. These occur at 3 observed spots along the stream in the southern portion of the woodlot (Figure 1). The largest of these is far east near the start of the ditch and presents the greatest hazard for humans as it blocks the path that leads further south within the woodlot. These should be addressed as they could be dangerous for anyone that may try and cross over on top of the fallen concrete.

References

Kolp, Matthew R., Matthew T. Chansler, Garrett E. Crow, and L. Alan Prather. 2020. Declining Native Species Richness in Natural Areas in Eastern North America: An Example from Baker Woodlot in Central Michigan. *Rhodora* 122, no. 991 (2020): 139-201.