Bio-Inventory Report – Hudson Woodlot

Executive Summary and Recommendations

Hudson woodlot is an excellent representation of mature southern mesic forest. It has a notable diversity of native tree species present in the canopy layer, although this diversity is expected to decline over time because a single species (sugar maple) dominates all other strata. We found a total of 66 species of vascular plants, 50 of whom were native species. Based on a Floristic Quality Assessment, the plant diversity represented at Hudson is good, but not exceptional from a conservation perspective. Several invasive species were found at Hudson, but all in very low numbers and most are confined to the edges around the fenceline. There is ample evidence of past research at Hudson, but it is not clear that any of it is currently active. Much of the flagging, piping and other research materials seem old and in disrepair. Staff from the surrounding farms appear to be managing fallen trees and branches along the perimeter of the woodlot and are causing some moderate disturbances around the perimeter.

From a conservation perspective, the most notable feature of Hudson woodlot is the lack of impact by invasive species and white-tailed deer. Most fragmented woodlots in this area have far greater abundance of invasive species and much greater deer-impacts on regeneration. Hudson woodlot appears to be a "healthy" forest in both regards, although one which will decline in tree species diversity over time in the absence of management. Hudson woodlot's isolation from the general public and main campus mean it has a high value for research and teaching. In particular, Hudson woodlot appears to be well-suited for teaching/demonstration projects on forest management and/or restoration.

Recommendations

1. CNAC members should walk the perimeter of the woodlot with farm staff to discuss perimeter issues and find new approaches to managing woody debris.
2. CNAC should work with researchers and volunteers (Forestry Club or other student groups), to remove older research detritus.
3. Treat the few occurrences of invasive species in the forest interior (mostly barberry and privet) now while they are still manageable.
4. Consider working with natural resources faculty to implement some forest management activities aimed at promoting regeneration of less-shade tolerant tree species. Goals would be to support teaching in the natural resource disciplines as well as to maintain the diversity and resilience of the woodlot.

Forest Inventory

Overstory

We found a total of 13 species of trees in the overstory (>4" dbh) at Hudson Woodlot; 6 of these were encountered in our fixed-area plot inventory and 7 were found during our walking survey of the property. Living overstory (>4" dbh) trees at Hudson Woodlot had a total basal area of 116.2 $ft^2\ ac^{-1}$ and a stem density of 120 trees per acre. Sugar maple (*Acer saccharum*) was by far the most important overstory tree species according to our plot survey having the highest relative dominance, density and frequency of any species (Table 1). American beech (*Fagus grandifolia*) is the next most important overstory tree species, although it is important to note that it's importance comes through its presence as a few, scattered very large diameter individuals. Basswood (*Tilia americana*), bitternut hickory (*Carya cordiformis*), and black maple (*Acer nigrum*) are smaller but well-distributed components of the forest canopy at this site. In our final walking survey we found an additional 7 tree species in the overstory, that were not encountered in any of our plots: northern red oak (*Quercus rubra*) bur oak (*Quercus macrocarpa*), chinkapin oak (*Quercus muehlenbergii*), black walnut (*Juglans nigra*), black cherry (*Prunus serotina*), eastern cottonwood (*Populus deltoides*) and sycamore (*Platanus*

occidentalis). Northern red oak and black cherry were notable in that we encountered several very large overstory individuals of each species throughout the woodlot, suggesting that our random sample of plots failed to capture two important components of the overstory of this site. In contrast, the remaining species were observed as only single individual trees (bur oak, black walnut, cottonwood) or isolated patches of 2-3 individuals (chinkapin oak and sycamore). The presence of black maple, bitternut hickory and chinkapin oak all indicate fertile, base-rich soils at this site.

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	32.2	7.1	28.6	22.6
basswood	5.2	4.8	28.6	12.9
big-toothed aspen	1.9	2.4	14.3	6.2
bitternut hickory	8.9	11.9	28.6	16.5
black maple	2.5	7.1	28.6	12.7
sugar maple	49.2	66.7	100	71.9

Understory

Based on our inventory plots we estimate that there are a total of 1457 stems per acre of trees recruiting into the sapling class (at least 4.5 feet tall and </= 4” dbh) at Hudson Woodlot. Sugar maple overwhelmingly dominated the sapling class in this forest, accounting for 82 percent of all saplings measured and occurring in every one of our plots (Table 2). The closely related black maple was the next most abundant species in the sapling class at 7.8% relative density and a relative frequency of 43%, followed by American beech at 3.9% relative density and 29% relative frequency and white ash (*Fraxinus americana*) at 2.9% relative density and 29% relative frequency. Black cherry, chokecherry (*Prunus virginiana*), and northern hackberry (*Celtis occidentalis*) each accounted for 1% of the sapling layer. The distribution of species across the different sapling size classes further demonstrates that sugar maple is dominating the recruits in this stand that will replace overstory trees as they die. American beech and black maple were found in the larger sapling classes in very small numbers, whereas mid-tolerant black cherry, northern hackberry and white ash appear unable to recruit beyond the <1” class.

