Box Woodland

Bio-Inventory Report

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

Executive Summary and Recommendations

Box Woodland is a representation of a southern mesic forest that has been degraded by human disturbance and subsequent biological invasion. Its 17 native tree species in the canopy are notable for its relatively small size. However, this diversity might decline over time because a single species (sugar maple) dominates the understory layer while the other species exist in low quantities. A total of 64 species of vascular plants were found in this woodland. Of these, 48 were native species to Michigan. Based on a Floristic Quality Assessment, the plant diversity represented here is low, probably due to Box's small size and human disturbances. Several non-native species were found, but abundance was low within the woodland. Most non-native species are confined to the edges around the agricultural border. There is little evidence of past and ongoing research here, and none seems to be active.

While harboring native species, this woodland lacks any high-fidelity species that would indicate a quality woodland. While most fragmented woodlands in this area have far greater abundance of invasive species, this woodland has been able to slow the invasion. Being surrounded by agricultural land and having a drain run through the woodland, Box will likely see further invasion by non-native species in the future. With an underdeveloped herbaceous ground flora, the only important feature about this woodland is the number of native canopy

species that grow here, albeit in low quantities. Box Woodland's distance from campus and lack of a fence discourages public and research use. This woodland was surveyed in June 2023.

Recommendations
1. Non-native and invasive species that have invaded the interior of this woodland should be managed while they are relatively non-abundant to prevent spreading and a subsequent loss of biodiversity.
2. This woodland should not be prioritized for teaching and research because of its small size and isolation.

Forest Inventory

Overstory

17 tree species were found in the overstory (>4" dbh) within Box Woodland. Of these, four were encountered in a fixed-area plot inventory and the other 13 were encountered during a meandering survey of the woodland. Some species like bladdernut were very common along the edge of the woodland, but not present within the interior canopy. Most of this woodland's canopy comprises of the maples, while the other species had only a few representatives. Living overstory (>4" dbh) trees had a total basal area of 202.9 ft^2 ac^{-1} and a stem density of 150 trees per acre. Silver maple is this woodland's most important overstory species as it has the highest relative density, relative dominance, and importance value. However, sugar maple has the highest relative frequency, as it occurs in both two plots. Green ash and black cherry are also common in this woodland.

The 13 other overstory species which were identified during a meandering survey include boxelder, butternut hickory, hackberry, American beech, black walnut, eastern hophornbeam, American sycamore, and basswood. Silver maple was common along Banta Drain which runs through the middle of this woodland.

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
Fraxinus pennsylvanica	1.2	6.7	100.0	36.0
Acer saccharinum	69.7	40.0	50.0	53.2
Acer saccharum	23.8	26.7	100.0	50.1
Prunus serotina	5.3	20.0	50.0	25.1
Unknown (dead)	0.0	6.7	50.0	18.9

Understory

Box woodland supports an estimated 2,150 sapling stems per acre (at least 4.5 feet tall and </= 4" dbh). The dominant species in the sapling class is sugar maple, with a 51% relative frequency (Table 2). These saplings were common in both plots and throughout the rest of the woodland. A drastic lack of first year seedlings was apparent within Box Woodland. Instead, larger saplings were present. The second most common understory component were unknown dead saplings. Despite dominating the overstory, only one silver maple seedling was identified within the fixed-area plots. The overwhelming density of sugar maples in the sapling layer coupled with a lack of larger diameter saplings suggests that this species will continue to dominate in the overstory.

Table 2. Composition and size class distribution of the sapling layer in Box Woodland. 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 saccharinum	2.3	50	0	1	0	0
Acer saccharum	51.2	100	4	12	5	1
Unknown (dead)	41.9	100	12	3	2	0
Fraxinus pennsylvanica	4.7	50	0	1	1	0

Regeneration Layer

One tree species was identified in the seedling layer (<4.5 feet tall): sugar maple (Table 3). The shrub chokeberry was also present here. The forest floor of Box was characterized by bare ground and a thin herbaceous ground layer. Sugar maple, which occurs in one of two plots, has an average estimated ground coverage of 2.5%.

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 saccharum	2.5	50
Prunus virginiana	2.5	100

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 202.9 ft^2 ac^{-1}, 100% was in Risk Class 1 trees. This accounted for 15 individual trees that fell within the fixed-area plots. In addition to living trees, 20 standing dead (snags) trees were found per acre, which together accounted for 2.4 ft^2 ac^{-1}. Based on the two recorded snags, there is an estimated 20 snags per acre. 100% of the recorded dead trees were in Decay Class 1.

Across the woodland, an average of 3.3 m^3 ha^{-1} of coarse woody debris (CWD) was identified. Variability across the woodland ranged from 0 to 33.4 m^2 ha^{-1}. A coefficient of variation (CV) of 316% was recorded for this natural area.

