



Beal Pinetum

Bio-Inventory Report

Submitted to
MSU Campus Natural Areas Classroom, Curriculum and Conservation
Committee Submitted May 2024 by Matthew Peña

Executive Summary and Recommendations

Beal Pinetum can best be summarized as a fairly poor quality forest, but at the same time, it is also very unique. It is the only Michigan State University natural area in which a coniferous species is the most dominant overstory tree, although this is due the high quantity of eastern white pines (*Pinus strobus*) planted by Professor William J. Beal in 1896. Beneath the pines, the forest has a pretty good overstory that consists mostly of maples, especially sugar maple (*Acer saccharum*), but the understory is sparse and is completely composed of invasive species in some areas. This suggests that deer pressure is very high in this forest, and the lack of a fence on the western border could be a reason for that. Another issue is that invasive species are highly prevalent in this forest, and many pose threats to this natural area's future. Through plot sampling, a walking survey, and confirmed iNaturalist observations from members of the community, we identified 103 species within Beal Pinetum. However, 34 of these 103 were non-native and/or invasive species. Many of these invasive species pose major threats to the woodlot and have been adequately detailed in this report. Additionally, many instances of human activity were observed at Beal Pinetum. This includes sites where people have appeared to be camping out, and sites with heaps of trash, such as glass bottles. A high volume of this trash is observed along the southern fence, suggesting that tenants at the nearby apartment complex could be the culprits.

Due to its easy access, smaller size, and close proximity to the campus, Beal Pinetum's best use for the MSU community would be for teaching. Some courses already use this natural area for certain aspects of their class, and there is potential for others to find this unique forest

useful. It is a relatively close natural area that has a coniferous overstory, along with generally being of lower quality, and makes for a great location for any classes interested in studying either of these forest features. For this reason, cleaning up the garbage should be one of the main priorities in order to provide a safer and cleaner classroom experience. Additionally, management strategies, such as felling single trees to open up the canopy, could be employed to either promote growth in the sparse understory. Various forms of invasive species management could also be tested here. Either of these could possibly be done as class projects and/or experiences.

Recommendations

1. Remove the trash and encampments seen throughout the forest.
2. Employ forest management tactics to promote understory growth.
3. Work to remove invasive species, especially in the northern half of the pinetum.

Forest Inventory

Overstory

In total, we encountered 13 species of trees in the overstory (>4" dbh) at Beal Pinetum; 7 of these were observed in our fixed-area plots and 6 of them were seen on our walking survey of the forest. The living overstory trees (>4" dbh) at Beal Pinetum had a total basal area of 169.4 ft² ac⁻¹ and a stem density of 143.3 trees per acre. The most important overstory tree was eastern white pine due to the fact that many individuals were planted here a long time ago (hence the "pinetum" title). The pinetum was established in 1896, making the white pines here to be about 128 years old at the time of sampling. Because of this, each overstory white pine has a dbh over 20 inches, and they collectively have a species basal area of 115.6 ft² ac⁻¹. Sugar maple (*Acer saccharum*) was the most common species across the entire woodlot, but the generally small sizes of the sugar maple inhibit both its dominance and importance within the natural area. The remaining overstory trees found within the plots, in decreasing order of importance, are basswood (*Tilia americana*), black maple (*Acer nigrum*), silver maple (*Acer saccharinum*), buckthorn (*Rhamnus cathartica*), and green ash (*Fraxinus americana*). Furthermore, we encountered 6 species of overstory trees on the walking survey of the property. These species were: black walnut (*Juglans nigra*), boxelder (*Acer negundo*), eastern cottonwood (*Populus deltoides*), northern hackberry (*Celtis occidentalis*), red maple (*Acer rubrum*), and *Morus alba x rubra*.