Table 2. Composition and size class distribution of the sapling layer in Hudson 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
American beech	3.9	28.6	43	14	0	0
black cherry	1.0	14.3	14	0	0	0
black maple	7.8	42.9	86	14	0	14
choke cherry	1.0	14.3	14	0	0	0
northern hackberry	1.0	14.3	14	0	0	0
sugar maple	82.4	100	929	200	57	14
white ash	2.9	28.6	43	0	0	0

Regeneration Layer

We identified 8 species of trees regenerating in the seedling layer (<4.5 feet tall): American beech, basswood, bitternut hickory, black cherry, black maple, sugar maple, sweet cherry (*Prunus avium*) and white ash (Table 3). Sugar maple also dominated the seedling layer, occurring in 100% of plots with an average estimated ground coverage of 36%. Basswood seedlings were found in more than half the plots at a 6% coverage; however, it is important to note that all basswood seedlings we observed were new germinants. The complete lack of 2nd year or older basswood seedlings suggests that this species is not regenerating within Hudson Woodlot.

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
American beech	2.5	43
basswood	5.6	57
bitternut hickory	2.5	43
black cherry	2.5	14
black maple	18	43
sugar maple	36	100
sweet cherry	2.5	14
white ash	8.8	29

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 stand basal area of 116.2 ft^2 ac^{-1}, 85% (100 ft^2 ac^{-1}) was in Risk Class 1 trees, 10% (11 ft^2 ac^{-1}) was in Risk Class 2 and 5% (5 ft^2 ac^{-1}) was in Risk Class 3. On an individual tree basis, 88% (106 trees per acre) were in Risk Class 1, 7% (9 trees per acre) were in Risk Class 2, and 5% (6 trees per acre were in Risk Class 3. In addition to living trees, we found 17.1 standing dead (snags) trees per acre, which together accounted for 35.7 ft^2 ac^{-1}. Of the 17.1 snags per acre 17% were in decay class 1, 50% in decay class 2, 0% in decay class 3, 17% in decay class 4 and 17% in decay class 5.

Across the woodlot, we found an average of 54.6 m^3 ha^{-1} of coarse woody debris (CWD). Variability across the woodlot was quite high with a range across our 7 plots from 0 to 175.6 m^2 ha^{-1} and a CV of 109%. Eight percent of the CWD volume was in decay class 1, 19% in decay class 2, 61% in decay class 3 and 11% in decay class 4. We did not estimate volumes for decay class 5 CWD.

Forest Inventory Summary and Conclusions

Hudson Woodlot contains an excellent example of mature Mesic Southern Forest as defined by the Michigan Natural Features Inventory (Cohen et al. 2020). The overstory is dominated by shade-tolerant sugar maple and American beech, but also has excellent representation of a diverse mix of associated species. Many hardwood forests of the southern Lower Peninsula are heavily impacted by deer browsing and have poor stocking in the sapling layer and/or dominance of the sapling layer by undesirable species such as white ash and ironwood (*Ostrya virginiana*). White ash and ironwood are unpalatable to deer and are undesirable from a forestry perspective because they are incapable of growing to canopy size; ironwood due to its inherent growth potential and white ash due to Emerald Ash Borer (EAB). Hudson woodlot, in contrast, has an extremely well stocked sapling layer composed of species capable of recruiting into the canopy as gaps form above them. One cause for concern, however, is the nearly complete dominance of the sapling layer by a single species - sugar maple. Without a major disturbance or management intervention the tree species diversity of this woodlot will decline overtime as mid-tolerant and intolerant canopy species die and are replaced overwhelmingly by sugar maple.

Botanical Assessment

Overall we found 68 different species of vascular plants in Hudson woodlot, although two of these could not be identified to species (Table 4). One of these was an unidentified member of the genus *Rubus* and the other an unidentified member of the family Apiaceae. Of the 66 species completely identified, 50 were native and 16 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 an overall Floristic Quality Index (FQI) of 26.8 for Hudson Woodlot. 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 Hudson Woodlot in May, 2021.