Forest Inventory Summary and Conclusions

Box Woodland is a mesic southern forest as defined by the Michigan Natural Features Inventory (Cohen et al. 2020). This woodland has become invaded and degraded by non-native species and has felt the consequences of altered hydrology by human disturbance. The overstory is dominated by shade-tolerant sugar maple and silver maple, while other species hang on within

the woodland. 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). Box Woodland might show signs of this deer pressure as first year sugar maple saplings are relatively lacking compared to the number of older saplings. Along with black cherry, these were the only saplings identified within the fixed-area plots. The other 15 tree species may be threatened with being removed from the canopy if they cannot regenerate. Another cause for concern is the lack of an important canopy species, silver maple. Without a major disturbance or management intervention the tree species diversity of this woodland will decline overtime as mid-tolerant and intolerant canopy species die and are replaced overwhelmingly by sugar maple.

Botanical Assessment

Overall, 64 species of vascular plants were identified in Box Woodland (Table 4). Of these species, 48 were native and 16 were non-native. Only one species, bladdernut, has a high C value, indicative of fidelity to high quality native habitats. Although it is important to note this species was found only as shrubs on the exterior edge of the woodland and didn't occur within the canopy. The species list resulted in a Total Floristic Quality Index (FQI) of 21.6 for Box Woodland. 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 Box Woodland in June and July of 2023.

Scientific Name	Family	Native	Physiognomy
Acer negundo	Sapindaceae	native	tree
Acer saccharinum	Sapindaceae	native	tree
Acer saccharum	Sapindaceae	native	tree

Agastache nepetoides	Lamiaceae	native	forb
Alliaria petiolata	Brassicaceae	non-native	forb
Allium tricoccum	Alliaceae	native	forb
Arisaema triphyllum	Araceae	native	forb
Capsella bursa-pastoris	Brassicaceae	non-native	forb
Carex albursina	Cyperaceae	native	sedge
Carex blanda	Cyperaceae	native	sedge
Carex grayi	Cyperaceae	native	sedge
Carya cordiformis	Juglandaceae	native	tree
Celtis occidentalis	Cannabaceae	native	tree
Circaea canadensis	Onagraceae	native	forb
Cornus foemina	Cornaceae	native	shrub
Crataegus mollis	Rosaceae	native	tree
Echinocystis lobata	Cucurbitaceae	native	vine
Epipactis helleborine	Orchidaceae	non-native	forb
Euonymus fortunei	Celastraceae	non-native	vine
Euonymus obovatus	Celastraceae	native	shrub
Fagus grandifolia	Fagaceae	native	tree
Fraxinus americana	Oleaceae	native	tree
Fraxinus pennsylvanica	Oleaceae	native	tree
Geranium maculatum	Geraniaceae	native	forb
Juglans nigra	Juglandaceae	native	tree
Laportea canadensis	Urticaceae	native	forb

Leonurus cardiaca	Lamiaceae	non-native	forb
Linum catharticum	Linaceae	non-native	forb
Lonicera maackii	Caprifoliaceae	non-native	shrub
Lonicera morrowii	Caprifoliaceae	non-native	shrub
Maianthemum racemosum	Convallariaceae	native	forb
Ostrya virginiana	Betulaceae	native	tree
Parthenocissus inserta	Vitaceae	native	vine
Parthenocissus quinquefolia	Vitaceae	native	vine
Persicaria virginiana	Polygonaceae	native	forb
Phalaris arundinacea	Poaceae	native	grass
Phytolacca americana	Phytolaccaceae	native	forb
Platanus occidentalis	Platanaceae	native	tree
Podophyllum peltatum	Berberidaceae	native	forb
Populus deltoides	Salicaceae	native	tree
Prunus serotina	Rosaceae	native	tree
Prunus virginiana	Rosaceae	native	shrub
Quercus macrocarpa	Fagaceae	native	tree
Rhamnus cathartica	Rhamnaceae	non-native	tree
Ribes americanum	Grossulariaceae	native	shrub
Ribes cynosbati	Grossulariaceae	native	shrub
Rosa multiflora	Rosaceae	non-native	shrub
Rubus allegheniensis	Rosaceae	native	shrub
Rubus flagellaris	Rosaceae	native	shrub

Rumex obtusifolius	Polygonaceae	non-native	forb
Sambucus racemosa	Adoxaceae	native	shrub
Sanguinaria canadensis	Papaveraceae	native	forb
Silene latifolia	Caryophyllaceae	non-native	forb
Solanum dulcamara	Solanaceae	non-native	vine
Staphylea trifolia	Staphyleaceae	native	shrub
Taraxacum officinale	Asteraceae	non-native	forb
Tilia americana	Malvaceae	native	tree
Torilis japonica	Apiaceae	non-native	forb
Toxicodendron radicans	Anacardiaceae	native	vine

Several species of non-native plants were identified within Box Woodland with most being right along the edge. Non-native species are amplified by the fact that Box is surrounded by agricultural fields or roads. To make things easier for invasion by non-native species, Box Woodland has a high edge border compared to its size. While invasives were most common along the borders of the woodland, open areas within the woodland also harbored these. Fortune's spindle was common throughout the woodland interior. Within the dense canopy of the woodland and the lack of a developed herbaceous layer, invasives may be able to easily take over.