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
Basswood	8.7	7.0	33.3	16.3

Black Maple	2.3	7.0	33.3	14.2
Buckthorn	0.6	4.7	16.7	7.3
Green Ash	0.3	2.3	16.7	6.4
Silver Maple	5.2	4.7	16.7	8.8
Sugar Maple	14.7	46.5	83.3	48.2
White Pine	68.2	27.9	66.7	54.3

Understory

Based on our inventory plots, we estimate that there are about 533.3 trees per acre in the understory (at least 4.5 feet tall and a dbh less than 4”) at Beal Pinetum. The understory here is largely absent within the interior of the forest as all 300 trees per acre of sugar maple were observed in the southwest corner of the natural area. Additionally, each of the understory species were only observed in 1 plot each, and only 3 of our 6 plots had any understory species at all. Furthermore, of the species we saw in the understory, only two of them, sugar maple and black cherry (*Prunus serotina*), have the capacity to grow large enough to become a part of the overstory, as privet and buckthorn are both shrubby and undesirable invasives, and American elm (*Ulmus americana*), and green ash are highly unlikely to ever reach the overstory due to pressure from Dutch elm disease and emerald ash borer, respectively. Understory sugar maple trees were observed more frequently during the walking survey than the data suggests, but this is still largely localized to the southern portion of the forest. This overall lack of understory presence suggests heavy deer pressure, and counter measures need to be taken if this natural area hopes to have a healthy overstory in the next 100 or so years.

Table 2. Composition and size class distribution of the sapling layer in Beal Pinetum. 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 Elm	3.1	16.7	0	16.7	0	0
Black Cherry	3.1	16.7	16.7	0	0	0
Buckthorn	6.3	16.7	0	16.7	16.7	0
Green Ash	3.1	16.7	0	0	0	16.7
Privet	28.1	16.7	100	50	0	0
Sugar Maple	56.3	16.7	300	0	0	0

Regeneration Layer

We observed 12 tree species regenerating in the seedling layer (<4.5 feet tall) at Beal Pinetum: American beech (*Fagus grandifolia*), American elm, bitternut hickory (*Carya cordiformis*), black cherry, black maple, buckthorn, bur oak (*Quercus macrocarpa*), green ash, red oak (*Quercus rubra*), silver maple, sugar maple, and white ash. Sugar maple was the most prominent species regenerating, however it still regenerated in very low numbers as it was found with an average coverage percentage of 16.3% per plot (plot size is 1/100th of an acre, or 12 ft radius). The remaining species were all found in even lower quantities, and the second most abundant regenerating species is buckthorn - a non-native species. Similar to the data shown from the understory samples, these low numbers of regeneration are likely due to deer pressure on the natural area. There is a bit more variety and abundance of native trees in the regeneration layer than in the understory, but management must be done in order to give these seedlings the best chance possible of growing beyond the regeneration class.

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	16.7
American Elm	2.5	16.7
Bitternut Hickory	2.5	33.3
Black Cherry	2.5	33.3
Black Maple	2.5	33.3
Buckthorn	8.8	33.3
Bur Oak	2.5	16.7
Green Ash	2.5	16.7
Red Oak	2.5	16.7
Silver Maple	2.5	16.7
Sugar Maple	16.3	100
White Ash	6.7	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 169.4 ft² ac⁻¹, 89% (151.2 ft² ac⁻¹) was in Risk Class 1 trees, 11% (17.8 ft² ac⁻¹) was in Risk Class 2, and less than 1% (0.4 ft² ac⁻¹) was in Risk Class 3. On an individual tree basis, 86% (123.3 trees per acre) were in Risk Class 1, 12% (16.7 trees per acre) were in Risk Class 2, and 2% (3.3 trees per

acre) were in Risk Class 3 in the total 143.3 trees per acre. In addition to living trees, we found 16.7 standing dead (snags) trees per acre, which account for 8.7 ft² ac⁻¹. We observed 5 standing dead trees, including 1 in decay class 2, 1 in decay class 3, 2 in decay class 4, and 1 in decay class 5.

Across the woodlot, we found an average of 80.2 m³ ha⁻¹ of coarse woody debris (CWD). Coarse woody debris was prevalent across the natural area with each of our 6 plots having at least 2 pieces of CWD. We observed 1 log in decay class 1, 15 logs in decay class 3, 2 logs in decay class 4, and 3 logs in decay class 5. We did not observe any pieces of CWD in decay class 2.