Scientific Name	Family	Native?	C	Form	Duration	Common Name
Acer nigrum	Sapindaceae	native	4	tree	perennial	black maple
Acer saccharum	Sapindaceae	native	5	tree	perennial	sugar maple
Actaea pachypoda	Ranunculaceae	native	7	forb	perennial	dolls-eyes
Alliaria petiolata	Brassicaceae	non-native	0	forb	biennial	garlic mustard
Allium tricoccum	Alliaceae	native	5	forb	perennial	wild leek
Arctium minus	Asteraceae	non-native	0	forb	biennial	common burdock
Arisaema triphyllum	Araceae	native	5	forb	perennial	jack-in-the-pulpit
Barbarea vulgaris	Brassicaceae	non-native	0	forb	biennial	yellow rocket
Berberis thunbergii	Berberidaceae	non-native	0	shrub	perennial	japanese barberry
Cardamine concatenata; dentaria laciniata	Brassicaceae	native	5	forb	perennial	cut-leaved toothwort
Carya cordiformis	Juglandaceae	native	5	tree	perennial	bitternut hickory
Caulophyllum thalictroides	Berberidaceae	native	5	forb	perennial	blue cohosh
Celtis occidentalis	Cannabaceae	native	5	tree	perennial	hackberry
Circaea canadensis; c. lutetiana	Onagraceae	native	2	forb	perennial	enchanters-nightshade
Claytonia virginica	Montiaceae	native	4	forb	perennial	spring-beauty
Cornus alternifolia	Cornaceae	native	5	tree	perennial	alternate-leaved dogwood
Dryopteris carthusiana	Dryopteridaceae	native	5	fern	perennial	spinulose woodfern
Epifagus virginiana	Orobanchaceae	native	10	forb	annual	beech-drops
Erythronium americanum	Liliaceae	native	5	forb	perennial	yellow trout lily
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

Fraxinus americana	Oleaceae	native	5	tree	perennial	white ash
Galium aparine	Rubiaceae	native	0	forb	annual	annual bedstraw
Geranium maculatum	Geraniaceae	native	4	forb	perennial	wild geranium
Hydrophyllum appendiculatum	Boraginaceae	native	7	forb	biennial	great waterleaf
Juglans nigra	Juglandaceae	native	5	tree	perennial	black walnut
Lamium purpureum	Lamiaceae	non-native	0	forb	annual	purple dead-nettle
Leonurus cardiaca	Lamiaceae	non-native	0	forb	perennial	motherwort
Ligustrum vulgare	Oleaceae	non-native	0	shrub	perennial	common privet
Lonicera maackii	Caprifoliaceae	non-native	0	shrub	perennial	amur honeysuckle
Maclura pomifera	Moraceae	non-native	0	tree	perennial	osage-orange
Maianthemum racemosum; smilacina r.	Convallariaceae	native	5	forb	perennial	false spikenard
Ostrya virginiana	Betulaceae	native	5	tree	perennial	ironwood; hop-hornbeam
Parthenocissus quinquefolia	Vitaceae	native	5	vine	perennial	virginia creeper
Picea abies	Pinaceae	non-native	0	tree	perennial	norway spruce
Platanus occidentalis	Platanaceae	native	7	tree	perennial	sycamore
Podophyllum peltatum	Berberidaceae	native	3	forb	perennial	may-apple
Polygonatum biflorum	Convallariaceae	native	4	forb	perennial	solomon-seal
Populus deltoides	Salicaceae	native	1	tree	perennial	cottonwood
Populus grandidentata	Salicaceae	native	4	tree	perennial	big-tooth aspen
Prunus avium	Rosaceae	non-native	0	tree	perennial	sweet cherry
Prunus serotina	Rosaceae	native	2	tree	perennial	wild black cherry
Prunus virginiana	Rosaceae	native	2	shrub	perennial	choke cherry
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
Ribes cynosbati	Grossulariaceae	native	4	shrub	perennial	prickly or wild gooseberry
Rosa multiflora	Rosaceae	non-native	0	shrub	perennial	multiflora rose
Rubus occidentalis	Rosaceae	native	1	shrub	perennial	black raspberry
Sambucus racemosa	Adoxaceae	native	3	shrub	perennial	red-berried elder
Sanguinaria canadensis	Papaveraceae	native	5	forb	perennial	bloodroot
Smilax ecirrata	Smilacaceae	native	6	forb	perennial	upright carrion-flower
Solanum dulcamara	Solanaceae	non-native	0	vine	perennial	bittersweet nightshade
Taraxacum officinale	Asteraceae	non-native	0	forb	perennial	common dandelion
Tilia americana	Malvaceae	native	5	tree	perennial	basswood
Toxicodendron radicans	Anacardiaceae	native	2	vine	perennial	poison-ivy
Trillium grandiflorum	Trilliaceae	native	5	forb	perennial	common trillium
Ulmus americana	Ulmaceae	native	1	tree	perennial	american elm
Urtica dioica	Urticaceae	native	1	forb	perennial	stinging nettle
Viburnum acerifolium	Adoxaceae	native	6	shrub	perennial	maple-leaved viburnum
Viola pubescens	Violaceae	native	4	forb	perennial	yellow violet
Vitis aestivalis	Vitaceae	native	6	vine	perennial	summer grape
Zanthoxylum americanum	Rutaceae	native	3	shrub	perennial	prickly-ash