Concerns, Threats, and Human Impacts

Research/Teaching Artifacts

There is little evidence of research and/or teaching activities within Box Woodland. A few pink marking flags were identified near the border of the agricultural field along the western edge of the woodland. While it wasn't identified what these flags were for, nothing seemed to be disturbed.

Trash, Structures or Other Human Disturbance

The Banta Drain runs through Box Woodland where it exists as an uncovered ditch (see **Figure 2**). Very little non-research trash was evident anywhere within Box Woodland.

Figure 1. Human Disturbances: Left image shows the Banta drain which runs through the woodland. The middle and right images show the pink flags and holes from ground digging animals.
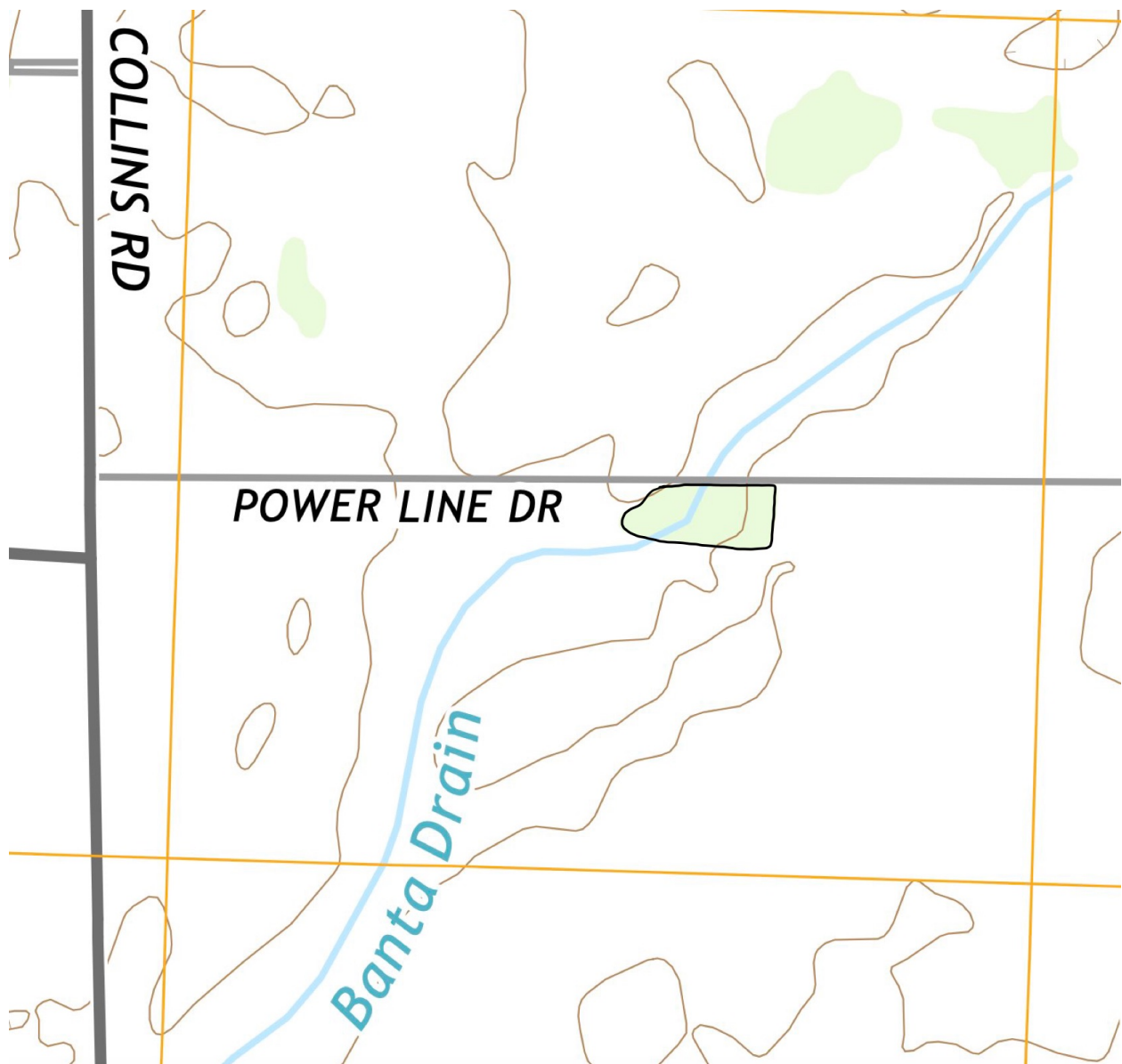

Biotic Concerns
Deer pressure is likely occurring within the woodland and keeping the sugar maple and other canopy species from regenerating. Holes in the ground were present from ground digging animals.

Water Features
Box Woodland lacks water features except for the Banta Drain and its supporting arteries that feed into the drain.

Figure 1. Map of Box Woodland

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).