Forest Inventory Summary and Conclusions

Despite having a very unique overstory compared to the other campus natural areas, Beal Pinetum is a fairly poor site that has a jeopardized future due to the lack of native tree species regenerating in the understory and ground layers. Understory trees especially are seen sparingly across the natural area, and there are currently few options to replace the large white pines when they eventually fall. Although these pines are unlikely to fall in the near future, forest management to promote understory growth still needs to be done soon to secure the future structure of the pinetum.

Botanical Assessment

Overall, we found 103 different species of vascular plants in Beal Pinetum. Throughout these 103 species, 39 were observed within one of our 6 plots, 31 were observed via a walking survey shortly after completion of plot data collection, and the remaining 34 were acquired via verifiable iNaturalist observations. It is also worth noting that 3 specimens observed within our plots could not be identified to species. These were members of the *Poa*, *Solidago*, and *Carex* genera. Of the 100 identifiable species, 66 were native species, and 34 were non-native, however one of these non-native species was identified to be a hybrid of *Morus alba* and *Morus rubra* and could not be added to the following assessments. The species list overall resulted in a Floristic Quality Index (FQI) of 26.9 for Beal Pinetum. Additionally, we calculated an FQI of 20.2 for just the species observed just within our plots and on the walking survey as iNaturalist allows us to record species that are either seen infrequently throughout the natural area, or are unidentifiable at the time of sampling. 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 Beal Pinetum; survey taken place May, 2024.

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
Ailanthus altissima	Simaroubaceae	non-native	0	tree	perennial	tree-of-heaven
Alliaria petiolata	Brassicaceae	non-native	0	forb	biennial	garlic mustard
Allium vineale	Alliaceae	non-native	0	forb	perennial	field garlic
Ambrosia artemisiifolia	Asteraceae	native	0	forb	annual	common ragweed
Anemone quinquefolia	Ranunculaceae	native	5	forb	perennial	wood anemone
Arisaema triphyllum	Araceae	native	5	forb	perennial	jack-in-the-pulpit
Asarum canadense	Aristolochiaceae	native	5	forb	perennial	wild-ginger
Barbarea vulgaris	Brassicaceae	non-native	0	forb	biennial	yellow rocket
Berberis thunbergii	Berberidaceae	non-native	0	shrub	perennial	japanese barberry
Boehmeria cylindrica	Urticaceae	native	5	forb	perennial	false nettle
Calamagrostis canadensis	Poaceae	native	3	grass	perennial	blue-joint
Cardamine concatenata; dentaria laciniata	Brassicaceae	native	5	forb	perennial	cut-leaved toothwort
Cardamine douglassii	Brassicaceae	native	6	forb	perennial	pink spring cress
Carex intumescens	Cyperaceae	native	3	sedg e	perennial	sedge
Carex stipata	Cyperaceae	native	1	sedg e	perennial	sedge

<i>Carya cordiformis</i>	Juglandaceae	native	5	tree	perennial	bitternut hickory
<i>Carya ovata</i>	Juglandaceae	native	5	tree	perennial	shagbark hickory
<i>Catalpa speciosa</i>	Bignoniaceae	non-native	0	tree	perennial	northern catalpa
<i>Caulophyllum thalictroides</i>	Berberidaceae	native	5	forb	perennial	blue cohosh
<i>Celtis occidentalis</i>	Cannabaceae	native	5	tree	perennial	hackberry
<i>Circaea canadensis</i> ; <i>c. lutetiana</i>	Onagraceae	native	2	forb	perennial	enchanters-nightshade
<i>Cirsium vulgare</i>	Asteraceae	non-native	0	forb	biennial	bull thistle
<i>Claytonia virginica</i>	Montiaceae	native	4	forb	perennial	spring-beauty
<i>Convallaria majalis</i>	Convallariaceae	non-native	0	forb	perennial	lily-of-the-valley
<i>Diarrhena obovata</i> ; <i>d. americana</i>	Poaceae	native	9	grass	perennial	beak grass
<i>Dicentra cucullaria</i>	Papaveraceae	native	7	forb	perennial	dutchmans-breeches
<i>Dryopteris carthusiana</i>	Dryopteridaceae	native	5	fern	perennial	spinulose woodfern
<i>Enemion biternatum</i> ; <i>isopyrum b.</i>	Ranunculaceae	native	8	forb	perennial	false rue-anemone
<i>Erythronium americanum</i>	Liliaceae	native	5	forb	perennial	yellow trout lily
<i>Euonymus alatus</i>	Celastraceae	non-native	0	shrub	perennial	winged euonymus
<i>Euonymus fortunei</i>	Celastraceae	non-native	0	vine	perennial	wintercreeper
<i>Euonymus obovatus</i>	Celastraceae	native	5	shrub	perennial	running strawberry-bush
<i>Fagus grandifolia</i>	Fagaceae	native	6	tree	perennial	american beech