Whereas we identified several species of exotic invasive plants in or around Hudson Woodlot, virtually all of the invasive species we observed were right along the fenceline. Away from the immediate area along the fenceline, Hudson Woodlot is remarkably free of invasive plants. Some invasives do occur a few meters into the woodlot where trees have been felled or fallen along the fence. Another notable occurrence is a dense sward of garlic mustard (*Allaria petiolata*) along the disturbed ground at the northeast corner (see incursions section). The only invasive species we consistently observed in the forest interior were Japanese barberry (*Berberis thunbergii*) and privet (*Ligustrum vulgare*) which both appeared to be more common in the southern ~⅓ of the woodlot. Both invasive shrubs occurred as widely-spaced, isolated individuals with no apparent invasion front. Cut and spray treatments of these two species would be quite manageable at this stage and could prevent further spread.

Human Impacts

Research/Teaching Artifacts

There is quite a bit of evidence of research and/or teaching activities within Hudson Woodlot. Most of these appear to be quite old and abandoned. There are still a few tire structures attached to trees (Fig. 1) from the 1990s era mosquito study, although most of these were removed in 2019-2020. There are occasional flagged trees, and apparently abandoned research debris scattered in various places. Jugs and funnels from the Dowtin/Rothstein throughfall experiment are still in evidence but in disrepair and the Rothstein teaching soil pit is still active and covered by plywood.

Figure 1. Photos of old research materials.

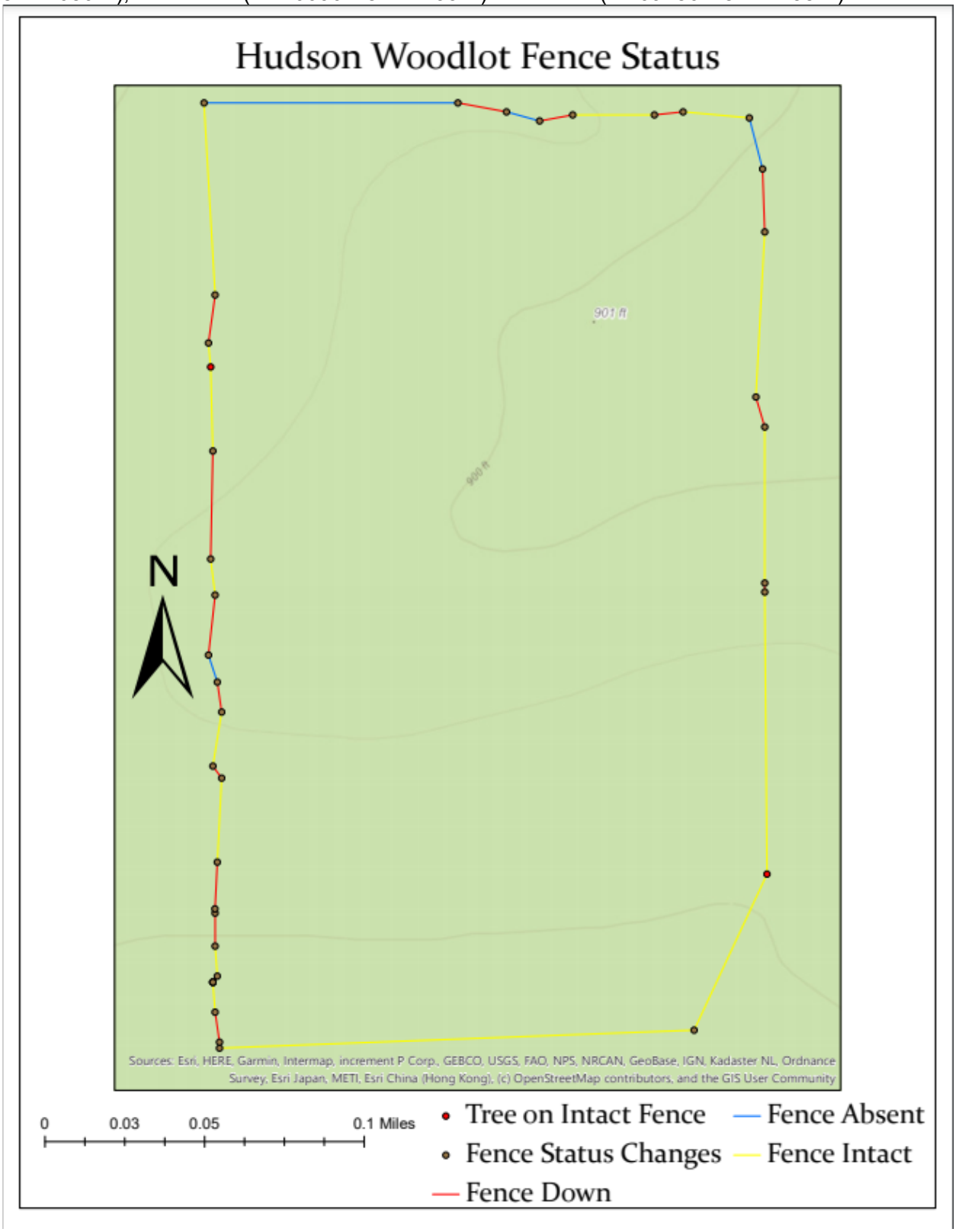
Trash, Structures or Other Human Disturbance