Ficaria verna; ranunculus ficaria	Ranunculaceae	non-native	0	forb	perennial	lesser celandine
Fraxinus americana	Oleaceae	native	5	tree	perennial	white ash
Fraxinus pennsylvanica	Oleaceae	native	2	tree	perennial	red ash
Galium aparine	Rubiaceae	native	0	forb	annual	annual bedstraw
Geranium maculatum	Geraniaceae	native	4	forb	perennial	wild geranium
Geum canadense	Rosaceae	native	1	forb	perennial	white avens
Glechoma hederacea	Lamiaceae	non-native	0	forb	perennial	ground-ivy
Hesperis matronalis	Brassicaceae	non-native	0	forb	perennial	dames rocket
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 obtusifolium	Oleaceae	non-native	0	shrub	perennial	border privet
Ligustrum vulgare	Oleaceae	non-native	0	shrub	perennial	common privet
Linaria vulgaris	Plantaginaceae	non-native	0	forb	perennial	butter-and-eggs
Lonicera maackii	Caprifoliaceae	non-native	0	shrub	perennial	amur honeysuckle
Lysimachia nummularia	Myrsinaceae	non-native	0	forb	perennial	moneywort
Maianthemum racemosum; smilacina r.	Convallariaceae	native	5	forb	perennial	false spikenard
Maianthemum stellatum; smilacina s.	Convallariaceae	native	5	forb	perennial	starry false solomon-seal

Menispermum canadense	Menispermaceae	native	5	vine	perennial	moonseed
Onoclea sensibilis	Onocleaceae	native	2	fern	perennial	sensitive fern
Parthenocissus inserta	Vitaceae	native	4	vine	perennial	thicket creeper
Parthenocissus quinquefolia	Vitaceae	native	5	vine	perennial	virginia creeper
Phytolacca americana	Phytolaccaceae	native	2	forb	perennial	pokeweed
Pinus strobus	Pinaceae	native	3	tree	perennial	white pine
Platanus occidentalis	Platanaceae	native	7	tree	perennial	sycamore
Poa pratensis	Poaceae	non-native	0	grass	perennial	kentucky bluegrass
Podophyllum peltatum	Berberidaceae	native	3	forb	perennial	may-apple
Populus deltoides	Salicaceae	native	1	tree	perennial	cottonwood
Prunella vulgaris	Lamiaceae	native	0	forb	perennial	self-heal
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 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
Robinia pseudoacacia	Fabaceae	non-native	0	tree	perennial	black locust
Rosa multiflora	Rosaceae	non-native	0	shrub	perennial	multiflora rose
Rubus occidentalis	Rosaceae	native	1	shrub	perennial	black raspberry
Rumex obtusifolius	Polygonaceae	non-native	0	forb	perennial	bitter dock