Very little non-research trash was evident anywhere within Hudson Woodlot. A few whiskey bottles and the occasional plastic grocery bag. There was no evidence of foot trails, forts or other signs of human use.

Boundary Issues

Overall, the fence around Hudson Woodlot is in poor shape. Please refer to the map below (Fig. 2) for a detailed representation of the fence status around the woodlot. While the southern side is fully intact and the eastern side is mostly upright, the western and northern fences have many problems that need to be fixed. Beginning along the western edge, there are many areas where the fence is down, as well as two areas where there is no fence at all. Many of these downed fences have trees on top of them, suggesting that the fence was toppled due to the falling tree. As denoted by the red dots, there are even a couple areas (on the east and west borders) that are still standing for the moment; however, due to fallen trees, those areas are likely to collapse if a little bit more stress is applied to that area. On the northern edge, there is a long span of unfenced forest, and it appears that there once was a plan in place to fence it off due to a large spool of barbed wire that is located at the northwestern corner. This corner is starting to get overgrown, especially with Osage-orange, so it is likely that the barbed wire was not placed there recently.

Figure 2. Map of fenceline: SW corner (42.69780N 84.47673W); NW corner (42.70095N 84.47680W); NE corner (42.70090N 84.47433W) SE corner (42.69786N 84.47458W)



There appear to be issues with staff working on the surrounding farms that will need to be addressed. It appears that staff are maintaining the N-S access road that runs along the western fenceline by cutting Osage orange trees growing on the fenceline and clearing trees and limbs that fall out of the woodlot onto the two track. We observed a series of wood chip piles running along the inside of this fenceline, extending 2-5 meters into the woodlot (Fig. 3), which suggests that farm staff are chipping these materials and blowing them into the woodlot. A more serious incursion appears to have occurred within the last few years at the very northeast corner of the woodlot. Here there are two large piles of earth and woody debris that appear to have been bulldozed into the woodlot (Fig. 4). We suspect that a tree, or trees, at the corner must have fallen out of the woodlot, been too large to chip and instead bulldozed into the woodlot for disposal. In addition to the piles of debris there are two clear paths that were scarified by operation, which are now well colonized by garlic mustard.

Figure 3. Photos of wood chip piles inside the woodlot, along the west fenceline.

Figure 4. Photos of the disturbance at the northeast corner of the woodlot. Large woody debris was apparently bulldozed ~20 meters into the woodlot creating two large piles of earth and debris, plus two disturbed pathways that have been colonized by garlic mustard.

Water Features
No wetlands, ponds or streams were observed in our survey of Hudson woodlot.

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).