Sambucus racemosa	Adoxaceae	native	3	shrub	perennial	red-berried elder
Sanguinaria canadensis	Papaveraceae	native	5	forb	perennial	bloodroot
Saururus cernuus	Saururaceae	native	9	forb	perennial	lizards-tail
Scilla siberica	Hyacinthaceae	non-native	0	forb	perennial	siberian squill
Solanum dulcamara	Solanaceae	non-native	0	vine	perennial	bittersweet nightshade
Staphylea trifolia	Staphyleaceae	native	9	shrub	perennial	bladdernut
Symplocarpus foetidus	Araceae	native	6	forb	perennial	skunk-cabbage
Taraxacum officinale	Asteraceae	non-native	0	forb	perennial	common dandelion
Teucrium canadense	Lamiaceae	native	4	forb	perennial	wood-sage
Thalictrum dioicum	Ranunculaceae	native	6	forb	perennial	early meadow-rue
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
Verbascum thapsus	Scrophulariaceae	non-native	0	forb	biennial	common mullein
Verbena urticifolia	Verbenaceae	native	4	forb	perennial	white vervain
Viburnum opulus	Adoxaceae	non-native	0	shrub	perennial	european highbush-cranberry
Vinca minor	Apocynaceae	non-native	0	shrub	perennial	periwinkle
Vincetoxicum nigrum	Apocynaceae	non-native	0	vine	perennial	black swallow-wort
Viola odorata	Violaceae	non-native	0	forb	perennial	english or sweet violet
Vitis riparia	Vitaceae	native	3	vine	perennial	river-bank grape

Zanthoxylum americanum	Rutaceae	native	3	shrub	perennial	prickly-ash
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Invasive Species

Despite having 100 identified species, the large percentage of non-native species is one of the biggest takeaways from this species list. The cause for this high volume of invasive species is likely due to the pinetum’s urban placement, including the fact that a sidewalk and street run along the entire western border. Additionally, many of these invasive species were observed solely along the western edge and/or in very small numbers, but there are still many noteworthy invasive species that should be addressed in order to maintain the health of both this natural area and others nearby.

Of the 34 non-native species, we identified a list of 11 that are most notable and should be among the first invasive species addressed if invasive species management is done at this natural area. The first grouping of these are woody trees and shrubs: amur honeysuckle (*Lonicera maackii*), buckthorn (*Rhamnus cathartica*), common privet (*Ligustrum vulgare*), and border privet (*Ligustrum obtusifolium*). These species are all seen fairly commonly throughout the woodlot and are present in some of our overstory and understory samples. Especially given the allelopathic nature of amur honeysuckle and the aggressive reproduction of buckthorn and the privets, these are not species we want to see taking over the understory and regeneration layer.

The second important grouping of invasive species are smaller, mostly herbaceous spreading weeds: creeping jenny (*Lysimachia nummularia*), lesser celandine (*Ficaria verna*), lesser periwinkle (*Vinca minor*), European lily of the valley (*Convallaria majalis*), and garlic mustard (*Alliaria petiolata*). Each of these species are currently represented by numerous large populations across different areas of the forest and have ingrained themselves as a significant part of the forest’s composition unless intensive management is taken place. The most concerning of these would be creeping jenny and lesser celandine as these are species prevalent in wetter areas while two of Beal Pinetum’s highest C value species, beak grass (*Diarrhena obovata*) and lizard’s tail (*Saururus cernuus*) are present in these wet areas.

The final two noteworthy invasive species are tree of heaven (*Ailanthus altissima*) and black swallow-wort (*Vincetoxicum nigrum*). While these are both only present on the western edge and not currently present in high numbers, they’re both highly aggressive invaders and would be incredibly difficult to remove if their numbers get too high. Work has been done already to try and remove the tree of heaven, as stumps of larger trees were observed, but there are now individuals sprouting from those stumps.

Human Impacts

Trash, Structures or Other Human Disturbance

Lots of trash was found during the survey of Beal Pinetum, including evidence of encampments (Figure 1). Much of this trash was found along the southern border near the apartment complex.

Figure 1. Photos of trash and encampment sites within Beal Pinetum.



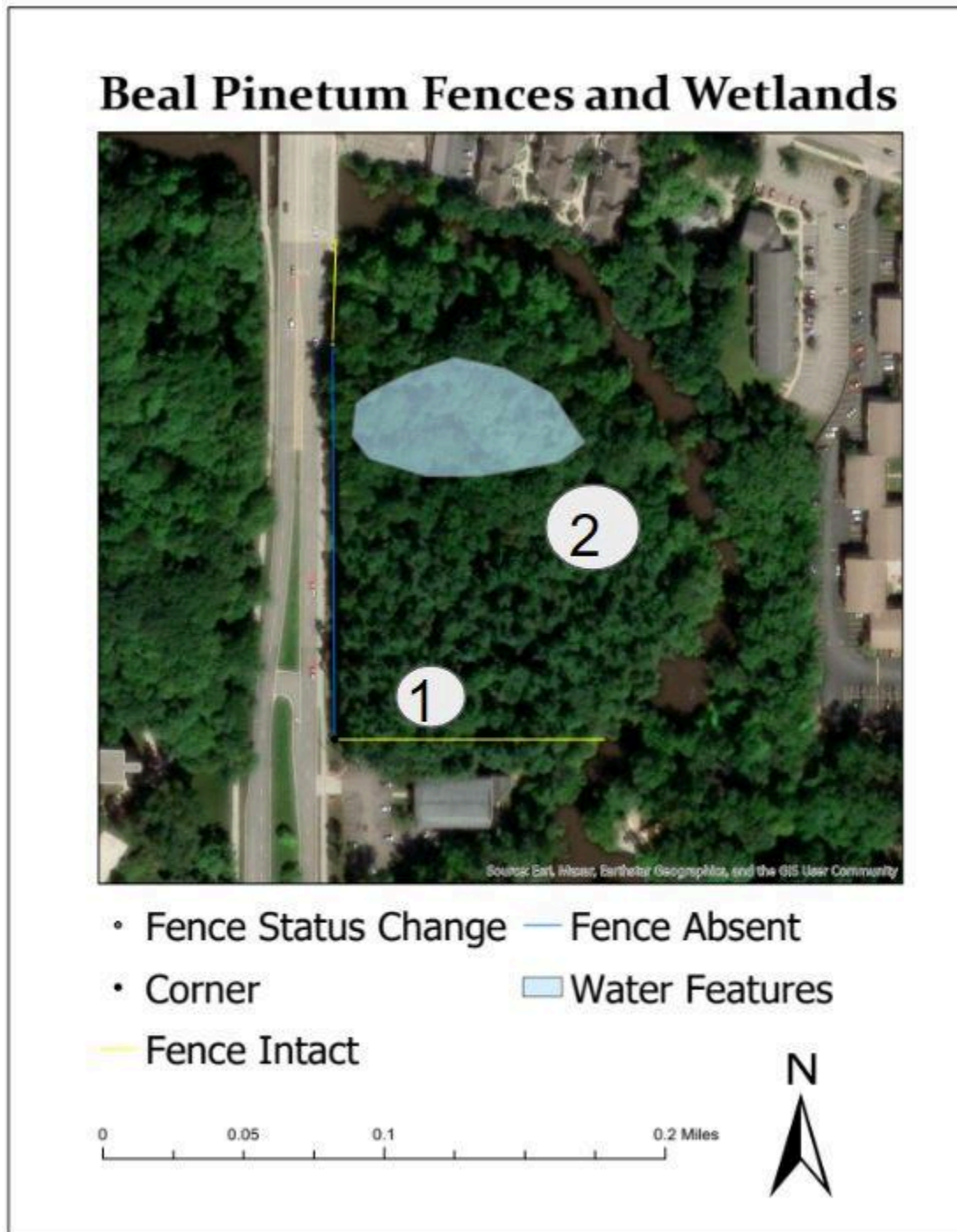
Boundary Issues

There are not really issues with the boundaries of this natural area. The fence along the southern border that separates the apartment complex from the forest is fully intact. The western border does not have a fence until the bridge over the river begins, and this fence is also intact. The only conversation to be had here would be the potential installment of a fence along the entire western border.

Water features

There is one large vernal pool that occupies much of the northern half of the natural area. Additionally, many areas nearby and beyond this pool, especially along the riverbank, are wetter areas home to many species well adapted to more hydric environments.

Figure 2. Map of fence statuses, wetlands, and other important features identified within Beal Pinetum.



1. A large pile of trash, mostly glass bottles
2. More trash and an encampment site